

Association of sleep duration and quality with depression among university students and faculty

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Abstract. *Background and aim:* Highly competitive and demanding environments in educational institutions led to reduced sleep time for both students and faculty globally. The primary objective of this study was to determine the duration and quality of sleep among students and faculty of Imam Abdulrahman Bin Faisal University (IAU). The secondary objective was to explore the relationship between depression and sleep duration and quality among students and faculty. *Methods:* The study was conducted during 2021 in Dammam, Saudi Arabia. An online survey was disseminated among the university students. The survey form included: demographic data, Patient Health Questionnaire (PHQ9), Pittsburg Sleep Quality Index (PSQI) and Epworth Sleepiness scale (ESS). The responses were analyzed using bivariate and multivariate analysis. *Results:* A total of 509 responses satisfying the inclusion criteria were included (323 student and 186 faculty). The average sleep duration for the entire cohort was 6.21 ± 1.32 hours, with 6.5% sleeping less than 5 hours per night. The mean PSQI score was 7.6 ± 3.0 , with 73.1% falling in the poor sleep quality category (PSQI score >5). The mean PHQ9 score was 8.9 ± 6.2 , with 64% falling in the mild depression category. The mean ESS score was 6.6 ± 4.0 , with 11% having a score >10 (corresponding to excessive daytime sleepiness). *Conclusions:* A significant proportion of surveyed students and faculty IAU suffer from sleep insufficiency, poor sleep quality, and mild degree of depression. Initiatives to tackle the issue of poor sleep quality and quantity among university students and faculty are required. (www.actabiomedica.it)

Key words: Sleep deprivation, depression, university, sleep quality

Introduction

Sleep is considered the third pillar of health, after diet and exercise (1). The American Academy of Sleep Medicine recommends that the sleep duration should be between 7-9 hours for adults and at least 10 hours for school-age students (2). Sleeping less than the recommended hours is generally associated with several adverse mental and physical health outcomes, such as poor attention, depression, obesity, hypertension, and cardiovascular diseases (3).

Among the various surveys conducted in different countries, insufficient sleep was reported by 30% in the United States, 23% of a representative sample from Japan (4), 12% in Sweden (5), and by 9% in Finland (6). The US Center for Disease Control (CDC) examined data from over 400,000 participants and found that 11.1% reported insufficient sleep every day during the preceding 30 days (7). In Saudi Arabia, Ahmed et al. (8) suggested that approximately 33.8 % of the Saudi population sleep less than 7 hours per night. Stranges et al. (9) estimated

that the global prevalence of sleep deprivation was approximately 16%.

The consequences of sleep deprivation are catastrophic, including, but not limited to, physiological deterioration, cardiovascular diseases, and mortality risk (10). One of the major impacts of sleep deprivation is reduced cognitive performance and productivity (10).

A meta-analysis included seven prospective studies from both Japan and the United States, has found that short and long sleep duration was significantly associated with increased risk of depression (11).

The primary objective of this study was to determine the duration and quality of sleep among students and faculty of Imam Abdulrahman Bin Faisal University (IAU), hypothesizing that at least 30% of the sample will report sleeping between 7-9 hours of sleep. The secondary objective was to explore the relationship between depression and sleep duration and quality, among the students and faculty.

Methods

Study design and participants

The study design was an institution-based, cross-sectional observational study. The study was conducted during the first quarter of 2021 in Imam Abdulrahman Bin Faisal University, Dammam, Saudi Arabia. We recruited 509 participants who were identified using either direct contact with the departments and their faculty or email advertisements sent to those who are affiliated with Imam Abdulrahman Bin Faisal University (IAU). Only responses that were submitted by IAU students and faculty were included in the study. Responses that were incomplete or lacked crucial pieces of data were excluded. Written informed consent was obtained from the participants, and the study was approved by the University Institutional Review Board (IRB) (IRB-UGS-2020-1-321).

Materials and data collection process

An internet-based questionnaire was used to collect the data for this study. Participants were given the options to complete the questionnaire either in Arabic

or English language, according to their preferences. The questionnaire consisted of section for demographic data and the following questionnaires: Pittsburg Sleep Quality Index (PSQI) questionnaire (12,13), Patient Health Questionnaire (PHQ9) (14,15), Epworth Sleepiness scale (ESS) (16,17).

Validated Arabic versions of the PSQI, PHQ9, and ESS were also used to collect the required answers from participants, if they choose the Arabic version of the questionnaire.

