

Effect of sleep deprivation on the attitude and performance of medical students, Riyadh, Saudi Arabia

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Received November 17, 2015. Accepted November 25, 2015

Abstract

Background: Sleep is crucial for learning, performance, and physical and mental health. College students often have erratic sleep schedules, poor sleep hygiene, and correspondingly poor sleep quality, which might affect their performance.

Objective: To study the effect of sleep deprivation on medical students at different academic levels and investigate causes of sleep deprivation affecting them and problems related to it.

Materials and Methods: This cross-sectional study was conducted in September 2012. The participants were medical students of the first, second, third, fourth, and fifth academic years in the College of Medicine, King Saud University, Riyadh, Saudi Arabia.

Result: There were 341 responses, with a response rate of 88.8%. The number of medical students who had normal sleeping hours was 104 (53.1%) male students and 71 (49%) female students. The prevalence of sleep deprivation was more among male students (62 [31.6%]) as compared with female students (42 [29%]), *P* value was 0.278. Fifth-level students were more deprived on weekdays and weekends than other level students with *P* value 0.216 and 0.001, respectively. There was a significant difference in the grade point average (GPA) in relation to sleep deprivation. The number of students who got GPA 4 or more and who were sleep deprived was 68 (65.4%) whereas the number of those who were not sleep deprived was 180 (83%) (*P* = 0.0004).

Conclusion: The most common cause of sleep deprivation among medical students was studying. Certain sleep disorders were found in this group of students, the most common one was not getting enough sleep time. Sleep deprivation was negatively associated with academic performance in the medical students. It is the role of the educators and college authorities to empower and educate college students about good sleep habits to improve their performance.

KEY WORDS: Sleep deprivation, medical students, academic performance

Introduction

There is no doubt that sleep is crucial for proper brain function, no less than air, water, and food. In addition, sleep is an integral part of human health and life. It is crucial for learning,

performance, and physical and mental health. Working and studying for long hours can be necessary in many professions, it is the work nature of the medical practice during medical college years. Physicians' work depends on cognitive skills for patient care, and being awake and alert is equally important to the learning process. Performance errors, reduced punctuality for lectures, and low academic performance and grade point average (GPA) all have been linked to sleep deprivation. Sleep deprivation term is used to describe a state caused by inadequate quantity or quality of sleep. Most of the medical students' sleep-wake cycle is characterized by insufficient sleep duration, delayed sleep onset, and occurrence of napping episodes during the day.^[1] Bahammam et al.^[1] revealed that sleep deprivation is associated with poor academic performance. A sleepy fatigued person is accident prone,

Access this article online	
Website: http://www.ijmsph.com	Quick Response Code:
DOI: 10.5455/ijmsph.2016.17112015207	

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judgment impaired, and more likely to make mistakes and bad decisions as well as it affects the academic performance of the medical student.^[2] In the past 30 years, many articles had discussed the effect of sleep deprivation on patient safety and medical students' learning and well-being. Results of one study indicated that college students with poor sleep could improve their sleep and reduce symptoms of mood disturbances, which might affect their performance by self-administering a cognitive-behavior strategy-based program delivered via low-cost electronic media. These findings suggest that further program development, implementation, and evaluation may help students improve the quality and regularity of their sleep, and perhaps even help halt or slow the progression from poor sleep to depressive illness.^[3] In addition, one of the studies discussed the relationship between sleep deprivation and clinical performance of the medical students and physicians, such as in an earlier work by Friedman *et al.*,^[4] they found that residents who had been on call the night before made more errors in reading an electrocardiogram than their rested colleagues. In addition, there is a significant relation between sleep duration and performance in some activities as well as subjective alertness.^[5] In addition, another study shows that students who had later bed times were more likely to have poor sleep quality, which as a result may affect their academic performance.^[6]

