Sleep Quality as a Predictor for Academic Performance in Menoufia University Medical Students

Yasser Atta Shehata, Asmaa Yehia Sharfeldin, Ghadeer Maher El Sheikh*.
Public Health and Community Medicine Department, Faculty of Medicine, Menoufia University, Egypt
***Corresponding author: Ghadeer Maher El Sheikh, Mobile:** +201004039259**, Email:** ghadeer_maher@yahoo.com

ABSTRACT

Background: Poor sleep quality is an important public health problem with multiple unfavourable consequences. Sleep disorders are widespread among university students and have a significant impact on their general health and academic performance. **Aim:** To investigate the relationship between sleep quality and academic performance among medical students in Menoufia University. **Participants and methods:** This cross-sectional study was carried out from 1st November 2021 to the end of March 2022 on 1033 undergraduate medical students from Menoufia University in Egypt. The data were collected using self-administered questionnaire to obtain information regarding sociodemographic variables, academic achievement in the previous year, sleep habits and environmental sleep factors like smoking, exercise and media use. The Pittsburgh Sleep Quality Index (PSQI) was used to assess sleep quality.

Results: The mean overall score of the PSQI was 18.03 (SD ± 7.59); the majority of students (96.5%) had bad sleep quality with PSQI score greater than 5. There was a highly significant difference between good and bad academic performance regarding Pittsburgh sleep quality score. Mean sleep duration was 6.67 (SD ± 2.05) hours. Most of participants were non-smokers (91.9%), physically not active (50.6%), and use the internet for more than two hours daily (55.8%).

Conclusion: Poor sleep is a major problem for Egyptian medical students, and there was also a significant relationship between sleep quality and academic performance.

Keywords: Academic performance, medical students, Pittsburgh Sleep Quality Index.

INTRODUCTION

Sleep is a crucial process that is required for the enhancement of normal cognitive functioning such as attention, decision-making, communication, and, most importantly, learning and memory, and hence, student academic performance [1]. "Good" subjective sleep quality is described as the ability to fall asleep easily, sleep for enough time to wake up feeling rested, and get through the day without feeling drowsy [2].

The Pittsburgh Sleep Quality Index (PSQI) is the gold standard for subjective sleep quality measurement [3]. In Egypt, there is scarcity of information about the association between sleep quality and academic performance among the students. So, it has been urgently necessary to conduct this study to assess the relationship between sleep quality and academic performance among undergraduate medical students at Faculty of Medicine, Menoufia University, and subsequently, provide relevant scientific based information about situation in Egypt.

PARTICIPANTS AND METHODS

This cross-sectional analytic study was carried out from 1st November 2021 to the end of March 2022 on 1033 undergraduate medical students from Menoufia University, Egypt. The G*power software was used to estimate the sample size (Heinrich Heine University Düsseldorf, Germany). A former study stated that 58% of the medical students had poor sleep quality [4]. With 5% alpha error and 80% study power, the sample size was calculated to be 980. To account for non-responders, we increased the sample size by an additional 98 students (10%). Thus, the total sample size was 1078, (which was spread over medical students from grade 2 to grade 6 and house officers). Forty-five invalid questionnaires were excluded. So, the final sample size was 1033 students. As regards sampling techniques, in Menoufia medical faculty, each academic year is subdivided into four small groups of about 100 students for their practical and clinical round rotations. The study sample was randomized through selection of two random groups of students from each grade.

Each participant was asked to complete a self-administered questionnaire to obtain information about sociodemographic variables (age, gender, year of education, residence, student's habitat during the study, height, weight), sleep habits and environmental sleep factors like smoking, exercise and media use, academic achievement in the previous year. The grading system of students at the faculty of Medicine in Menoufia University is classified according to the overall score of the student. Student is considered (failed) if he/she had < 60% of the overall score of subjects studied at the nominated year and is considered (passed) if he/she had >60% of the overall score of subjects studied at the nominated year. Furthermore, passed students are sub-classified into four categories: Accepted 60-<65%, Good 65-<75%, Very Good 75-<85%, and Excellent ≥85% of the overall score of subjects studied at the nominated year.