- **PSQI:** The PSQI is a self-reported questionnaire assessing sleep duration and quality. It is comprised of seven components, which are given a corresponding score depending on the response of the participant. The sum of these components is then used to calculate the "global score." The global score can range from 0 to 21. A global score of 5 or less is considered "good quality sleep," while a global score >5 is considered "poor quality sleep."
- **PHQ9:** The PHQ9 is a self-reported questionnaire to assess the severity of depression. It is comprised of 9 questions, which are given a corresponding score depending on the response of the participant. Participants' responses are given numeric values from 0-3, and then their sum is used to categorize the severity of depression. Possible scores can range from 0 to a maximum of 27. A score of 10 or less corresponds to the "normal," and a score >10 indicates pathological depression.
- **ESS:** The ESS is a self-reported questionnaire to assess the subjective daytime sleepiness. It is composed of 8 questions, which are given a corresponding score depending on the response of the participant. Participants rate their chances of dosing-off during certain activities, with each question being graded from 0 to 3 and then summed for a total score. Scores of 10 or less are considered normal, and scores >10 indicates excessive daytime sleepiness.

The 3 questionnaires (PSQI, PHQ9, and ESS) were compiled into a survey form. The survey form was then made electronically available using Google Forms

in both Arabic and English languages. This online survey form was then disseminated to IAU students and faculty using an electronic link sent to their email addresses.

Data 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, Mann Whitney U-test and Kruskal Wallis tests 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

A total of 509 responses, which met the inclusion and exclusion criteria, were included in the final analysis, with 323 (62.4%) student responses, and 186 (35.9%) faculty responses. The gender distribution of the responses was 206 (40.5 %) male and 303 (59.5%) females.

Sleep duration

For students, the mean sleep duration was 6.2 ± 1.3 hours (males: 6.5 ± 1.1 hours, females:

6.1 ± 1.2 hours, $P= 0.015$). For faculty, the mean sleep duration was 6.1 ± 1.3 hours (males= 5.3 ± 1.6 hours, females= 6.2 ± 1.2 hours, $P= 0.16$). Although there was no significant difference between the male and female faculty in terms of duration of sleep, female faculty exhibited a longer duration of sleep than males. Table 1 shows the mean and standard deviation of sleep durations, for the entire cohort stratified by gender.

For students, the mean global PSQI score was 8.0 ± 3.0 (males: 7.1 ± 2.8 , females: 8.6 ± 3.0). For faculty, the mean global PSQI score was 6.9 ± 3.1 (males: 5.8 ± 2.6 , females: 7.7 ± 3.1). The mean PSQI score for the entire cohort was 7.6 ± 3.1 (male: 6.6 ± 2.8 , female: 8.3 ± 3.1).

The majority (73.1%) of students and faculty had global PSQI score of >5 , which indicate poor quality sleep, compared to 27% who had a global PSQI score of <5 , which indicates good sleep quality (Table 2).

Figure 1 shows a negative correlation between the global PSQI scores and sleep duration of participants (Spearman's coefficient = -0.5 ; $P= <0.001$). The figure shows a trend of poor sleep quality being associated with a fewer number of hours of sleep.

The depression score and its association with sleep duration and quality

For students, the mean PHQ9 score was 8.9 ± 6.2 (males: 6.8 ± 5.4 , females: 10.2 ± 6.3). For faculty, the mean PHQ9 score was 5.8 ± 5.3 (males: 3.7 ± 4.6 ,

Table 1. Sleep duration stratified by gender.

		Male	n	Female	n	P-value
Group	Faculty	5.3 ± 1.6	73	6.2 ± 1.2	113	0.16
	Students	6.5 ± 1.1	133	6.1 ± 1.2	190	0.015

Table 2. Sleep quality comparison between faculty and students.

