ORIGINAL ARTICLE

Impact of Sleep Pattern of Pharmacy College Students on Academic Performance

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Abstract

Purpose Disrupted sleep pattern has shown to impact the mental health of medical sciences students. However, few studies assessed its association with academic performance, and the impact of other factors among pharmacy students. This study aimed to evaluate the relationship between different sleep pattern variables and academic performance among pharmacy students.

Methods A cross-sectional study using self-administered survey was distributed to all students at a large pharmacy college in Saudi Arabia between November 2020 and February 2021. The students were asked to answer based on their sleep pattern and academic performance in the previous year of 2019–2020 (before COVID-19 lockdown).

Results 237 students completed the survey. Shorter sleeps before exams and taking medicines for insomnia were significantly associated with failing at least one course (adjOR = 0.78 and 3.68; 95% CI 0.63–0.97 and 1.18–11.49; $P = 0.028$ and 0.025, respectively). As such, for each extra hour of sleep/night on exam nights, there is a 0.22 lower odd of failing at least one course, and taking insomnia medications increases the odds of failing by 3.68 times. Fewer sleep hours were significantly correlated with tiredness upon wake up, daytime sleepiness, and in-class sleepiness ($r_s = -0.24$, -0.38, and -0.24, respectively; $P \leq 0.001$ for all correlations).

Conclusions Disrupted sleep pattern negatively impacted the academic performance of pharmacy students. Getting sufficient quality sleep, especially before exams, maybe associated with better performance and lower odds of course failures. College administrators should encourage good sleep hygiene to their students and pair the recommendations with evidence on the impact of sleep on academic performance.

Keywords Students · Sleep · Academic performance · Pharmacy education

1 Introduction

Sleep disruption is defined as a curtailed sleep pattern that has persisted for at least 3 months for most days of the week, along with complaints of sleepiness during the day. Frequently occurring episodes of insufficient sleep are associated with the experience of unfavorable impacts on mental and physical well-being [1]. Adequate sleep affects mental functioning optimally, and therefore, affects the performance of students on examinations and ultimately grades obtained [2]. Sleep is often difficult for medical students because of the large amount of learning they need to do [3]. Cognitive performance is prone to inadequate periods of sleep, defined as less than 7 h per day for adults [4]. Inadequate sleep reduces general alertness and impairs attention, leading to decreased cognitive processing [5].

The sleep pattern one experiences over a 24-h period correlates directly with physical health, mood, and mental functioning [6]. Sleep problems among pharmacy students have been reported and have been associated with decreased academic performance [7]. Epidemiological data on poor sleep patterns in different countries were found to vary between studies based on the methods used and population characteristics, including marital status, gender, age, and culture [3]. The prevalence of poor sleep patterns among female medical students was found to be particularly high in a similar local study [5]. Poor sleep quality affects students' academic performance as their attention span and decreases the overall

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classroom energy to participate and learn [8]. Insufficient sleep affects alertness and leads to a decrease in attention, thereby slowing down cognitive processing. Furthermore, inadequate sleep interferes with the function of the prefrontal cortex and hippocampus, affecting memory, language, creativity, and logical and critical reasoning. Therefore, the academic performance of students may be compromised, thus increasing the risk of future medical malpractice and maltreatment [4].

Very few studies in the literature evaluated the link between sleep pattern and academic performance among students of medical or health sciences colleges. Therefore, this study aimed to evaluate such relationship among students attending a large college of pharmacy.

2 Methods

2.1 Study Design and Participants

We carried out a cross-sectional study to assess the sleep pattern of pharmacy college students at a large university in Saudi Arabia and to correlate such findings with the students' academic performance in terms of failing at least one course in the previous year and the grade point average (GPA). An online self-administered survey containing 19 questions was distributed to all pharmacy students from the second to the sixth year (internship year) of the Doctor of Pharmacy program from November 2020 to February 2021. First year students were enrolled in a preparatory/pre-med program in a different campus; hence, they were not approached. The students were asked to answer the survey based on their sleep pattern and academic performance in the previous academic year of 2019–2020 (before COVID-19 lockdown). Ethical approval was obtained from the Research Ethics Committee at the Faculty of Pharmacy.