Instrumental tool used in the study: - The Pittsburgh Sleep Quality Index (PSQI) is a self-reported questionnaire used to assess sleep quality over a one-month period. The measure consists of 19 distinct items that combine to form 7 components that result in a single global score, and it takes 5–10 minutes to complete. Subjective sleep quality, latency, duration, habitual sleep efficiency, sleep disruptions, usage of sleep medication, and daytime dysfunction are all

components. Each component score ranges from 0 (no difficulty) to 3 (severe difficulty). The global score, which varies from 0 to 21, is calculated by adding the 7 component scores. A PSQI score of less than or equal to 5 indicates good sleep quality, whereas a value of more than 5 suggests poor sleep quality [3].

Ethical consent:
An approval of the study was obtained from Menoufia University Academic and Ethical Committee. Every participant signed an informed written consent for acceptance of participation in the study. This work has been carried out in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans.

Statistical analysis
Data management and analysis were carried out using the Statistical Package for the Social Sciences (SPSS) Version 23 (IBM Corp., Armonk, N.Y., USA). Quantitative data were expressed in mean, and standard deviation (SD), while qualitative data were expressed in frequency and percent (%). The Student's t-test was used for comparison of normally distributed continuous variables while Mann-Whitney test was used for not normally distributed data. To assess the association between two or more qualitative variables, the Chi-square test was performed. Receiver Operator Characteristic (ROC) curves with the Area Under the Curve (AUC) was used to determine the optimal cutoff scores of the PSQI scale. Binary logistic regression was used to evaluate the strength of the link between independent risk factors and the academic performance as the dependent outcome, with the risk assessed by Odds ratio at 95% confidence intervals (CI). A P value of less than 0.05 was considered significant.

RESULTS
Our results showed that there was highly significant relationship between good and bad academic performance regarding age, sex, BMI, habitat, smoking and internet use. Mean age of our participants was 22.1 ± 1.9, the majority of them was females (59.7%). Most of participants had average BMI (49.5%), were non-smokers (91.9%), physically not active (50.6%), in academic years 2nd, 3rd grades (51.6%) and use the internet for more than two hours daily (55.8%) (Table 1).

Table (1): Relation between sociodemographic data and academic performance of last year

Variables	Good (n = 831)		Bad (n = 202)		Total		Test of significance (P value)
	No	%	No	%	No	%	
Age (Mean ± SD)	22.23±1.85		21.55±2.18		22.1±1.9		t test = 4.47 **(<0.001)****
Sex							
Males	304	36.6	112	55.4	416	40.3	X^2 =24.038
Females	527	63.4	90	44.6	617	59.7	**(<0.001)****
BMI							
Underweight	160	19.3	61	30.2	231	22.4	
Average	443	53.3	68	33.7	511	49.5	X^2 = 26.00
Overweight/Obese	228	27.4	73	36.1	291	28.1	**(<0.001)****
Residence							
Urban	504	60.6	134	66.6	638	61.8	X^2 =2.225
Rural	327	39.4	68	33.7	395	38.2	(0.136)
Habitat							
Home/House	490	58.9	87	43.1	577	55.9	X^2 = 16.65
Student's Dorm	341	41.1	115	56.9	456	44.1	**(<0.001)****
Smoking							
Yes	28	3.4	56	27.7	84	8.1	X^2 = 129.01
No	803	96.6	146	72.3	949	91.9	**(<0.001)****
Physical activity							
Active	415	49.9	95	47.1	510	49.4	X^2 = 0.55
Not active	416	50.1	107	52.9	523	50.6	0.458
Internet use							
< 2 hrs /day	350	42.1	107	53.0	457	44.2	X^2 = 7.758
≥ 2 hrs/day	481	57.9	95	47.0	576	55.8	**(0.005)***
Academic Year							
2nd, 3rd, 4th	394	47.4	139	68.8	533	51.6	X^2 = 29.795
5th, 6th, house officer	437	52.6	63	31.2	500	48.4	**(<0.001)****

t: Student t test, X^2: Chi square test, **: Highly significant (p value <0.001), *: Significant (P<0.05)

In addition to that, sleep hours didn't show significant effect on academic performance. There was a highly significant difference between good and bad academic performance regarding Pittsburgh sleep quality score. Comparing good and bad academic performance regarding total Pittsburgh sleep quality score at cutoff point 5 revealed no statistically significant difference (Table 2).