		Sleep Quality		
		Poor (>5)	Good (≤ 5)	P-value
Groups	Faculty	139 (75%)	47 (25%)	0.029
	Students	268 (83%)	55 (17%)	

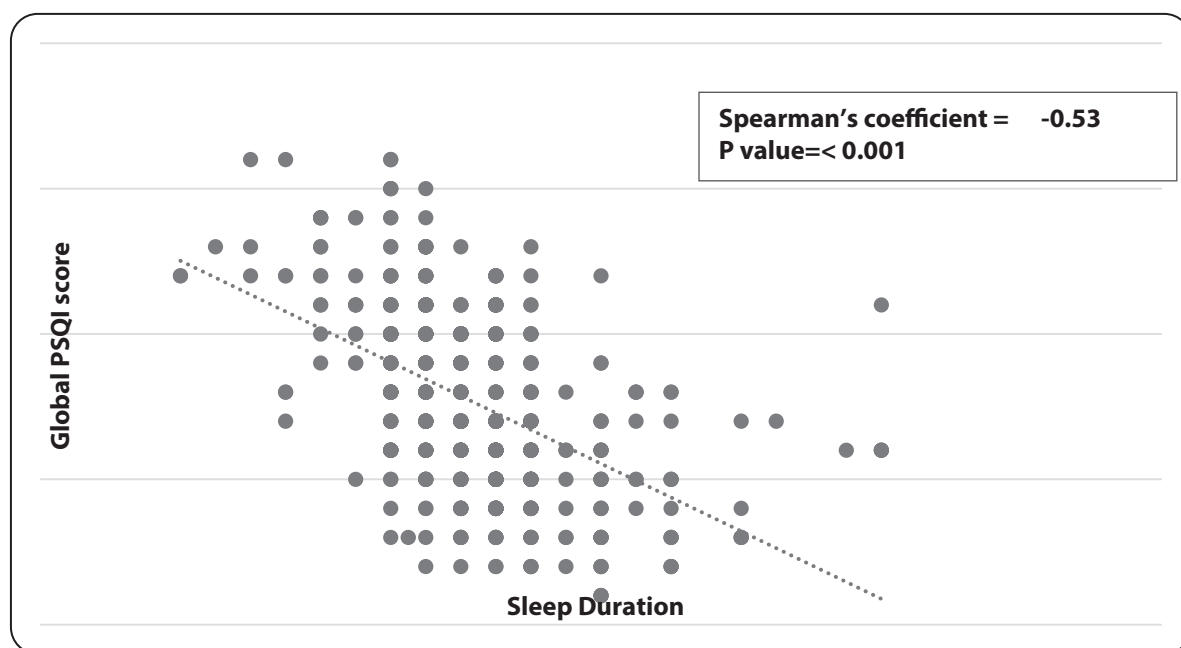


Figure 1. Correlation of PSQI global score and Sleep duration.

females: 7.1 ± 5.3). The mean PHQ9 score for the entire cohort was 7.8 ± 6.1 (males: 5.7 ± 5.3 , females: 9.1 ± 6.1), with 33% of students and faculty having a PHQ9 score of ≥ 10 .

Figure 2 shows a trend (possibly toward U-shaped correlation) between PHQ9 and sleep duration. Short and long sleep duration were associated with higher levels of depression scores. A duration of 7-9 hours seemed to be the most favorable for least depressive score.

When the PSQI global score and PHQ9 score of participants were correlated, a trend showing that a higher score of PSQI (poor sleep quality) was associated with higher score in PHQ9 (Figure 3. Spearman's coefficient = 0.58; $P < 0.001$).

The Epworth sleepiness score

For students, the mean ESS score was 6.4 ± 4.2 (males: 6.3 ± 4.0 , females: 7.3 ± 4.3). For faculty, the mean ESS score was 6.2 ± 3.8 (males: 6.2 ± 3.5 , females: 6.2 ± 3.9). The mean ESS score for the entire cohort was 6.6 ± 4.0 (males: 6.3 ± 3.8 , females: 6.8 ± 4.1), with 11% having a score of > 10 (Table 3).

Discussion

The main finding of this study was that majority of the students and faculty at the university sleep less than the recommended 7-9 hours of sleep (2), with 73% of them having poor sleep quality. We have also found that the recommended hours of sleep were associated with least depression score.