The changes related to sleep deprivation are approved and consistent with the evidences from laboratory-based sleep studies suggesting that sleep deprivation impairs mood, cognitive functioning, and motor performance.^[7] In addition, recent studies on doctors have approved that they do not perform as effectively after a night without sleep^[8] and as a result may be at a risk of making increased medical errors.^[9] It was stated that moderate fatigue after 20–25 h of sleeplessness impairs task performance to an extent comparable with that caused by alcohol intoxication at a level of 0.10% blood alcohol concentration.^[10] A study by Arnedt *et al.*^[11] investigated acute sleep deprivation that showed impairments in neurobehavioral functioning following a night on call that was equivalent to functioning in an acutely intoxicated state. There are many studies suggesting that sleep loss or deprivation contributes to adverse events and medical errors occurring in hospitals.^[12] Chronic partial sleep deprivation can also be significant and it can affect several aspects of performance including decreased professionalism when interacting with patients, difficulty with complex cognitive tasks resulting in increased risk of misdiagnoses, and impaired learning.^[13]

We assumed some hypotheses that we tested in our study. First, students who have sleep deprivation will have lower academic performance than those who sleep well. Second, sleep hours are reduced in medical students after joining medical college. Third, increasing or catching up sleep during weekends helps to recover sleep deprivation during weekdays. Fourth, delayed college start time could be beneficial to improve sleep pattern.

Many studies show that sleep deprivation is associated with lower academic performance. Medeiros *et al.*^[14] showed that there was a significant correlation between irregularity of

sleep and academic performance ($P < 0.03$), implying that the students with a more irregular sleep-wake cycle and a shorter length of sleep presented worse academic performance.

The goal of this study was to see the effect of sleep deprivation on academic performance, ability to understand during lectures, communication abilities, mood, and decision making and also to see the punctuality of sleep-deprived students for lectures, in addition to the prevalence of sleep deprivation among male and female students.

Materials and Methods

An informed consent that was clear and indicated the purpose of the study and the right of the participant to withdraw at any time without any obligation toward the study team was given for every participant. In addition, participant anonymity was assured by assigning each student with a code number (cross-matched with his or her academic number) for the purpose of analysis only. No incentives or rewards were given to the participants by us but we acknowledged their generosity of giving us some of their valuable time. We also got the approval of IRB-Institutional Review Board in the College of Medicine.

Ours is a quantitative, observational, cross-sectional study. The data were collected from medical students at the College of Medicine of King Saud University, Riyadh, Saudi Arabia. The questionnaire was distributed in the university lecture halls after students attended a usual lecture. To assure a maximum possible cooperation from students, we got help from the leaders of each class. Those leaders made sure that every randomly chosen student would fill up the survey. However, the medical student had the right to refuse participating in the questionnaire. In case it happened, we chose another student randomly by using table of random numbers. We considered both genders in our study. We randomly selected students from the lists of first, second, third, fourth, and fifth years of academic levels in the College of Medicine. The sample size was calculated assuming a prevalence of sleep deprivation (P) equal to the absence of sleep deprivation (q) of 50% with a degree of precision (d) of 0.05 at the 95% level of confidence ($z = 1.96$).

The sample size was 384 medical students, which included 154 female and 230 male students. In our college, the number of male students is more than the female students, about 1.5:1, respectively. We used a simple random sampling technique to determine the effect of sleep deprivation on the attitude and performance of medical students. In addition, we did not have any inclusion or exclusion criteria except that we excluded those who were not willing to participate in the study. A questionnaire was formulated according to many reliable questionnaires that examined students' performance, attitude, mood, and decision making, and was validated by a professor in epidemiology and a professor in family medicine. We did not have any funding source; furthermore, we did not have any conflict of interest. The study was conducted from September 2012 to October 2012. The questionnaire was pretested on a sample of 25 students (five from each level, three male

students and two female students) as a pilot study and the required modifications were done before starting to distribute the questionnaire among all students.

SPSS (Statistical Package for the Social Sciences, version 21.0, Chicago, IL, USA) and Microsoft Excel were used for the data management and statistical analysis.

Result

The questionnaire was distributed to 384 medical students and completed questionnaires were received from 341 students with response rate of 88.8% [Table 1]. The majority were male participants (196 [57.5%]) and mostly third-year medical students (75 [22%]). The number of medical students who had normal sleeping hours was 104 (53.1%) male students and 71 (49%) female students. The prevalence of sleep deprivation was 62 (31.6%) among male students as compared to 42 (29%) among female students (P value 0.278). Fifth-level students (29 [27.9%]) were more sleep deprived on weekdays than other level students [Table 3] and also fifth-level students (13 [52%]) were significantly more sleep deprived on weekends than other level students [Table 4].