Table (2): Relation between sleep quality and academic performance of last year

		Academic Performance of Last Year			Total (n= 1033)		Test of significance (P value)
		Good (n = 831)		Bad (n = 202)			
		No	%	No	%	No	%	
Sleep hours Mean ± SD		6.66 ± 2.05		6.72 ± 2.04		6.67± 2.05		**t** = 0.352 (0.725)
PSQC	**Total Score** (Mean ±SD)	17.49± 7.55		20.23 ± 7.35		18.03± 7.59		**U** = 4.640 (<0.001)
	< 5	28	3.4	8	4.0	36	3.5	**X²** = 0.169 (0.681)
	≥ 5	803	96.6	194	96.0	997	96.5	

t: Student t test, U: Mann-Whitney test, X²: Chi square test

A new cutoff point for total Pittsburgh sleep quality score (PSQC) was needed to detect the difference between good and bad academic performance. On doing ROC curve between total PSQC and academic performance, a modified Egyptian cutoff point was selected (8.5) (Table 3).

Table (3): ROC curve results to estimate a cutoff value of total PSQC score to detect the good academic performance of students

AUC	P value	Cutoff point	Sensitivity	Specificity
0.605	<0.001	< 8.5	86.2%	19.6%

A PSQI score of less than or equal to 8.5 indicates good sleep quality, and there was statistically significant difference between good and bad academic performance regarding Pittsburgh sleep quality score (PSQC) at the new cutoff point (Table 4).

Table (4): Relation between sleep quality (according to the pre-determined cutoff value) and academic performance of last year

Variables	Academic Performance of Last Year				Total (n= 1033)		Test of significance (P value)
	Good (n = 831)		Bad (n = 202)				
	No	%	No	%	No	%	
Modified Egyptian classification of PSQC							
< 8.5	115	13.8	15	7.4	130	12.6	**X²** = 6.075 (0.014)*
≥ 8.5	716	86.2	187	92.6	903	87.4	

*Significant

Logistic regression model of the risk factors associated with academic performance showed that; sex, overweight or obesity, living in student's dorm were significant predictors of bad academic performance. Male students were 2.195 times associated with bad academic performance more than females. Overweight/obese students were 2.01 times riskier for bad academic performance than others with average BMI or even underweight. Finally, total PSQC ≥ 8.5 was 1.769 times riskier for bad academic performance than PSQC <8.5, table (5).

Table (5): Logistic regression model of risk factors associated with bad academic performance of last year

Independent factors	B	Sig.	Odds	95% CI	
				Lower	Upper
Age	0.178	**<0.001**	.837	0.771	0.91
Sex: Male	0.786	**<0.001**	2.195	1.601	3.011
Residence: Urban	0.211	0.211	1.235	0.887	1.72
BMI: Overweight /obese	0.416	**0.041**	2.01	2.98	6.013
Habitat: Student's Dorm	0.517	**0.032**	1.640	0.293	1.95
Smoking: yes	0.110	0.231	0.843	0.301	.992
Physical activity: No	0.249	0.137	1.76	0.618	3.984
Sleep hours	0.008	0.087	1.003	0.928	1.084
PSQC: ≥ 8.5	0.617	**<0.001**	1.769	1.004	2.351
Constant	2.174	0.043	8.79		

DISCUSSION

Sleep quality has an important role on the academic performance of all students. [5] This study investigated the sleep quality among Menoufia University medical students and its impact on their academic performance.

Mean of sleep hours for our participants (±SD) was 6.67 ± 2.05 which was in concordance with **Abdulghani et al.** [5] findings; 94.7% of their participants had 4-7 sleep hours and **Alsaggaf et al.** [6] findings; mean of sleep hours in excellent and good or below academic performance were 5.4± 2 and 6± 1.8 respectively. While **Adelantado-Renau et al.** [7] showed that sleep duration (hours) was 8 ± 0.9. **Kelly et al.** [8] revealed that sleeping for nine hours or more in a 24-hour period resulted in much higher academic performance than sleeping for less than six hours in the same time period.

Variations in sleep patterns (including sleep hours) were found to be associated with academic performance impairments [9]. Increased numbers of sleeping hours was associated with higher academic performance [10]. However, our findings showed that there was no correlation between sleep duration and academic achievement, this was in agree with **Alsaggaf et al.** [6].

