ISSN 2664-3987 (Print) & ISSN 2664-6722 (Online)
South Asian Research Journal of Medical Sciences
Abbreviated Key Title: South Asian Res J Med Sci

| Volume-8 | Issue-6 | Nov-Dec -2026 | **DOI: https://doi.org/10.36346/sarjms.2026.v08i06.001**

Original Research Article

Impact of Sleep Quality on Academic Outcomes among Iraqi Medical Students

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Article History
Received: 04.09.2026
Accepted: 28.10.2026
Published: 02.11.2026

Abstract: ***Background***: Medical students are likely to have sleep problems, which can influence their academic performance. The purpose of the study was to investigate the connection between the quality of sleep, sleepiness during the day, mental health, and the academic performance of Iraqi medical students. ***Materials & Methods***: The study involved 102 undergraduate medical students in Iraq in a cross-sectional study. An online self-administered questionnaire was used to gather data. The quality of sleep was measured with the help of the Pittsburgh Sleep Quality Index (PSQI), whereas the daytime sleepiness was estimated with the help of Epworth Sleepiness Scale (ESS). PHQ-2 and GAD-2 were used to screen depression and anxiety. Descriptive statistics, correlation tests and regression analysis were done using statistical analysis. ***Results***: A low quality of sleep was observed in 69.6 percent of the students and 33.3 percent of them were overly sleepy. The correlation between both PSQI and ESS scores with GPA were negative. Students who slept well and were not sleepy during the day performed much better in terms of GPA. Poor sleep was highly correlated with depression and anxiety and depression was a predictor of poor sleep quality on its own. ***Conclusion***: Iraqi medical students experience sleep disturbance which is associated with poor academic performance. Sleep and mental health screening and improvement can be used to improve the academic performance of students.

Keywords: Sleep, Medical Students, Depression, Anxiety, Mental Health, Academic Performance.

INTRODUCTION

The luxury of sleep. It is a biological necessity. Sleep is beneficial to attention, memory, mood regulation, and day-to-day functioning. Sleep deprivation decreases focus and learning. These implications are even more significant when it comes to medical education, where students have to memorize a lot of information and work long hours. Recent research in Egypt and Saudi Arabia once again emphasized that sleep assists cognitive and psychological processes in medical students [1, 2].

A high-risk group of sleep problems is medical students. Their workload is excessive. They have irregular schedules. Sleep timing is disrupted by clinical rotations, exams, and studying late. A meta-analysis on a large scale across

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the world revealed that the quality of sleep is extremely low among medical students, where the prevalence was 52.7 and the pooled mean of PSQI was 6.1 [3]. Another recent global study also found poor sleeping quality in 55.64% of medical students and excessive daytime sleepiness (33.32%) and average sleep duration of just under 6.5 hours per night [4].

These figures have a serious meaning to the public health. Sleepiness during the day and a short sleep is not only a way of making students feel sleepy. They also impair vigilance, decision making and memory consolidation. The global survey by Binjabr and others was able to associate lack of sleep with less concentration during lectures and clinical training. In the literature that it synthesized, the same review reported that reduced nocturnal sleep duration and increased daytime sleepiness were associated with reduced academic performance [4]. This renders the quality of sleep not only a lifestyle issue but an educational issue as well.

Student sleep disturbance is also a big burden in the Middle East and North Africa. A 2025 meta-analysis of 150 studies across 16 MENA countries found that 59.1% of medical students had poor sleep quality, 59.8% had inadequate sleep duration, and 38.4% were excessively sleepy. The same review revealed that the issue of sleep was dependent on stress level and other academic related issues [5]. These results at the regional level imply that the issue is very common, yet the trend can vary across countries.

A number of country-based studies in the area substantiate that issue. Talaia *et al*., observed low sleep quality among 71.2% of medical students in Egypt and low sleep hygiene in 93.6% [1]. In another Egyptian study by Menoufia University, 96.5% of medical students reported poor sleep quality, and their sleep problems were strongly linked to poor performance in academics [6]. Almalki *et al*., demonstrated 78.5% poor sleep and 40.9% excessive daytime sleepiness in Saudi Arabia, but failed to identify a GPA relationship [2]. In Lahore, Pakistan, 66.65 percent of medical students reported poor sleep quality and students with a higher quality of sleep scored much higher on academic performance [7].