2.2 Statistical Analysis

Based on an estimated total number of students of 600 enrolled students, a sample size of 235 students was needed as a representative sample to achieve 95% confidence level with 5% margin of error. To estimate the association between different variables with the outcome of failing at least once course in the previous year, multivariate logistic regression was conducted to calculate adjusted odds ratios (adjOR) and 95% confidence intervals (CI). Hosmer–Lemeshow test was used to establish the goodness-of-fit of the model, and omnibus test of model coefficients was used to establish the significance of the model. Two-tailed Spearman correlation was used to measure the correlation of sleep pattern with the GPA group, tiredness upon waking up, daytime sleepiness, and in-class sleepiness (i.e., ordinal variables). Spearman

correlation was selected as the continuous variables (sleep hours, sleep hours before exams, and number of weekly naps) were not normally distributed as determined by Shapiro–Wilk test of normality. Significance was indicated with a P value of < 0.05. All analyses were conducted on SPSS version 24.0 (SPSS Inc., Chicago, USA).

3 Results

A total of 237 students completed the survey, of whom 63.7% were males. The majority of the participants were in the second year (28.3%) followed by the fifth (26.6%) and fourth (20.3%) years. No difference was observed in the number of hours slept between all academic years. Table 1 lists the characteristics of the participants and their overall academic performance. Only 19 (8%) of the students reported taking a prescription medicine for insomnia or narcolepsy. Sleep patterns of the surveyed students appear in Table 2, where students reported later bedtimes; thus, shorter night sleeps on exam nights compared with their typical routines. While no significant correlation was found between the GPA and different sleep patterns, sleeping less hours before exam days, taking prescription medicine for

Table 1 Characteristics of the participants ($n = 237$)

Charactersitic	N (%)
Age	
< 20 years	69 (29.1)
≥ 20 years	168 (70.9)
Gender, male	151 (63.7)
Academic year	
Second	67 (28.3)
Third	31 (13.1)
Fourth	48 (20.3)
Fifth	63 (26.6)
Sixth	28 (11.8)
GPA[a]	
< 2.50	4 (1.7)
2.51–3.00	16 (6.8)
3.01–3.50	19 (8)
3.51–4.00	19 (8)
4.01–4.50	47 (19.8)
4.51–5.00	48 (20.3)
	10.3 (43.5)
Failed at least one course in the previous year	51 (21.5)
Take prescription medicine for sleep	19 (8)

GPA grade point average

[a]GPA is based of 5 points

Table 2 Sleep pattern of pharmacy college students (*n* = 237)

Sleep characteristic	*N* (%) or Median [IQR]
Bedtime	
Before 9 pm	20 (8.4)
Between 9 pm and 12 am	66 (27.8)
After 12 am	151 (63.7)
Wake up time	
Before 5 am	19 (8)
Between 5 and 8 am	150 (63.3)
Between 8 and 11 am	46 (19.4)
After 11 am	22 (9.3)
Hours of sleep per night	6 [3]
Frequency of daytime napping during the week	1 [2]
Late bedtime than usual on exam nights	
Always	130 (54.9)
Sometimes	73 (30.8)
Never/almost never	34 (14.3)
Early wake up than usual on exam days	
Always	176 (74.3)
Sometimes	48 (20.3)
Never/almost never	13 (5.5)
Hours of sleep per night on exam nights	4 [2]
Tired upon waking up	
Always	72 (30.4)
3–5 times a week	76 (32.1)
Once to twice a week	79 (33.3)
Never/almost never	10 (4.2)
Daytime sleepiness	
Always	55 (23.2)
3–5 times a week	65 (27.4)
Once to twice a week	96 (40.5)
Never/almost never	21 (8.9)
In-class sleepiness	
Always	53 (22.4)
3–5 times a week	55 (23.2)
Once to twice a week	102 (43)
Never/almost never	27 (11.4)

IQR interquartile range

insomnia, and more frequent daytime napping during the week were significantly associated with failing at least one course in the previous year (adjOR = 0.78, 3.68, 1.27; 95% CI 0.63–0.97, 1.18–11.49, and 1.02–1.58; *P* = 0.028, 0.025, and 0.030, respectively) as shown in Table 3.

Moreover, fewer hours of sleep per night (or later bedtime) were significantly associated with tiredness upon wake up, daytime sleepiness, and in-class sleepiness (r_s = − 0.24, − 0.38, and − 0.24, respectively; *P* ≤ 0.001 for all correlations). Unsurprisingly, students taking prescription medicines for insomnia reported more in-class sleepiness (r_s = 0.13; *P* = 0.044, respectively). Regarding the frequency of napping during the week, being a male, sleeping later at night, and having sleepiness during class were all significantly associated with more frequent naps during the week (r_s = 0.19, 0.18, and 0.20; *P* = 0.004, 0.006, and 0.002, respectively).

