

The association between academic performance and sleep quality and quantity among health sciences college students

Hussain Aldoraissi¹, Mustafa Istad¹, Mohammed Albakeem¹, Ahmad Nabzah¹, Khaled Alsubogh¹, Hatem A. Alqahtani², Khalid Albarkan², Yousef D. Alqurashi¹

¹Respiratory Care department, College of Applied Medical Sciences, Imam Abdulrahman Bin Faisal University, Dammam, Saudi Arabia; ²Family and Community Medicine department, College of Medicine, Imam Abdulrahman Bin Faisal University, Dammam, Saudi Arabia

Abstract. *Background and aim of the work:* The relationship between sleep and academic performance in Undergraduate health sciences college students have not been adequately addressed in the literature. This study aimed to investigate the association between sleep duration and quality with students' academic performance measured by cumulative grade point average (GPA). *Research design and Methods:* The sample consists of students from health Sciences colleges at Imam Abdulrahman Bin Faisal University (IAU), Dammam, Saudi Arabia. The data were collected through random sampling using Pittsburgh Sleep Quality Index (PSQI) in both Arabic and English language. The academic performance of the students was measured using their average GPA. The chi-square, t-test, and ANOVA tests were used to examine the relationship between sleep quality and duration and Academic performance. *Results:* In total, 448 students were recruited, of which 45% were males (n=200) with a mean age of 21±1 years. The average GPA calculated was 4.21±0.4. The students with GPA above 4.21 are considered higher achievers. There was a significant difference between sleeping hours at night and GPA (p-value = 0.034). There was no significant difference between sleep quality and GPA (x²= 0.150, p value = 0.903). *Conclusions:* Our data suggests that students who sleep 6 to 7 hours are academically better performers with higher GPA than those with less hours of sleep. Therefore, students at higher education institutions should be encouraged to have adequate sleep to get better grades in their courses.

Key words: sleep, academic performance, sleep duration, sleep quality, health sciences

Introduction

Sleep is one pillar of health and an essential aspect of human's life (1, 2). It plays an important role for mental and physical health, quality of life and cognitive functions (3, 4). Previous studies have shown that sleep is crucial for memory consolidation and learning (5, 6). Medical and health science students tend to get less sleep compared to the other specialties, presumably due to intense academic and clinical load (7).

Medical students who experience sleep problems face a significant risk of negative consequences. The lack of sleep can impair their cognitive abilities, hinder

memory consolidation, and ultimately hurt their academic performance (8). For example, sleep is responsible for 25% of the variance in academic performance in college students (1). Multiple studies have demonstrated that medical students have poor quality of sleep (9). A meta-analysis showed that sleepiness, sleep length, and sleep quality have a negative impact on school performance in children and adolescents; sleepiness was the strongest factor followed by sleep quality and sleep duration (10,11). Furthermore, Asarnow et al showed that there was a negative association between GPA and sleep quality (12). Regionally, Abdulghani et al showed that sleep duration of 6-10 hours per day

was associated with a GPA of ≥ 3.75 (13). Another study showed negative correlation between bedtime, and academic achievement, independent of weekday or weekend designation (14).

Therefore, the aim of this study was to investigate the association between sleep duration and quality and students' GPA among health science students at Imam Abdulrahman Bin Faisal University, Dammam Saudi Arabia.

Patients and methods

Participants

Participants were prospectively recruited from different health sciences colleges at Imam Abdulrahman Bin Faisal University (IAU), Dammam, Saudi Arabia. Participants were recruited through emails sent to them from the deanship of public relations and media at IAU. The inclusion criteria were all students in health sciences colleges at IAU from the second year until sixth year, not including the internship year. The exclusion criteria were students in a preparatory year (first year) and students who did not complete the survey. The preparatory year was excluded because they do not have a cumulative GPA yet. This study was approved by the Standing Committee for Research Ethics on Living Creatures (SCRELC) in IAU IRB number (IRB-UGS-2020-03-002) and informed consent was obtained from all participants.