Outside the region evidence points the same general way. In a study of medical students in France, it was revealed that 49.7% had an unfavorable sleep quality and that the variables of sleep quality were associated with academic mean scores [8]. Pakistani study in a privately owned medical college found that 78.2 percent of the students had low sleep quality, but the academic impact was the most evident among final-year students [9]. These studies combined demonstrate that there is indeed a sleep academic relationship, although its magnitude varies with setting and year of study, and the precise sleep outcome being assessed.

There is still a scarcity of Iraqi data. In a study published in Fallujah University in 2024, stress, anxiety, and depression were found to be highly related to sleep quality and academic performance of Iraqi medical students [10]. The importance of that outcome is that it indicates that sleep and mental health might co-move in the Iraqi setting. Nonetheless, further statistical analysis is required. Specifically, one may want to understand how subjective sleep quality, daytime sleepiness, depressive symptoms, anxiety symptoms, and stress exhibit the same pattern in academics or different ones.

The current paper thus discusses an uploaded Iraqi medical student dataset in detail. It involves a wide statistical method. It explores descriptive trends, differences between groups, correlations, categorical associations, and multivariate models. The objective is to come up with a clear image of the relationship between sleep quality and academic performance in this sample and how this relationship compares with current evidence in Iraq, Middle East, Asia, among other regions of the world.

MATERIALS AND METHODS

This study was designed as a cross-sectional observational study of 102 medical students. The purpose was to determine the correlation between sleep quality, daytime sleepiness and academic performance among Iraqi medical students. An online self-administered questionnaire was used to collect the data. Undergraduate medical and pharmaceutical students in Iraq were included in the study. Eligible students included students in years 1 to 6 aged 18 years or above. The involvement was voluntary and informed consent was taken electronically. Other students not in medical related disciplines, those who did not consent or those who provided incomplete questionnaires were locked out. Data were gathered with the help of an online questionnaire employed via academic platforms and student bodies. The period of collection was between January 20, 2026 and February 25, 2026. The survey was anonymous and no personal information was gathered. The questionnaire was written in English and it required approximately 15-20 minutes to fill. The questionnaire was made up of 72 questions that were categorized into eight sections. These sections encompassed the sociodemographic information, academic achievement, sleep quality, daytime sleepiness, lifestyle, mental health screening, medical history, and optional comments. The quality of sleep was also assessed using the Pittsburgh Sleep Quality Index (PSQI) comprising 19 items and assessing sleep quality in the past month. The Epworth Sleepiness Scale (ESS) was used to measure daytime sleepiness. PHQ-2 was used to measure depression and GAD-2 to assess anxiety. The demographics that were gathered in the study included age, sex and academic year. Academic variables were study habits and GPA. The variables related to sleep were PSQI scores and sleep patterns. Depression and anxiety scores were

considered as mental health variables. Lifestyle variables were also incorporated like the consumption of caffeine and exercise. Participation was on a voluntary basis and informed consent was to be obtained prior to participation. Data collection was done anonymously and stored in a secure manner. Participants were free to withdraw any time. Statistical software like SPSS or R was used to analyse data and summarized through descriptive statistics. The variables were tested to find relationships between them using correlation tests. The predictors were identified by using regression analysis. The $p = 0.05$ was established as the statistical significance.

RESULTS

Participant Characteristics

A total of 102 students were included in the dataset. The mean age was 22.85 ± 1.93 years. The sample was evenly divided by sex, with 51 females and 51 males. Most students were in the senior stage of study (years 5-6, 84.3%). Most were single and lived with family. Good academic standing was reported by 79 students (77.5%). The mean harmonized GPA was 72.31 ± 13.51%.

Table 1: Demographic and academic characteristics of the sample

Characteristic	Value
Sample size	102 students
Institution: Jabir ibn Hayyan University	101 (99.0%)
Mean age, years	22.85 ± 1.93
Sex: Female	51 (50.0%)
Sex: Male	51 (50.0%)
Stage group: Early (years 1-2)	4 (3.9%)
Stage group: Middle (years 3-4)	12 (11.8%)
Stage group: Senior (years 5-6)	86 (84.3%)
Marital status: Single	97 (95.1%)
Living with family	85 (83.3%)
Academic standing: Good standing	79 (77.5%)
Academic standing: At-risk	10 (9.8%)
Academic standing: Academic probation	5 (4.9%)

Percentages are based on the full sample of 102 students. GPA values were harmonized to a 0-100 metric for the main analyses.