Medical students in third level were less likely to be sleep deprived on weekdays than other level students. The majority of students (218 [66.1%]) reported decrease in the duration of sleep after joining medical college. In addition, students who reported that late starting lecture was better for understanding were 200 (60.4%) [Table 2]. The main problem related to sleep among medical students was “no enough sleep time” (188 [55.1%]). The main causes of sleep deprivation were studying (193 [56.5%]) followed by watching television (134 [39.2%]). The majority of students (255 [76.8%]) reported that they did not sleep well and had mood suppression. In addition, 220 (66.6%) students stated that sleep deprivation negatively affects their academic performance. The number of students who attended a lecture while they felt sleepy and who described their concentration and understanding as poor was 151(45.3%) [Table 2]. Moreover, 246 (73.9%) students reported that they took a longer time to study a lecture at home if they attended it while they were sleepy. Furthermore, the students

who did not sleep well had decreased communication ability (203 [61.5%]), difficulty in making appropriate decisions (211 [63.3%]), and arrived late to lectures (169 [76.3%]). The students who were deprived of sleep during weekdays were 104 (30.5%) and during weekends were 25 (7.3%). In addition, 256 (75.1%) students had more than 8 h of sleeping during weekends compared with 62 (18.2%) students during weekdays [Tables 3 and 4]. The number of students who got GPA 4 or more and who were sleep deprived was 68 students (35 male and 33 female students) whereas those without sleep deprivation was 180 students (107 male and 73 female students) [Table 5] ($P = 0.0004$). A total of 20 students did not provide their GPA in the questionnaires.

Discussion

This study was conducted to discuss the causes of sleep deprivation affecting medical college students and the problems related to it. In addition, our study results can help students for better time management as normal sleep duration is essential for optimal performance. Different studies have indicated that sleep deprivation has detrimental effects on the academic performance and health.^[1] Bahammam *et al.*^[1] showed that students who scored excellent in college had longer sleeping hours during weekdays and an earlier bedtime compared with average scoring students who had a higher Epworth sleepiness scale score, and a higher percentage of students who felt sleepy during class ($P = 0.01$). This was supported by our results that students who did not have sleep deprivation and who had GPA score ≥ 4 were 82.9% compared with those who had sleep deprivation and those who had GPA score more than 4, that is, 65.3% ($P = 0.0004$). We found that two-thirds of the students reported decrease in duration of sleep after joining medical college as medical students have a lot to do in a limited time. It was found that the fifth-level students were significantly more deprived of sleep on weekdays and weekends than the others, which may be due to their more practical involvement in the clinical field and their need to increase studying hours to improve their GPA as it is the last year before graduation. It was noticed that medical students in third level were less likely to be deprived of sleep on weekdays than other level students but we could not explain why. Also, a study in the University of Washington showed that less sleep-deprived students have higher GPA than more sleep-deprived students,^[15] which was similar to what we have found in our study. The main problem related to sleep among medical students was no enough sleep time, which in turn will affect both the academic performance and their health status, and this conclusion was also found in a study done in Taiwan that included 1,922 first-year college students, 44% of whom reported experiencing sleep problems with insufficient sleep being the most common complaint (23.9%).^[16] Most of the students had explained that if they did not get enough sleep they might have poor communication with others, suppressed

Table 1: Demographic characteristics of 341 medical students

	Frequency	%
Male	196	57.5
Female	145	42.5
Grade		
First year	62	18.2
Second year	62	18.2
Third year	75	22.0
Fourth year	71	20.8
Fifth year	71	20.8