4 Discussion

This study evaluated the correlation of sleep pattern of pharmacy students in one of the largest pharmacy schools in Saudi Arabia with their academic performance in terms of GPA and course failure. Although no correlation was observed between daily and pre-exam sleep pattern with the GPA, significant associations were noticed between poor sleep before exams and frequent weekly daytime napping with course failure. Similar findings were reported in a study by Al Shammari, et al. who evaluated the impact of sleep quality on academic performance of Saudi medical students [7]. In their study, the authors found a significant association between poor sleep quality and excessive daytime sleepiness with poor academic achievement (adjOR = 3.33 and 4.58; 95%CI 1.28–8.63 and 1.09–20.81, respectively).

It is well-recognized that medical schools put significant demands on students' attention, and these results suggest that this time is taken from the students' sleeping hours. A study by Curcio et al. reported that sleep quality and quantity are closely related to student learning and academic performance [6]. Faculty members should pay attention to sleep deprivation in pharmacy students. Previous findings have shown that sleep loss leads to sleep-related problems, such as diabetes, cardiovascular disease, and reduced cognitive function and well-being, in addition to daytime fatigue and low academic success [9]. Colleges should work on raising students' awareness of the possible effects of their sleeping habits on their academic performance. Such guidance should be given to freshmen during their orientation, and it could include results of studies evaluating the impact of sleep pattern on academic performance, as well as recommendations for establishing good sleep hygiene. This knowledge of beneficial sleep behaviors may enable students to improve sleep habits that will carry over into their professional careers.

Rea et al. collected data from 654 college students regarding sleep patterns, where they found that shorter night sleeps were associated with longer napping the following day [10]. Such finding is similar to our finding of the higher probability of more frequent napping with later bedtimes. Furthermore, a study by Rotvold, et al. showed that college students slept for more hours than usual compared to pre-COVID-19 periods (44.3% compared with 36.4% reporting about the same sleep pattern and 13.6% reporting fewer than usual

Table 3 Association between different variables and failing at least one course in the previous year

Factor	AdjOR	95% Confidence interval	P Value
Age			
≥ 20 years	1.16	0.46–2.92	0.750
< 20 years	Ref	Ref	Ref
Gender			
Male	4.55	1.76–11.78	0.002
Female	Ref	Ref	Ref
Academic year			
Second	1.20	0.34–4.20	0.773
Third	3.92	1.02–15.04	0.047
Fourth	2.35	0.65–8.46	0.191
Fifth	1.11	0.31–3.91	0.873
Sixth	Ref	Ref	Ref
Take prescription medicine for sleep	3.68	1.18–11.49	0.025
Hours of sleep per night	1.07	0.89–1.29	0.469
Frequency of daytime napping during the week	1.27	1.02–1.58	0.030
Hours of sleep per night on exam nights	0.78	0.63–0.97	0.028
Tired upon waking up[a]			
Always	0.77	0.26–2.26	0.637
3–5 times a week	0.48	0.20–1.16	0.101
Once to twice a week	Ref	Ref	Ref
Daytime sleepiness			
Always	5.35	0.58–49.70	0.140
3–5 times a week	5.91	0.58–59.95	0.133
Once to twice a week	6.47	0.58–72.55	0.130
Never/almost never	Ref	Ref	Ref
In-class sleepiness			
Always	0.33	0.09–1.20	0.093
3–5 times a week	0.24	0.06–1.01	0.052
Once to twice a week	0.24	0.05–1.05	0.058
Never/almost never	Ref	Ref	Ref

AdjOR adjusted odds ratio

[a]Due to having a value of zero in the number of students who failed at least one course and never/almost never have been tired upon waking up, this category was eliminated from the regression analysis to allow for appropriate computation of adjORs for the other categories using "Once to twice a week" as a reference

hours; $P < 0.001$) [11]. The authors also found that sleeping for additional hours at night was slightly, but significantly, associated with frequent night wake ups, which may impact sleep quality.

Our study was limited by a few factors. It was conducted at a single college, which may limit its generalizability. The study also lacked evaluation of sleep quality, since academic performance can be impacted by both sleep quality and quantity [12]. In addition, we asked the students to remember their sleep habits over the course of the prior two semesters, which may lead to a recall error. Finally, the cross-sectional nature of this study impeded creating a causal association between sleep duration and academic performance at the end of the academic year. Finally, since this was a self-administered survey, it was prone to recall bias, as well as prestige bias in terms of GPA exaggeration or in terms of reporting course failure.

5 Conclusion

Getting sufficient quality sleep, especially before exam days, as well as establishing a year-round good sleep habits to reduce the need for daytime napping may be associated with better academic performance and lower risk of course failures. College administrators should encourage good sleep hygiene to their students and pair the recommendations with evidence on the impact of sleep on academic performance.

Declarations

Conflict of Interest The authors declare no conflict of interest.

Ethical Approval The study was approved by the Research Ethics Committee of the Faculty of Pharmacy.

Informed Consent Informed consent was obtained through the study survey.

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