Survey

A self-reported online survey was designed via Google forms. The survey was sent through academic email to all students in the university by the deanship of public relations and media. Before we published the survey, we administered it to three students to see if there is any difficulty in understanding the questions. Our survey was designed in both languages' Arabic and English.

The first part of the survey contains demographic data such as age, gender, health sciences colleges in IAU (medicine, dentistry, clinical pharmacy, nurse, public health and applied medical sciences), Academic

Table 1. The baseline characteristics of participants from all colleges.

Variable	Mean \pm SD	Minimum	Maximum
Age (years)	21 \pm 1	19	25
GPA (out of 5)	4.2 \pm 0.4	2.2	4.9
Studying (hours)	4.0 \pm 2.3	1.0	14.0
Nap (min)	51.6 \pm 64.3	0.0	420.0
Time in bed (hours)	6.9 \pm 1.8	2.0	13.5
Total sleep time (hours)	6.1 \pm 1.6	2.0	12.0
Global PSQI	6.80 \pm 3.3	0.0	16.0

year, academic performance (GPA), studying hours, nap in minutes -if any-, and sleeping hours at night. We divided sleeping hours at night into four groups: less than 4 hours, between 4-6 hours, between 7-10 hours, and more than 10 hours. Then, we calculated the average (mean) of student GPA (Table 1) and students with GPA above the mean were considered higher achievers than students with GPA below or equal to the mean.

The second part was the Pittsburgh Sleep Quality Index (PSQI). It is a self-administered questionnaire used to assess sleep quality. It consists of 24 items, 19 items self-rated questions, and the rest 5 items related to the partner. The second part usually used only for clinical purposes and was not included in the score. A score of more than 5 points is considered poor sleep quality.

Statistical analysis

Responses were collected and recorded using an online Google Form. The data were then cleaned and organized using Microsoft Excel. SPSS version 22 (IBM USA) was used for statistical analysis. Mean, standard deviations, and frequencies were calculated as descriptive statistics. Parametric or non-parametric tests were applied based on the distribution of the data. For comparing the differences, t test and analysis of variance (ANOVA) were used and associations were calculated using a Chi-Square test as a part of inferential statistics. Spearman's test was used to estimate the

correlations. P-values of less than 0.05 were considered statistically significant.

Results

The questionnaire was sent to 480 students and 448 have responded to the questionnaire, of which 200 (45%) were males with a response rate of 93%. Table 1 below shows the baseline characteristics for all variables collected from participants from all colleges.

Table 2 below shows the quality of sleep based on PSQI score stratified by genders and colleges.

GPA and studying hours

In our study we found that the highest GPA was 4.98 points in college of medicine and the lowest GPA was 2.29 in collage of public health. The total number of students who achieved GPA of ≤ 4.2 points were 208 students compared to 267 who achieved ≥ 4.2 points. The studying hours varied among all students from all colleges. There was a statistically significant difference between GPA and studying hours (t value = -3.599, p value = 0.00).

GPA and sleep duration

There was a statistically significant association between GPA and total sleep time at night ($\chi^2 = 8.660$, p value = 0.034).

GPA and sleep quality

The sleep quality was good in 168 students (37.5%) and poor in 280 students (62.5%) among all students from all colleges. There was no statistically significant association between PSQI and GPA ($\chi^2 = 0.150$, p value = 0.903).

Figure 1 below shows the comparison of GPA, studying hours and hours slept for all students among different colleges.

Table 3 below shows the ANOVA test results performed to examine the effect of age, colleges, studying hours, hours slept, and global PSQI score on GPA.

Discussion

The main finding of this study was that there was a statistically significant difference between GPA and total sleep time at night, sleep quality and studying hours.