Table 2: Impact of sleep deprivation on male and female medical students

	Yes		No	
	Frequency	%	Frequency	%
During examination time				
Daily sleep hours decrease	229	68.9	103	31.1
Going to exam without sleep	99	37.9	162	62.1
Sleep duration change after joining the medical college				
Sleep duration increases	17	7.2	-	-
Sleep duration decreases	218	92.8	-	-
Do not sleep well				
Communication with others is decreased	203	61.5	127	38.5
Mood is suppressed	255	76.8	77	23.2
Ability to make decisions might get affected	211	63.3	122	36.7
Arrive late to lectures	169	76.3	161	23.7
Concentration and understanding of lectures if not sleep well				
Poor	151	45.3	-	-
Moderate	164	49.2	-	-
Perfect	18	5.5	-	-
The lecture take a longer time from you to study at home if you attend the lecture while you are sleepy	246	73.9	87	26.1
What time do you prefer to start the first class?				
8 am	105	31.6	-	-
9 am	159	47.9	-	-
10 am	68	20.5	-	-
Late starting classes improve the understanding and performance	200	60.4	131	39.6
Sleep deprivation affect the academic performance	220	66.6	110	33.3

Table 3: Sleeping hours on weekdays according to students' grade

Sleep duration	Grade/year	Frequency	%	P value
Deprived (<6 h)	First	22	21.2	0.216
	Second	18	17.3	
	Third	14	13.5	
	Fourth	21	20.2	
	Fifth	29	27.9	
	Total	104	100.0	
Normal (6–7 h)	First	31	17.7	
	Second	31	17.7	
	Third	45	25.7	
	Fourth	39	22.3	
	Fifth	29	16.6	
	Total	175	100.0	
Up normal (8 and more hours)	First	9	14.5	
	Second	13	21.0	
	Third	16	25.8	
	Fourth	11	17.7	
	Fifth	13	21.0	
	Total	62	100.0	

Table 4: Sleeping hours on weekends according to students' grade

Sleep duration	Grade/year	Frequency	%
Deprived (<6 h)	First	3	12.0
	Second	2	8.0
	Third	2	8.0
	Fourth	5	20.0
	Fifth	13	52.0
	Total	25	100.0
Normal (6–7 h)	First	13	21.7
	Second	9	15.0
	Third	9	15.0
	Fourth	11	18.3
	Fifth	18	30.0
	Total	60	100.0
Up normal (8 and more hours)	First	46	18.0
	Second	51	19.9
	Third	64	25.0
	Fourth	55	21.5
	Fifth	40	15.6
	Total	256	100.0

Table 5: Medical students' GPA and its relation to sleep deprivation

GPA	Students with sleep deprivation	Students without sleep deprivation
<4.0	36	37
≥4.0	68	180
Total	104	217

GPA, grade point average.
P 0.0004.

mood, and inability to make appropriate decision. They also complained of improper concentration or understanding of lectures, which resulted in poor performance. This was seen clearly in the previous research outcomes. In a systematic review of literature that discussed the effect of chronic and acute sleep deprivation in physicians, they found that acute sleep loss (which they defined as progressive wakefulness between 14 and 26 h) caused several disruptions such as deterioration in mood, cognitive performance, and motor skills. In addition, chronic sleep loss (which they defined as restriction of sleep for less than 6 h per night for 2 weeks or more) caused attention decrease, deterioration of memory, depressed mood, and reduced cognitive performance. In addition, they realized some impairment in physician's performance and professionalism safety that resulting in adverse implications for patient care.^[17] Poor sleep might indirectly affect performance by increasing depression, decreasing motivation, and compromising health.^[18] We found that a higher percentage of students were sleeping more hours during weekends to compensate their sleep deprivation during

weekdays. This has been attributed in many studies as a result of insufficient sleep during weekdays.

The strength of this study was that the sample size included all the different grades of medical students, male and female students, who were selected randomly in an appropriate sample size; and the data obtained were analyzed with appropriate statistical analysis.

Although our study reported significant findings, yet it had certain limitations such as the self-reporting of the sleep habits was relying on the students' subjective accounts, which raised the possibility that the students might not have accurately reported their sleep habits. In addition, there are many hidden variables that might influence the measurement of academic performance, such as self-concept, motivational changes, mental stress, and social class. Moreover, because the study was cross-sectional, no conclusions about the long-term effects of insufficient sleep can be drawn.

Conclusion

This study showed that the most common cause of sleep deprivation for medical college students was studying for long hours. Certain sleep problems were found in this group of students, the most common one was not getting enough sleep time. Sleep deprivation, during weekdays and weekends, was negatively associated with the academic performance among the medical students. So, health education programs regarding duration and quality of 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 variables that lead to poor sleep quality and take an active role to empower and educate college students about good sleep habits to improve their performance.

