Sleep disorder among medical students: Relationship to their academic performance

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Abstract

Background: Medical students are exposed to a significant level of pressure due to academic demands. Their sleep pattern is characterized by insufficient sleep duration, delayed sleep onset, and occurrence of napping episodes during the day.

Objective: To examine the prevalence of sleep disorder among medical students and investigate any relationship between sleep disorder and academic performance.

Methods: This is a cross-sectional self-administered questionnaire-based study. The participants were medical students of the first, second, and third academic years. The Epworth Sleepiness Scale (ESS) was also included to identify sleep disorder and grade point average was recorded for academic performance.

Results: There were 491 responses with a response rate of 55%. The ESS score demonstrated that 36.6% of participants were considered to have abnormal sleep habits, with a statistically significant increase in female students ($p = 0.000$). Sleeping between 6–10 h per day was associated with normal ESS scores ($p = 0.019$) as well as the academic grades ≥ 3.75. Abnormal ESS scores were associated with lower academic achievement ($p = 0.002$).

Conclusion: A high prevalence of sleep disorder was found in this group of students, specifically female students. Analysis of the relationship between sleep disorder and academic performance indicates a significant relationship between abnormal ESS scores, total sleeping hours, and academic performance.

Introduction

The sleep–wake cycle, one of our biological rhythms, is driven by a circadian timing system which is influenced by some factors such as physiological function, school and work schedules, and many others (Lima et al. 2002). A study with a healthy sample showed that sleepiness may have a substantial adverse influence on general health and quality of life (Jewett et al. 1999). Moreover, the sleep–wake cycle of medical students is characterized by insufficient sleep duration, delayed sleep onset, and occurrence of napping episodes during the day (Ng et al. 2009; Sweileh et al. 2011). Sleep deprivation can be harmful to students. A high correlation has been demonstrated between sleep duration and performance in some activities as well as subjective alertness (Ravid et al. 2009). Studies have also demonstrated that insomnia may cause psychiatric disorders, psychosocial stress, and dysfunctions such as decreased work efficiency and learning disability (Jewett et al. 1999; Eliasson et al. 2010).

The prevalence of sleep disorders in the general population has been estimated to range from 22% to 65% (Jewett et al. 1999; Veldi et al. 2004). Bad or unsatisfactory sleep quality occurred in 7% (Roth & Ancoli-Israel 1999) and insomnia symptoms in 28% of medical students (Foley et al. 1995).

Practice points

- Medical students are exposed to a lot of pressure due to academic demands.
- High prevalence of sleep disorder among medical students.
- Female students are affected by sleep disorder more than male students.
- Significant and positive relationship between normal sleep and high academic performance.

Studies have showed that the manifestations of sleep disorders could precede or be associated with psychiatric illnesses. A study suggests that insomnia complaints may be an early marker of psychiatric disorders such as depression and anxiety (Eller et al. 2006). Other studies showed that there is relationship between sleep disturbances and psychiatric disorders especially depression and anxiety. Similar findings were observed among medical students (Rosal et al. 1997). Many studies have shown high level of psychological distress, anxiety, and depression in medical students in different countries (Lee & Graham 2001; Frank et al. 2006; Chan & Koh 2007; Abdulghani 2008; Loayza et al. 2011).

Sleep pattern is related to psychological, clinical, and social aspects. The medical student population is one of the populations that appear to be at increased risk for sleep deprivation (Veldi et al. 2004; Loayza et al. 2011). Sleep deprivation has been found to affect cognitive function in medical students and nurses (Parkerson et al. 1990; Roth et al. 2002). On the other hand, there is a positive relationship between adequate sleep and physical, social and general health and life satisfaction and performance (Parkerson et al. 1990; Rodigues et al. 2002; Eliasson et al. 2010).

One of the first studies that investigated the relationship between sleep habits and academic performance of medical students was published by Johns et al. (1976). This was then followed by other studies in both children and adult students (Thacher 2008; Ng et al. 2009; Ravid et al. 2009; Eliasson et al. 2010; Sweileh et al. 2011). Relatively few studies have investigated sleep habits and patterns among undergraduate medical students as a specific group and the relationship with the students' academic achievement, and cognitive functions (Rodigues et al. 2002; Peter et al. 2005). Some studies have concentrated specifically on postgraduate medical residents (Daugherty & Baldwin 1996; Halbach et al. 2003)

Extensive literature review could not reveal any local study that assesses the relationship between sleep disorders and academic achievement. This study was initiated to find out the prevalence of sleep disorder among medical students, and to look for any association between sleep disorder and their academic performance.