In a couple of studies performed by **Adelantado-Renau et al.** [7] **and Dewald et al.** [11], they revealed that academic performance correlated with sleep quality a bit higher than sleep hours (r = 0.096) and (r = 0.069) respectively. **Ahrberg et al.** reported that academic performance positively correlated with stress and sleep quality; 8% of all participants revealed poor sleep quality (PSQI > 5) post-exam [12].

Mean Pittsburgh Sleep Quality Index (PSQI) score was 19.5 (SD ± 7.01) among our medical students, unlike Assiut and Mansoura medical students' PSQI score, which was 6.01 (SD ± 2.73). In this study only 3.5 % of our participants had good sleep quality (PSQI < 5) while 96.5 % of them had poor sleep quality (PSQI ≥ 5), contrary to 46.7% good sleep quality in Assiut Universities, and 69.5% poor sleep quality among students in Dhaka, Bangladesh [13, 14]. **Ismail et al.,** reported that the prevalence of poor sleep quality (PSQI >5) was 72.5% among 829 secondary school students aged 15–19 years in Assiut, Egypt [15].

As a result of the high prevalence of bad sleep quality among the students, ROC curve was conducted to set a modified Egyptian cutoff-point for PSQI; our new cutoff-point was 8.5. A significant relationship was resulted between academic performance and PSQC at our new cutoff point (8.5).

In line with a systematic review conducted by **Dewald et al.**, who revealed that age and gender significantly affected school performance [11], our findings support this trend, showing a highly significant difference between good and poor academic performance with respect to age. Many explanations could lie behind these results (age). One of these explanations discussed by **Dewald et al.**, who attributed this to the developmental process of prefrontal cortex during adolescence [11]. Other potential explanations include the statistical distribution of studied participants, where more students (831 students) had good academic performance, while 202 students had bad academic performance one.

Females had significantly higher good academic performance than males; **Elwasify et al.** reported that 56.8% of females study more than 4 hours daily against 42.4% of males and academic performance was positively correlated with study hours. More in-depth studies investigating the relationship between academic performance and both age and gender are in-need, both at the local and international level to fill the gap of scarcity of relevant information [13].

Academic performance and BMI had a highly significant association; 36.1% of students with bad academic performance were obese (BMI > 30). In concordance with our findings, **Torrijos-Niño et al.** found that obese students had lower academic scores than overweight or normal weight ones. These findings could be explained by the fact that obesity affects sleep quality, studying hours, concentration and various life activities [16].

BaHammam et al. had another view; they stated that total BMI had no significant association with academic performance, where they found only 16.3% of bad academic performance students were obese [17].

Our results showed a highly significant difference between students live in their homes and dorm students regarding academic performance. Dorm students had bad academic performance than others, this may be due to living of more than one student in the same room with many distractions and other psychological factors that might affect studying. There is no consensus in these findings. **Delucchi** found that there were significant differences between commuters (students didn't live on campus nor in the adjacent student community) and dorm students regarding academic performance [18]. On the other hands, other study done by **De Araujo and Murray** showed that living on campus increases GPA (grade point average) from 0.19 to 0.97 [19].

Smoking had a substantial association with academic achievement: only 1.25% and 0.9% of students with excellent academic performance were smokers according to our findings and **BaHammam et al.** respectively. Also, there was a considerable link between academic performance and internet use as excellent academic performance was associated with using internet ≥ 2 hours daily and this agreed also to the findings of **BaHammam et al.** [17].

Regarding logistic regression model, age, sex, BMI, student's dorm and PSQC >8.5 were significant

predictors for bad academic performance. According to **BaHammam** *et al.* who agreed with us; smoking and obesity were significant predictors for bad academic performance, while total sleep time was inverse predictor. Also, **El Hangouche** *et al.* showed that old age and poor sleep were associated to low academic performance [20]. Finally, **Kim and So** discovered that obese boys were 1.461 and 1.443 times more likely to have poor and extremely poor academic performance, respectively. Additionally, the probability of obese girls performing averagely, poorly, or extremely poorly in school were 1.672, 1.887, and 1.887 times higher, respectively [21].

Conclusion:

Poor sleep quality is a considerable issue among Egyptian medical students, and there was also a significant relationship between sleep quality and academic performance. Therefore, more emphasis should be placed on raising awareness of this problem and developing active interventions to improve sleep quality among medical students.

Conflicts of interests: There was no conflicts of interests at the study.

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