Table 2: Descriptive statistics for continuous study variables

Variable	Mean ± SD	Median [IQR]
Age (years)	22.85 ± 1.93	23.00 [22.00-23.00]
Harmonized GPA (%)	72.31 ± 13.51	70.00 [62.50-85.00]
Study hours/week	21.45 ± 13.29	21.00 [14.25-28.00]
Attendance (%)	85.25 ± 14.82	88.00 [75.00-96.75]
Failed exams (count)	0.57 ± 0.99	0.00 [0.00-1.00]
PSQI global score	6.99 ± 2.96	7.00 [5.00-7.00]
ESS global score	8.45 ± 4.37	8.00 [5.25-12.00]
Sleep duration (hours)	5.40 ± 1.60	5.00 [4.63-6.00]
Sleep latency (min)	29.34 ± 36.36	20.00 [11.25-30.00]
PHQ-2 score	1.95 ± 1.64	2.00 [1.00-3.00]
GAD-2 score	2.35 ± 1.89	2.00 [1.00-4.00]
Stress level (1-10)	6.33 ± 2.46	7.00 [4.25-8.00]
Caffeine cups/day	1.76 ± 1.50	1.00 [1.00-2.00]
Exercise hours/week	2.46 ± 4.79	1.00 [1.00-3.00]
BMI (kg/m²)	25.23 ± 5.13	24.46 [22.02-27.30]

IQR = interquartile range; PSQI = Pittsburgh Sleep Quality Index; ESS = Epworth Sleepiness Scale.

Sleep, Psychological Distress, and Lifestyle Profile

Sleeplessness was prevalent. The average PSQI score of the participants around the world was 6.99, SD 2.96 and 71 out of 102 students (69.6) were categorized under poor sleepers. The average ESS global score was 8.45 (SD=4.37) and 34 students (33.3) had reached the limit of excessive daytime sleepiness. Lack of sleep was disturbing. Only 80.4% of the students (n=82) slept less than 7 hours a night. A total of 31 students (30.4%), took at least 30 minutes to fall asleep.

Psychological distress was also common. Thirty students (29.4%) screened positive on the PHQ-2, and 36 students (35.3%) screened positive on the GAD-2. High stress was reported by 53 students (52.0%). Frequent napping was reported by 22 students (21.6%). Internal consistency was acceptable for the ESS (Cronbach's α = 0.71) and modest for the PSQI component structure (α = 0.60). Shapiro-Wilk testing showed that PSQI, PHQ-2, GAD-2, stress, attendance, failed examinations, study hours, sleep duration, and sleep latency were non-normal, while GPA and ESS were closer to normality.

Table 3: Sleep, mental-health, and lifestyle profile

Variable	Value
Poor sleep (PSQI > 5)	71/102 (69.6%; 95% CI 60.1-77.7)
Excessive daytime sleepiness (ESS ≥ 11)	34/102 (33.3%; 95% CI 24.9-42.9)
ESS category: Lower normal	26 (25.5%)
ESS category: Higher normal	42 (41.2%)
ESS category: Mild EDS	16 (15.7%)
ESS category: Moderate EDS	13 (12.7%)
ESS category: Severe EDS	5 (4.9%)
PHQ-2 positive	30/102 (29.4%; 95% CI 21.4-38.9)
GAD-2 positive	36/102 (35.3%; 95% CI 26.7-44.9)
High stress category	53/102 (52.0%; 95% CI 42.4-61.4)
Short sleep duration (<7 h)	82/102 (80.4%; 95% CI 71.6-86.9)
Sleep latency ≥30 min	31/102 (30.4%; 95% CI 22.3-39.9)
Napping frequently (≥5 times/week)	22/102 (21.6%; 95% CI 14.7-30.5)

Confidence intervals are Wilson 95% confidence intervals for prevalence estimates.