Participants and methods

A cross-sectional study was conducted over a 4-week period during the 2009–2010 academic year at the College of Medicine, King Saud University, Riyadh, Saudi Arabia. The participants in this study were 900 healthy male and female students from the first, second, and third academic years.

A self-administrated questionnaire was developed after extensive literature review. A group discussion was conducted with all co-authors to brainstorm and come up with a suitable data collection tool. This was further modified by consulting sleep medicine and medical education specialties. The modified questionnaire was piloted on 20 participants for further validation and finalization depending on the feedbacks from the pilot study. The feedback of the participants of the pilot group was incorporated and utilized in the finalization of the questionnaire. The questionnaire was designed in Arabic language containing questions enquiring about age, gender, academic level, grades, monthly income source, total sleep time per 24 h, naps during days, total study hours per day, any medical problem, and possible factors affecting bedtime or sleep pattern. Further daytime sleepiness (DTS) was studied using the Epworth Sleepiness Scale (ESS) which is a reliable validated sleep questionnaire to measure DTS (Miletin & Hanly 2003). It consists of eight items including different situation and activities of everyday life. The total ESS score is a measure of the average sleep propensity of falling asleep in those conditions. The total score ranges from 0 to 24, and the upper limit of normal in healthy adults is to be 10. Hence, an EES

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score of >10 indicates increased DTS (Chervin 2003; Bahamman et al. 2005).

Academic performance was assessed by students' grade point average (GPA). GPA was calculated by multiplying each course grade by the number of credit hours for that course and dividing this sum by the total number of the credit hours for that student. The resulting averages were converted to a 5.0 scale. A GPA of <3.75 was considered as poor performance.

This questionnaire was distributed to the students during mid-semester in their break times. The participation was voluntary and the student agreements were taken before the study. The study was approved by the College Ethical Research Committee.

Results

There were 491 responses from the total population of 900 students with a response rate of 55%.

Table 1 summarizes the demographic characteristics and other study variables. Male respondents totaled 307 (62.5%) and female 184 (37.4%), which is in keeping with the gender distribution of the college. The mean age ($\pm$ SD) was 24.4 ($\pm$1.9) years, ranging from 18 to 23 years. The students were distributed almost equally in the three academic years. A daily sleeping hours of 4–6 h were reported by 48% of the participants and 7–10 h by 46.67% while a small numbers of students were sleeping less than 4 h (2.6%) or more than 10 h (2.6%)

Table 1. Demographic characteristics and other variables of the study population ($n = 491$).

Variable	n (%)
Sex	
Male	307 (62.5)
Female	184 (37.5)
Academic year	
First	153 (31.1)
Second	172 (35)
Third	159 (32.3)
Sleep hours	
>10 h	13 (2.6)
7–10 h	229 (46.7)
4–6 h	236 (48)
<4 h	13 (2.6)
Midday nap	
Yes	288 (58.6%)
No	203 (41.3%)
Health problems	
Yes	68 (13.8%)
No	423 (86.1%)
Academic scores (GPA)	
4.5–5	187 (38)
3.75–4.5	164 (33.4)
2–3.75	140 (28.5)
Studying hours	
>6	12 (2.4)
4–6	63 (12.8)
2–4	199 (40.5)
<2	219 (44.6)
ESS score	
0–10 (normal)	312 (63.5)
>10–24 (abnormal)	179 (36.3)

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Table 2. Analysis of ESS scores with other study variables.

Ass. variable	ESS score 0–10 (normal)	ESS score >10 (abnormal)	Total n (%)	X2-value	p-value
Sex					
Male	229 (74.5%)	78 (25.4%)	307 (100%)	39.261	0.000
Female	85 (46.1%)	99 (53.8%)	184 (100%)		
Academic year					
First	97 (63.3%)	56 (36.6%)	153 (100%)	1.395	0.498
Second	116 (67.4%)	56 (32.5%)	172 (100%)		
Third	98 (61.6%)	61 (38.3%)	159 (100%)		
Academic scores (GPA)					
4.5–5	113 (60.4%)	57 (30.4%)	187 (100%)	11.989	0.002
3.75–<4.5	106 (64.6%)	44 (26.8%)	164 (100%)		
2–<3.75	59 (42.1%)	57 (40.7%)	140 (100%)		
Total sleeping hours					
<4 h	6 (4.6%)	7 (5.3%)	13 (100%)	11.765	0.019
4–6 h	159 (67.3%)	77 (32.6%)	236 (100%)		
7–10 h	146 (63.7%)	83 (36.2%)	229 (100%)		
>10 h	5 (3.8%)	8 (6.1%)	13 (100%)		
Nap during the day					
Yes	179 (62.1%)	109 (37.8%)	288 (100%)	0.716	0.397
No	133 (65.5%)	70 (34.4%)	203 (100%)		
Studying hours					
>6	6 (5%)	6 (5%)	12 (100%)	1.955	0.582
4–6	43 (6.8%)	20 (3.1%)	63 (100%)		
2–4	123 (61.8%)	76 (38.1%)	199 (100%)		
<2	140 (63.9%)	79 (36%)	219 (100%)		
Health problems					
Yes	32 (4.7%)	21 (3%)	68 (100%)	2.643	0.104
No	276 (64.4%)	152 (35.5%)	428 (100%)		

ESS scores were normal for 312 students (63.5%), while 70 students (36.6%) were defined abnormal, having excessive DTS based on ESS score of >10. Table 1 also showed the participants academic scores (GPA) and study hours.