Prior studies investigating the association between sleep patterns and academic performance have shown inconsistent results. Our study is in agreement with a previous study that showed no significant association between quality and quantity of sleep with GPA (15). In contrast, a study conducted on dental student found that 27% get PSQI less than 5 points, and there was a significant negative correlation between PSQI score and GPA (16). Another study conducted on pharmacy student showed that poor sleep quality was associated

Table 2. The quality of sleep based on PSQI scores among genders and colleges.

Variables	N	PSQI ≤ 5 n (%)	PSQI > 5 n (%)	X2 value	df	P value
Gender				1.387		0.239
Male	200	69 (34.5%)	131 (65.5%)		1	
Female	248	99 (39.9%)	149 (60.1%)			
Colleges				1.880	5	0.866
Medicine	136	46 (33.8%)	90 (66.2%)			
Dentistry	36	14 (38.9%)	22 (61.1%)			
Clinical pharmacy	32	14 (43.8%)	18 (56.2%)			
Applied medical sciences	173	67 (38.7%)	106 (61.3%)			
Nursing	35	12 (34.3%)	23 (65.7%)			
Public health	36	15 (41.7%)	21 (58.3%)			

with low GPA (17). Another study used Epworth Sleepiness Scale (ESS) has found that increase daytime sleepiness has a negative impact on GPA (18).

Sleep disturbances are prevalent among health sciences students, negatively impacting their physical and mental well-being, academic achievement, and potentially hindering their future careers. Previous studies showed that sleep deprivation are more prevalent in health sciences students compared to students from other specialities (19). This issue of sleep deprivation can be attributed to academic load, competitive nature

of health sciences specialities (20, 21). Students in our study reported experiencing sleep difficulties due to factors like depression, stress, overthinking, exhaustion, and pre-exam anxieties (4). Furthermore, a subset of the student population reported experiencing medical conditions that contribute to sleep disturbances. These conditions include insomnia, somnolence (sleep talking), and potential sleep apnea (indicated by shortness of breath). Bruxism (teeth grinding) was another reported sleep-disruptive factor.

In the current study, 75.7% (340) of students report their sleep quality as very good or fairly good and 24.3% (108) report their sleep quality fairly bad and very bad. Similar results were reported by Elagra in which 62.3% of students report poor sleep quality, and 37.6% get PSQI score of 5 points and below which indicate good sleep quality (16). Furthermore, A study conducted by Yilmaz and colleagues found that 56% of nursing students get a PSQI score above 5 points (22). These studies show that poor sleep quality is prevalent among health sciences students. This poor sleep quality is presumably due to intense academic schedule and the competitive nature of the health science field (23). Research suggests that sleep-deprived students

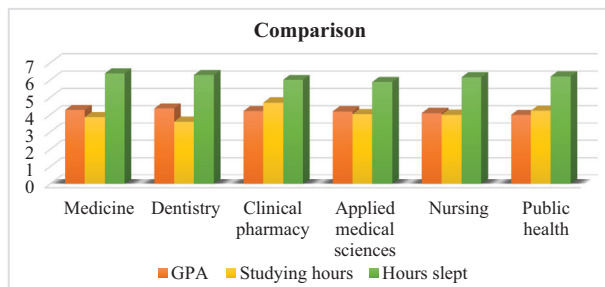


Figure 1. The mean of GPA, studying hours, and hour slept of all students among all health sciences colleges.

Table 3. ANOVA test results performed to examine the effect of age, colleges, studying hours, hours slept, and global PSQI score on GPA.

ANOVA						
		Sum of Squares	df	Mean Square	F	Sig.
Age	Between Groups	293.832	148	1.985	1.220	.077
	Within Groups	486.665	299	1.628		
	Total	780.498	447			
Colleges	Between Groups	446.207	148	3.015	1.176	.122
	Within Groups	766.666	299	2.564		
	Total	1212.873	447			
Study hours	Between Groups	1090.402	148	7.368	1.625	.000
	Within Groups	1355.358	299	4.533		
	Total	2445.759	447			
Hours slept	Between Groups	371.081	148	2.507	.964	.596
	Within Groups	777.811	299	2.601		
	Total	1148.892	447			
Global PSQI score	Between Groups	1853.750	148	12.525	1.270	.043
	Within Groups	2949.741	299	9.865		
	Total	4803.491	447			

experiencing academic difficulties are often unaware of the significant correlation between sleep loss and diminished cognitive performance (8, 18).