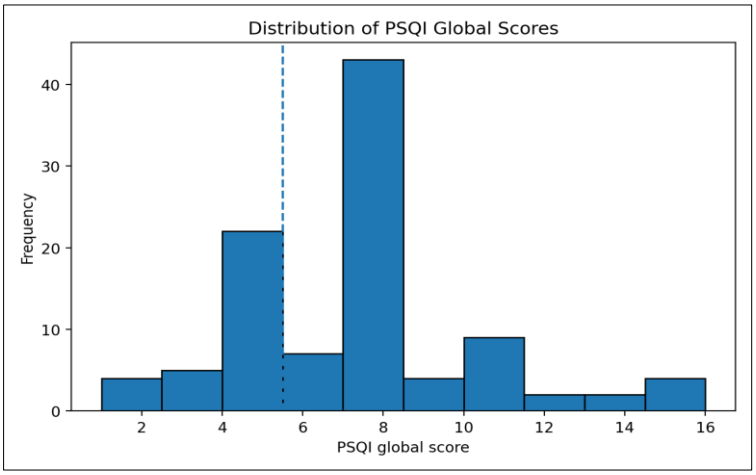


Figure 1: Histogram of PSQI global scores. The dashed line marks the conventional threshold for poor sleep quality (PSQI > 5)

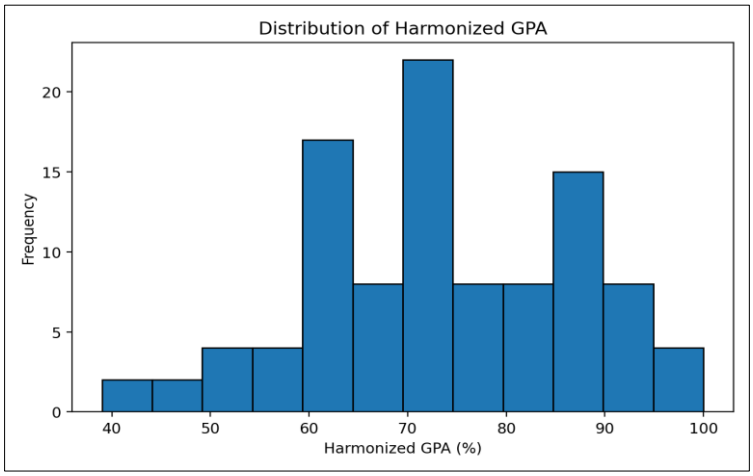


Figure 2: Histogram of harmonized GPA values on a 0-100 scale

Correlation Analysis

Spearman analysis showed that both worse sleep quality and greater daytime sleepiness were associated with lower GPA. PSQI was inversely correlated with harmonized GPA ($\rho = -0.240$, $p = 0.015$). ESS was also inversely correlated with GPA and showed a slightly stronger effect ($\rho = -0.258$, $p = 0.009$). PSQI and ESS were positively correlated with each other ($\rho = 0.229$, $p = 0.021$), which suggests overlap between poor night sleep and daytime somnolence.

Sleep was also tied to mental-health burden. PSQI correlated positively with stress, PHQ-2, and GAD-2. ESS also correlated positively with PHQ-2 and GAD-2. The strongest bivariate mental-health links were PSQI with PHQ-2 ($\rho = 0.440$) and PSQI with GAD-2 ($\rho = 0.442$). Sleep duration was inversely correlated with failed examinations ($\rho = -0.206$, $p = 0.038$). Attendance had almost no relationship with GPA in this sample.

Table 4: Selected Spearman correlations among academic, sleep, and mental-health variables

Variable pair	Spearman's rho	p
PSQI global score vs Harmonized GPA (%)	-0.240	0.015
ESS global score vs Harmonized GPA (%)	-0.258	0.009
PSQI global score vs ESS global score	0.229	0.021
Stress score (1-10) vs PSQI global score	0.223	0.024
Stress score (1-10) vs ESS global score	0.188	0.059
PHQ-2 score vs PSQI global score	0.440	<0.001
GAD-2 score vs PSQI global score	0.442	<0.001
PHQ-2 score vs ESS global score	0.360	<0.001
GAD-2 score vs ESS global score	0.284	0.004
Study hours/week vs Harmonized GPA (%)	0.178	0.073
Attendance (%) vs Harmonized GPA (%)	0.055	0.583
Failed exams vs Sleep duration (hours)	-0.206	0.038

Negative coefficients indicate that higher values of the first variable are associated with lower values of the second variable.