In our study, the average sleep duration for the whole sample was 6.21 ± 1.32 hours with 6.5% of participants sleep less than 5 hours per night, which is below the recommended hours of sleep. Consistent with our finding, previous reports in Saudi Arabia also showed that the average hours of sleep per night for adults was 6.4 hours (8). Although the optimal duration of sleep required to maintain physiological homeostasis varies between individuals and is influenced by genetic and environmental factors, the National Sleep Foundation, American Academy of sleep Medicine, and Saudi Center for Disease Control recommend that adults should, on average, sleep between 7-9 hours each night (2,18,19). This recommendation was based on previous studies that found significant U-shaped association between sleep duration and

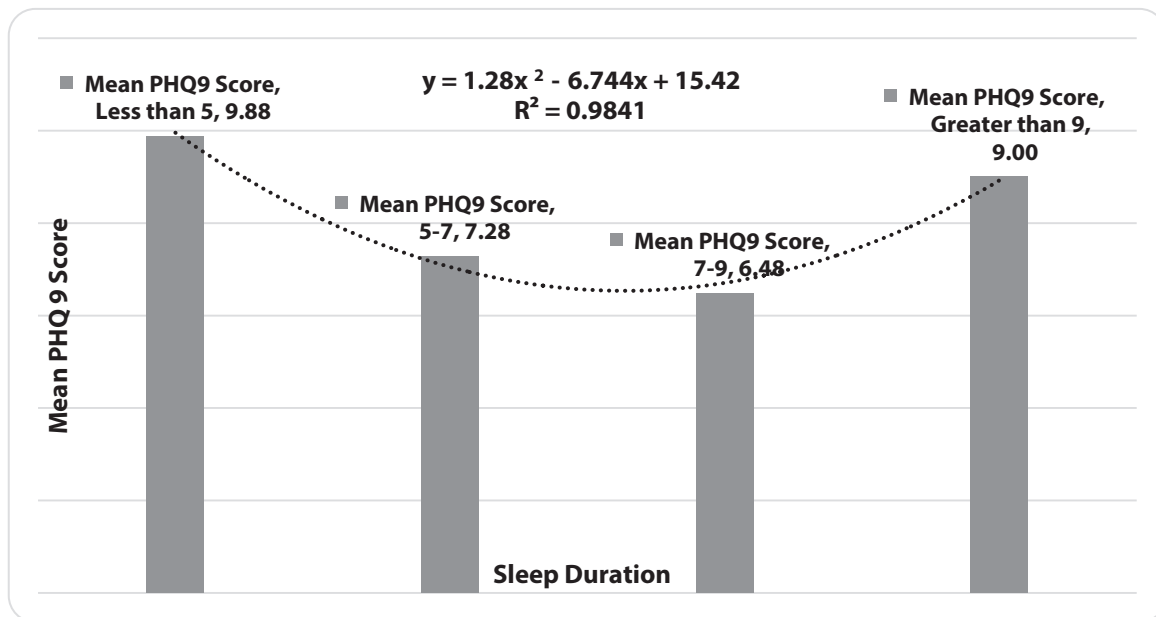


Figure 2. Mean PHQ9 score by sleep duration.