Table 2 shows further analysis of the study variables with ESS scores. There was a statistically significant relationship between the ESS scores and gender ($p = 0.000$), GPA ($p = 0.002$), total sleeping hours ($p = 0.019$), as majority (75%) of male students' ESS scores were normal compared to the majority (54%) of female students' ESS scores were abnormal ($p = 0.000$) high GPA and sleeping between 4 and 10 h was associated with normal ESS scores.

Discussion

To our knowledge, this is the first local study which has investigated the relationship between sleep disturbances of medical students and their academic achievements. Excessive DTS or inability to maintain an adequate level of wakefulness is found to be a harmful factor for student learning ability (Johns & Hocking 1997; Rodigues et al. 2002) and is associated with minor psychiatric disorders in medical students (Hidalgo & Caumo 2002). On the other hand, optimized sleep patterns may improve both neuro-cognitive and academic performance (Curcio et al. 2006). While other studies have revealed that sleep deprivation was a common finding in student academic life, the results of this study revealed that the prevalence of excessive DTS among the medical students on ESS scale was 36.6% (normal = ...) which is similar to those reported in Brazil (Rodigues et al. 2002), Hong Kong (Huen et al. 2007),

Malaysian (Zailinawati et al. 2009), and in a local study of non-medical population (Bahamman et al. 2005).

It is interesting to note that excessive DTS was more common in female students. Female students have a higher prevalence of sleep disorder than males, which relates to another local study in a non-medical student population (Alotair & Bahammam 2008). In a study on medical students, it was found that no gender dominance, but other study had shown more sleep disorders in females than males (Parkerson et al. 1990). The cause of differences between the prior results could be female race in different countries. It seems that men complain about sleep quality, whereas females seem to concentrate more on single symptom (Niemi & Vainiomaki 2006).

The association between sleep disturbances and academic performance among medical students has not been investigated thoroughly. An earlier study (Johns et al. 1976) and a more recent study (Rodigues et al. 2002) showed that DTS was associated with poor academic performance. On the other hand, one study showed that in a non-medical students who were presenting sleepy, insomniac without any relation to their academic performance (Thacher 2008). This study showed a significant relationship between academic performance and DTS. This finding favors other studies where academic achievement was affected by sleep disorders in medical students (Johns et al. 1976; Rodigues et al. 2002). In this study, several factors associated with minor sleeping disorders among medical students such as sleeping deprivation, gender, and mid-day napping. Other studies demonstrated these risk factors for sleep disturbances in addition to socioeconomic status, life habits, and psychological factors

(Loayza et al. 2001). A small number (2.6%) of our population sleep less than 4 h. Enough sleeping hours (7–10) were significantly associated with normal ESS, but unfortunately no previous study showed any relationship.

This is a small sample size study with a response rate of 55%. As in most observational studies about sleep, sleep disturbances were based only on subjective assessment by the respondent. It is possible that respondents did not consider a few nights of difficulty sleeping due to an obvious stress to be equivalent to insomnia, or even with a more persistent sleep disturbance. In addition, although subjective and objective sleep assessments appear to measure different phenomena, previous studies have shown that there is an imperfect, but strong, relation between subjective evaluation of sleep and objective polysomnograph measurements (Ohaeri et al. 1992; Loayza et al. 2001). Finally, the relationship of academic performance with sleep disturbances was totally based on a GPA item to be filled by the students in the questionnaire, which would dramatically affect the result by respondents' accuracy.

Conclusion

A high prevalence of sleep disorder information of DTS was found in this study on three groups of medical students. It showed that female students have more sleep disorder than male students. Analysis of the relationship between sleep disorders and academic achievement shows a significant relationship with DTS and academic grades. Undergraduate medical students should be educated about the importance of adequate sleep to their academic performance and progression in their study. Sufficient daily sleep may also have an impact on their general physical and psychological wellbeing.

We recommend further investigation on a larger scale to look carefully on sleep disturbance and its relation with academic performance in medical students because of its poverty on previous studies.

Acknowledgments

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