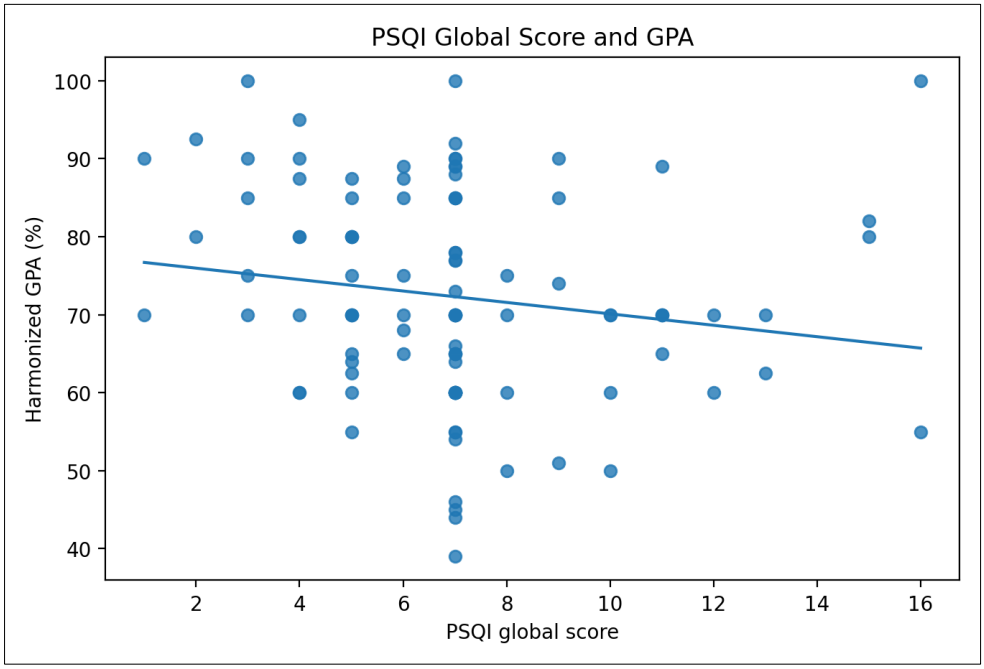


Figure 3: Scatter plot of PSQI global score versus harmonized GPA, with a simple fitted line for visual guidance

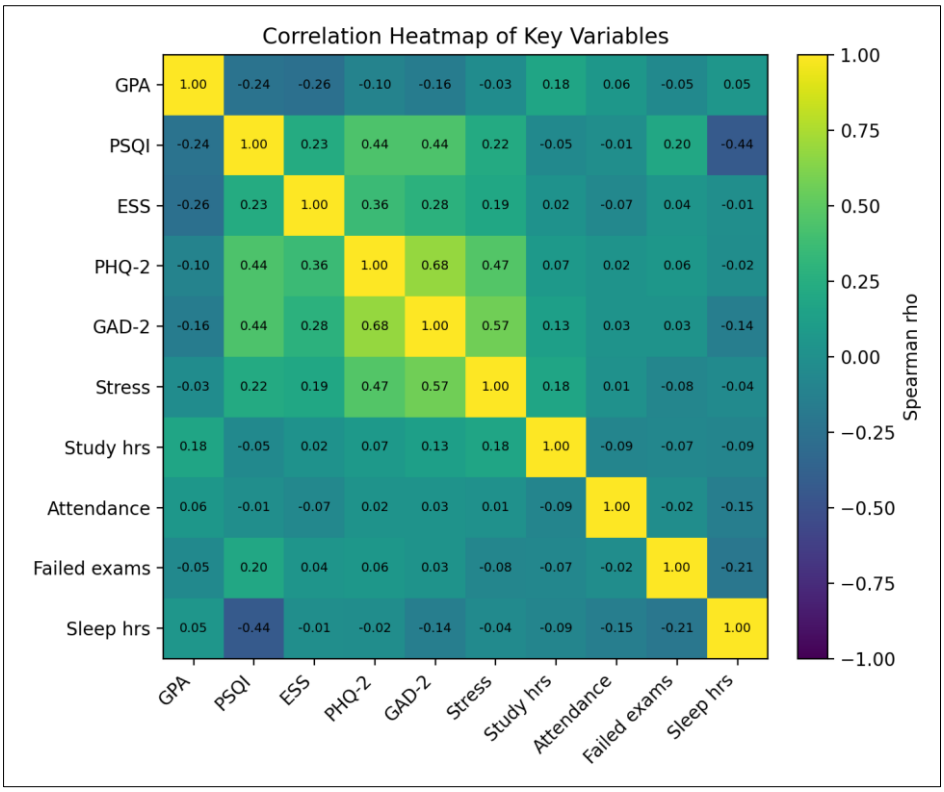


Figure 4: Correlation heatmap summarizing pairwise Spearman correlations among key academic, sleep, and mental-health variables

Independent-Samples Comparisons

Welch independent-samples t-tests showed that good sleepers had higher GPA than poor sleepers (76.74 ± 11.93 vs 70.38 ± 13.84; p = 0.021; Cohen's d = 0.48). Students without excessive daytime sleepiness also had higher GPA than those with daytime sleepiness (74.61 ± 13.28 vs 67.72 ± 12.92; p = 0.008; d = 0.52). These findings suggest that both poor sleep quality and daytime sleepiness are academically relevant in this dataset.