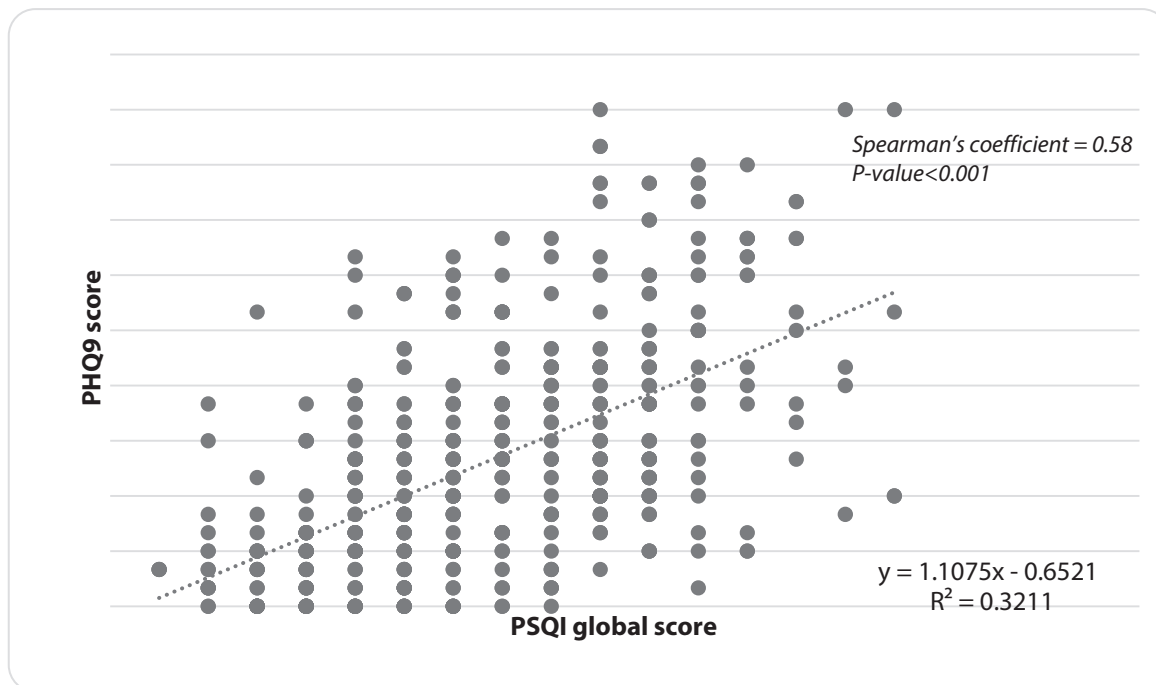


Figure 3. Correlation of PSQI global score and PHQ9 score.

several morbidities (obesity, diabetes or cardiovascular disease) and mortality risks (3,20,21). Recently, a large cohort study conducted in more than 300,000 individuals in Asia found that significant J-shaped association

between sleep duration and all-cause mortality, favoring the ultimate survival among individuals consistently sleeping between 7 to 8 hours (22). In our study, we have found a similar U-shape association between

Table 3. ESS score comparison between faculty and students.

		ESS Score		
		10 or less	Greater than 10	P-value
Group	Faculty	161 (88%)	23 (12%)	0.247
	Students	158 (83%)	23 (13%)	

sleep duration and depression, which emphasizes the importance of maintaining healthy sleep duration. This study along with the other mentioned studies show that healthy sleep is indeed a global health issue, making some researchers classify insufficient sleep syndrome as a non-communicable disease (23).

There is a strong bidirectional relationship between depression and sleep disturbances (24). Traditionally, sleep disturbance has been considered a symptom for depression. However, previous studies showed that extreme sleep duration (< 5 and >9 hours) was associated with the development of depression (10,25). Consistent with our findings, Watson et al. (26) have shown that short (< 5 hours) and long (> 9 hours) sleep was associated with higher score of depression using PHQ9. This type of association has been replicated in recent large cohort studies, urging the need of promoting healthy sleep among the general population (27,28).

Although the evidence is still scarce on the impact of long sleep duration, little empirical and high-quality evidence showed that long sleep duration is associated with cardiovascular diseases and all-cause mortality in different populations (3,20,21,29). Recently, Winer et al. (27) showed that even long sleep duration was associated with cognitive decline and higher burden of A β deposition, a marker of Alzheimer disease. These detrimental effects of extreme sleep duration are of special relevance to students whose healthy cognitive function is vital for academic performance; healthy sleep seems to be an important mediator for this relationship. Okano et al. (30) found that sleep quality, duration, and consistency are associated with better academic performance in college students.

Interestingly, in our study, there was a significant difference between the mean sleep duration of male and female students. This difference has been reported in some studies (31) but not others (32). The current sleep recommendations in different countries are stratified by age only; there is no specification of

sleep duration for men versus women. According to Svensson et al. (22), men who sleep 5 or fewer hours or 10 or more hours have a higher mortality risk. However, the mortality risk for women is associated with 8 or 9 hours of sleep. Overall, these findings demonstrate that recommendations for a healthy sleep duration must take gender into account, as it was found to be an independent predictor in increased morbidity and mortality (22,33).

While students' sleep duration and quality have been documented before, the data for faculty is lacking, and our study attempted to bridge this gap. Insufficient and poor sleep can affect the students' academic performance and faculty job performance and morale. Therefore, the data of this study may be used to make policy decisions in order to improve the working environment for better output of stake holders. Timely and appropriate interventions could enhance the academic and research achievement of students and faculty and raise the standard of education imparted the university.

Our study has several limitations. First, the questionnaires used in this study were subjective measures and depend entirely on each participant's recall. Second, due to the current circumstances brought on by COVID-19 and the precautions that had to be taken, the form could not be disseminated optimally, as many activities that require gatherings (e.g., lectures) are being conducted online, which made reaching student populations difficult.

Conclusion

A significant proportion of surveyed students and faculty are suffering from sleep insufficiency, poor sleep quality, and a mild degree of depression. Mindfulness and wellness programs to educate students and faculty about healthy sleeping habits and behaviors may be conducted to improve the sleeping habits.

Conflict of Interest: Each author declares that he or she 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.

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