Limitation

This study is subject to several potential limitations. First, sleep quality and duration were obtained through self-reported measures. As with any self-reported data, these measures may be susceptible to recall bias. Second, the sample size was restricted due to the inherent limitations of online surveys at the university level. Not all students consistently access their university email, and participation in the online survey was voluntary.

Future directions

Future studies should investigate the association between clinical versus nonclinical courses and sleep disturbances of medical students. These types of studies are important because it might identify potential stressors specific to clinical rotations. Clinical rotations often involve long hours, irregular schedules, and increased patient responsibility. Understanding if these factors contribute more to sleep disturbances compared to nonclinical coursework could inform interventions targeted at clinical settings.

Conclusion

We concluded that sleep quantity affects students' academic performance (GPA) among health care students. Future studies should investigate the impact of different sleep interventions on academic performance.

Conflict of Interest: Each author declares that he has no commercial associations (e.g. consultancies, stock ownership, equity interest, patent/licensing arrangement etc.) that might pose a conflict of interest in connection with the submitted article.

Authors Contribution: HA, ME, MA, AN, KA, YA: formulate the idea, data collection, data analysis, and first draft writing of manuscript. HA, KA, YA: Data analysis, writing final versions of the manuscript.

References

- Okano K, Kaczmarzyk JR, Dave N, Gabrieli JDE, Grossman JC. Sleep quality, duration, and consistency are associated with better academic performance in college students. *NPJ Sci Learn.* 2019;4(1):1-5. doi: 10.1038/s41539-019-0055-z.
- Li Y, Sahakian BJ, Kang J, et al. The brain structure and genetic mechanisms underlying the nonlinear association between sleep duration, cognition and mental health. *Nature Aging.* 2022;2(5):425-37. doi: 10.1038/s43587-022-00230-y.
- Alqurashi YD, AlHarkan K, Aldhawyan A, et al. Association Between Nap Duration and Cognitive Functions Among Saudi Older Adults. *Front Neurosci.* 2022;16:917987. doi: 10.3389/fnins.2022.917987.
- Alqurashi Y, Al Qattan A, Al Abbas H, et al. Association of sleep duration and quality with depression Among University Students and Faculty. *Acta Biomed.* 2022;93(5):e2022245. doi: 10.23750/abm.v93i5.13002.
- Girardeau G, Lopes-Dos-Santos V. Brain neural patterns and the memory function of sleep. *Science.* 2021;374(6567):560-4. doi: 10.1126/science.abi8370.
- Klinzing JG, Niethard N, Born J. Mechanisms of systems memory consolidation during sleep. *Nat Neurosci.* 2019;22(10):1598-610. doi: 10.1038/s41593-019-0507-z.
- Azad Muhammad C, Fraser K, Rumana N, et al. Sleep Disturbances among Medical Students: A Global Perspective. *J Clin Sleep Med.* 11(01):69-74. doi: 10.5664/jcsm.4370.
- Binjabr MA, Alalawi IS, Alzahrani RA, et al. The Worldwide Prevalence of Sleep Problems Among Medical Students by Problem, Country, and COVID-19 Status: a Systematic Review, Meta-analysis, and Meta-regression of 109 Studies Involving 59427 Participants. *Curr Sleep Med Rep.* 2023; 1-19. doi: 10.1007/s40675-023-00258-5.
- Almutairi H, Alsubaiei A, Abduljawad S, et al. Prevalence of burnout in medical students: A systematic review and meta-analysis. *Int J Soc Psychiatry.* 2022;68(6):1157-70. doi: 10.1177/00207640221106691.
- Dewald JF, Meijer AM, Oort FJ, Kerkhof GA, Bögels SM. The influence of sleep quality, sleep duration and sleepiness on school performance in children and adolescents: A meta-analytic review. *Sleep Med Rev.* 2009;14(3):179-89. doi: 10.1016/j.smrv.2009.10.004.
- Musshafen LA, Tyrone RS, Abdelaziz A, et al. Associations between sleep and academic performance in US adolescents: a systematic review and meta-analysis. *Sleep Med.* 2021; 83:71-82. doi: 10.1016/j.sleep.2021.04.015.
- Asarnow LD, McGlinchey E, Harvey AG. The effects of bedtime and sleep duration on academic and emotional outcomes in a nationally representative sample of adolescents. *J Adolesc Health.* 2014;54(3):350-6. doi: 10.1016/j.jadohealth.2013.09.004.
- Abdulghani HM, Alrowais NA, Bin-Saad NS, Al-Subaie NM, Haji AMA, Alhaqwi AI. Sleep disorder among medical students: Relationship to their academic performance