Sex differences in sleep were weaker. Females had somewhat higher ESS scores than males, but the Welch test was only borderline (p = 0.085). Females also had somewhat higher PSQI scores than males. In contrast, psychological distress showed large sleep effects. PHQ-2 positive and GAD-2 positive students had clearly worse PSQI and ESS scores than screen-negative students. The effect size for PHQ-2 positivity on PSQI was large (d = -0.92).

Table 5: Welch t-tests and Mann-Whitney sensitivity analyses

Comparison	Group 1	Group 2	Welch p	Mann-Whitney p	Cohen's d
GPA: good sleepers vs poor sleepers	Good (n=31), 76.74 ± 11.93	Poor (n=71), 70.38 ± 13.84	0.021	0.030	0.48
GPA: no EDS vs EDS	No (n=68), 74.61 ± 13.28	Yes (n=34), 67.72 ± 12.92	0.008	0.016	0.52
ESS: females vs males	Female (n=51), 9.20 ± 4.43	Male (n=51), 7.71 ± 4.21	0.085	0.050	0.34
PSQI: females vs males	Female (n=51), 7.53 ± 2.83	Male (n=51), 6.45 ± 3.02	0.066	0.036	0.37
PSQI: PHQ-2 negative vs positive	Negative (n=72), 6.25 ± 2.72	Positive (n=30), 8.77 ± 2.82	<0.001	<0.001	-0.92
PSQI: GAD-2 negative vs positive	Negative (n=66), 6.23 ± 2.86	Positive (n=36), 8.39 ± 2.58	0.001	<0.001	-0.78
ESS: PHQ-2 negative vs positive	Negative (n=72), 7.60 ± 4.17	Positive (n=30), 10.47 ± 4.17	0.003	0.004	-0.69
ESS: GAD-2 negative vs positive	Negative (n=66), 7.65 ± 4.28	Positive (n=36), 9.92 ± 4.15	0.016	0.020	-0.53

Cohen's d is reported as Group 1 minus Group 2 in standardized units.

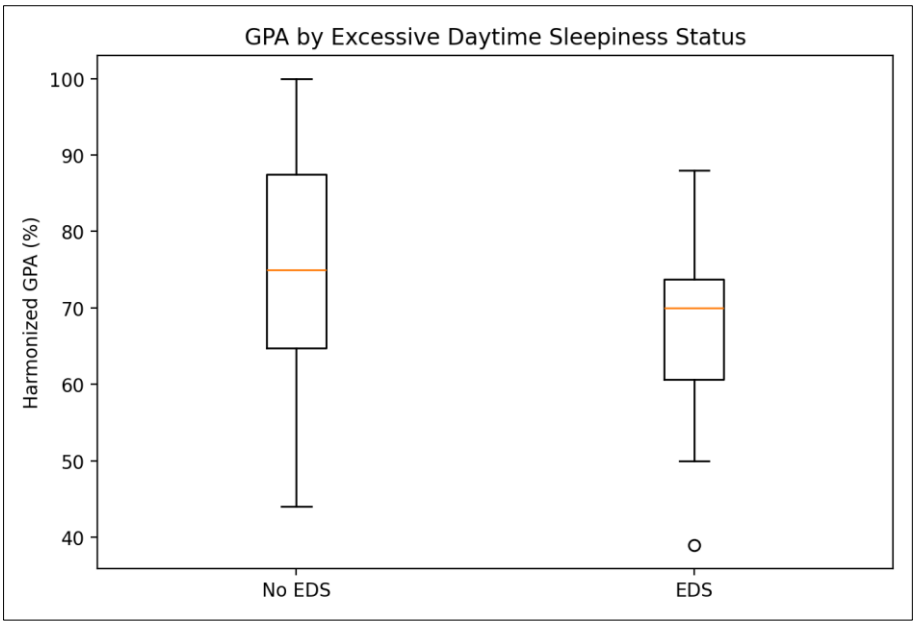


Figure 5: Box plot of harmonized GPA by daytime sleepiness status. Students with excessive daytime sleepiness had lower GPA on average