Acknowledgment

This research was supported by Research Chair, Deanship of Scientific Research, King Saud University.

References

1. Bahammam AS, Alaseem AM, Alzakri AA, Almeneessier AS, Sharif MM. The relationship between sleep and wake habits and academic performance in medical students: a cross-sectional study. *BMC Med Educ* 2012;12:61.
2. Ng EP, Ng Dk, Chan CH. Sleep duration, wake/sleep symptoms, and academic performance in Hong Kong Secondary School children. *Sleep Breath* 2009;13(4):357–67.
3. Brown FC, Buboltz WC Jr, Soper B. Development and education of the Sleep Treatment and Education Program for Students (STEPS). *J Am Coll Health* 2006;54(4):231–37.
4. Friedman RC, Bigger JT, Kornfield DS. The intern and sleep loss. *N Engl J Med* 1971;285(4):201–3.
5. Ravid S, Afek I, Suraiya S, Shahar E, Pillar G. Sleep disturbances are associated with reduced school achievements in first-grade pupils. *Dev Neuropsychol* 2009;34(5):574–87.

6. Estrada A, Killgore WD, Rouse T, Balkin TF, Wildzunans RM. Total sleep time measured by actigraphy predicts academic performance during military training. *Sleep* 2008;31:A134.
7. Pilcher JJ, Huffcutt AI. Effects of sleep deprivation on performance: a meta-analysis. *Sleep* 1996;19(4):318–26.
8. Grantcharov TP, Bardram L, Funch-Jensen P, Rosenberg J. Laparoscopic performance after one night on call in a surgical department: prospective study. *BMJ* 2001;323(7323):1222–3.
9. Landrigan CP, Rothschild JM, Cronin JW, Kaushal R, Burdick E, Katz JT, et al. Effect of reducing interns' work hours on serious medical errors in intensive care units. *N Engl J Med* 2004; 351(18):1838–48.
10. Orzeł-Gryglewska J. Consequences of sleep deprivation. *Int J Occup Med Environ Health* 2010;23(1):95–114.
11. Arnedt JT, Owens J, Crouch M, Stahl J, Carskadon MA. Neurobehavioral performance of residents after heavy night call vs after alcohol ingestion. *JAMA* 2005;294(9):1025–33.
12. Dula DJ, Dula NL, Hamrick C, Wood GC. The effect of working serial night shifts on the cognitive functioning of emergency physicians. *Ann Emerg Med* 2001;38(2):152–5.
13. Papp KK, Stoller EP, Sage P, Aikens JE, Owens J, Avidan A, et al. The effects of sleep loss and fatigue on resident physicians: a multi-institutional, mixed-method study. *Acad Med* 2004; 79(5):394–406.
14. Medeiros ALD, Mendes DBF, Lima PF, Araujo JF. The relationships between sleep–wake cycle and academic performance in medical students. *Biol Rhythm Res* 2001;32(2):263–270.
15. Eliasson AH, Lettieri CJ. Early to bed, early to rise! Sleep habits and academic performance in college students. *Sleep Breath* 2010; 14(1):71–5.
16. Yang CM, Wu CH, Hsieh MH, Liu MH, Lu FH. Coping with sleep disturbance among young adults: a survey of first-year college students in Taiwan. *Behav Med* 2003;29(3):133–8.
17. Mansukhani MP, Kolla BP, Surani S, Varon J, Ramar K. Sleep deprivation in resident physicians, work hour limitations, and related outcomes: a systematic review of the literature. *Postgrad Med* 2012;124(4):241–9.
18. Aldabal L, Bahammam AS. Metabolic, endocrine, and immune consequences of sleep deprivation. *Open Respir Med J* 2011;5:31–43.

How to cite this article: Amin HS, Almazroua IS, Alsahlan AS, Alrishan MA, Elmourad HM, Alotaibi MM et al. Effect of sleep deprivation on the attitude and performance of medical students, Riyadh, Saudi Arabia. *Int J Med Sci Public Health* 2016;5: 575-580

Source of Support: Nil, **Conflict of Interest:** None declared.