- Med Teach. 2012;34(s1):S37-S41. doi: 10.3109/0142159X.2012.656749.
14. 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. doi: 10.1186/1472-6920-12-61.
 15. Masudi E, Algarni A, Alhazzani N. The Relationship between Sleep Patterns and Academic Performance among Medical Students at King Saud Bin Abdulaziz University for Health Sciences. *The Egyptian Journal of Hospital Medicine.* 2018;70(7):1131-4. doi: 10.12816/0044537.
 16. Elagra M, Rayyan M, Alnemer O, et al. Sleep quality among dental students and its association with academic performance. *J Int Soc Prev Community Dent.* 2016;6(4): 296-301. doi: 10.4103/2231-0762.186788.
 17. Cates ME, Clark A, Woolley TW, Saunders A. Sleep quality among pharmacy students. *Am J Pharm Educ.* 2015;79(1):09. doi: 10.5688/ajpe79109.
 18. 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(1):61-. doi: 10.1186/1472-6920-12-61.
 19. Waqas A, Khan S, Sharif W, Khalid U, Ali A. Association of academic stress with sleeping difficulties in medical students of a Pakistani medical school: a cross sectional survey. *PeerJ.* 2015;3:e840. doi: 10.7717/peerj.840.
 20. Alsaggaf MA, Wali SO, Merdad RA, Merdad LA. Sleep quantity, quality, and insomnia symptoms of medical students during clinical years. Relationship with stress and academic performance. *Saudi Med J.* 2016;37(2):173-82. doi: 10.15537/smj.2016.2.14288
 21. Almojali AI, Almalki SA, Alothman AS, Masuadi EM, Alaqeel MK. The prevalence and association of stress with sleep quality among medical students. *J Epidemiol Glob Health.* 2017;7(3):169-74. doi: 10.1016/j.jegh.2017.04.005.
 22. Yilmaz D, Tanrikulu F, Dikmen Y. Research on Sleep Quality and the Factors Affecting the Sleep Quality of the Nursing Students. *Curr Health Sci J.* 2017;43(1):20-4. doi: 10.12865/CHSJ.43.01.03.
 23. Teimouri A, Amra B. Association between Sleep Quality and Gastroesophageal Reflux in Medical Students. *Middle East J Dig Dis.* 2021;13(2):139-44. doi: 10.34172/mejdd.2021.217.
-
- Correspondence:**
Received: 25 June 2023
Accepted: 4 June 2024
Yousef Alqurashi, PhD
Respiratory Care department, College of Applied Medical Sciences, Imam Abdulrahman Bin Faisal University, Dammam 34221, Saudi Arabia
Tel: 0133331328
Email: ydalqurashi@iau.edu.sa
ORCID: 0000-0003-3263-0237