One-Way Group Comparisons and Categorical Analyses

Group analysis showed that PSQI varied across stress categories in the nonparametric test (Kruskal-Wallis p = 0.018), even though the Welch ANOVA was only borderline (p = 0.085). The highest PSQI mean was seen in the high-stress group (7.64 ± 2.87). ESS also tended to rise with stress, but the difference was not statistically significant. GPA differed by stage of study in the Welch ANOVA (p = 0.012). Early-stage students had the highest GPA mean (87.63 ± 7.25), although this subgroup was very small (n = 4), so caution is needed. GPA also differed across academic-standing groups.

Categorical analysis reinforced the mental-health signal. Poor sleep was far more common in PHQ-2 positive students than in PHQ-2 negative students (93.3% vs 59.7%; $\chi^2 = 9.78$, p = 0.002; OR = 9.44). Poor sleep was also more common in GAD-2 positive students (86.1% vs 60.6%; $\chi^2 = 6.01$, p = 0.014; OR = 4.03). Poor sleep prevalence climbed to 83.0% in the high-stress group. Excessive daytime sleepiness was more frequent in females than in males (43.1% vs 23.5%), although that difference did not reach the usual $p < 0.05$ threshold (p = 0.059).

Table 6: One-way group comparisons

Analysis	Welch p	Kruskal p	Eta²	Main pattern
PSQI by stress category	0.085	0.018	0.05	High stress had the highest PSQI mean (7.64 ± 2.87).
ESS by stress category	0.167	0.165	0.04	High stress had the highest ESS mean (9.26 ± 4.47).
GPA by stage of study	0.012	0.034	0.06	Early-stage students had the highest GPA mean (87.63 ± 7.25).
GPA by academic standing (exploratory)	0.004	0.010	0.10	Good-standing students had the highest GPA mean (74.35 ± 14.01).

Eta² is shown as an approximate effect-size index.

Table 7: Categorical associations involving poor sleep and daytime sleepiness

Association	Chi-square	p	OR (95% CI)	Key percentages
PHQ-2 positivity vs poor sleep	9.78	0.002	9.44 (2.09-42.74)	Poor sleep: 93.3% in PHQ-positive vs 59.7% in PHQ-negative
GAD-2 positivity vs poor sleep	6.01	0.014	4.03 (1.39-11.70)	Poor sleep: 86.1% in GAD-positive vs 60.6% in GAD-negative
Stress category vs poor sleep	9.38	0.009	Not applicable	Poor sleep: 83.0% high stress, 55.3% moderate stress, 54.5% low stress
Sex vs EDS	3.57	0.059	Not applicable	EDS: 43.1% in females vs 23.5% in males

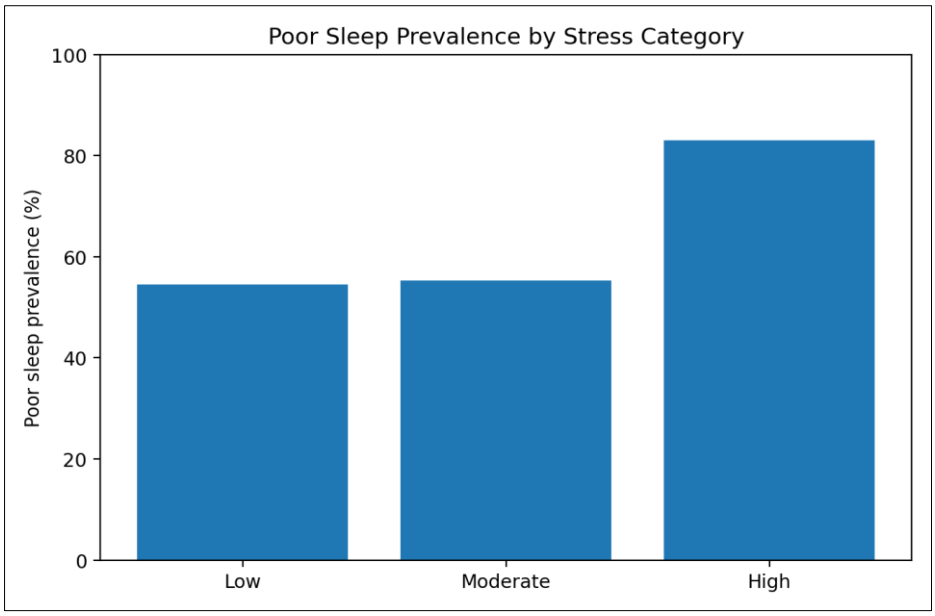


Figure 6: Prevalence of poor sleep across low, moderate, and high stress categories

Prespecified Hypothesis Testing and Multivariable Models

Across the 11 prespecified hypotheses, nine remained supported after false discovery rate correction. These included the bivariate PSQI-GPA association, the ESS-GPA association, the difference in GPA by sleep quality, the difference in GPA by daytime sleepiness, the stress-group difference in PSQI, the stage-group difference in GPA, both mental-health categorical sleep associations, and the multivariable PHQ-2 effect on poor sleep. Only the sex difference in ESS and the adjusted ESS-to-GPA effect were not supported after correction.

In the HC3-robust linear regression model, study hours per week independently predicted higher GPA (standardized $\beta = 0.192$, $p = 0.013$). ESS showed a borderline inverse association with GPA ($\beta = -0.195$, $p = 0.056$). PSQI was not independently significant in the same model. The overall model explained 14.2% of GPA variance ($R^2 = 0.142$; adjusted $R^2 = 0.068$).

In the multivariable logistic regression model, PHQ-2 positivity independently increased the odds of poor sleep by about 7.7 times (OR = 7.71, 95% CI 1.35 to 44.16, $p = 0.022$). GAD-2 positivity, stress score, caffeine intake, exercise, and sex were not independently significant in the same model. The model showed fair discrimination, with an area under the ROC curve of 0.74.

Table 8: Summary of the prespecified hypotheses and decisions

ID	Hypothesis	Test	Key estimate	p	FDR p	Verdict
H1	Higher PSQI is associated with lower GPA	Spearman correlation	-0.240	0.015	0.027	Supported after FDR
H2	Higher ESS is associated with lower GPA	Spearman correlation	-0.258	0.009	0.027	Supported after FDR
H3	Poor sleepers have lower GPA than good sleepers	Welch t-test	6.36	0.021	0.027	Supported after FDR
H4	Students with EDS have lower GPA than those without EDS	Welch t-test	6.89	0.008	0.027	Supported after FDR
H5	PSQI differs across stress categories	Kruskal-Wallis	8.05	0.018	0.027	Supported after FDR
H6	GPA differs across stage of study	Welch ANOVA	8.05	0.012	0.027	Supported after FDR
H7	Poor sleep is more frequent in PHQ-2 positive students	Chi-square	9.44	0.002	0.020	Supported after FDR
H8	Poor sleep is more frequent in GAD-2 positive students	Chi-square	4.03	0.014	0.027	Supported after FDR
H9	ESS differs by sex	Welch t-test	1.49	0.085	0.085	Not supported
H10	ESS independently predicts GPA after adjustment	Adjusted OLS	-0.195	0.056	0.061	Not supported after FDR
H11	PHQ-2 positivity independently predicts poor sleep after adjustment	Adjusted logistic regression	7.71	0.022	0.027	Supported after FDR

FDR p-values are Benjamini-Hochberg adjusted across the 11 planned hypotheses.

Table 9A: HC3-robust multivariable linear regression predicting harmonized GPA

Predictor	Beta	95% CI	p
Male sex (vs female)	0.015	-0.195 to 0.225	0.888
PSQI global score	-0.068	-0.350 to 0.214	0.636
ESS global score	-0.195	-0.394 to 0.005	0.056
Age (years)	-0.069	-0.370 to 0.232	0.654
Year of study	-0.134	-0.390 to 0.122	0.306
Attendance (%)	0.093	-0.071 to 0.256	0.268
Study hours/week	0.192	0.040 to 0.345	0.013
Stress score (1-10)	-0.056	-0.289 to 0.178	0.640

Standardized beta coefficients are reported for numeric predictors.

Table 9B: Multivariable logistic regression predicting poor sleep

Predictor	OR	95% CI	p
Male sex (vs female)	0.56	0.21 to 1.48	0.241
PHQ-2 positive (vs negative)	7.71	1.35 to 44.16	0.022
GAD-2 positive (vs negative)	1.84	0.51 to 6.61	0.351
Stress score (1-10)	0.99	0.80 to 1.24	0.941
Caffeine cups/day	1.07	0.76 to 1.49	0.700
Exercise hours/week	0.95	0.86 to 1.05	0.312

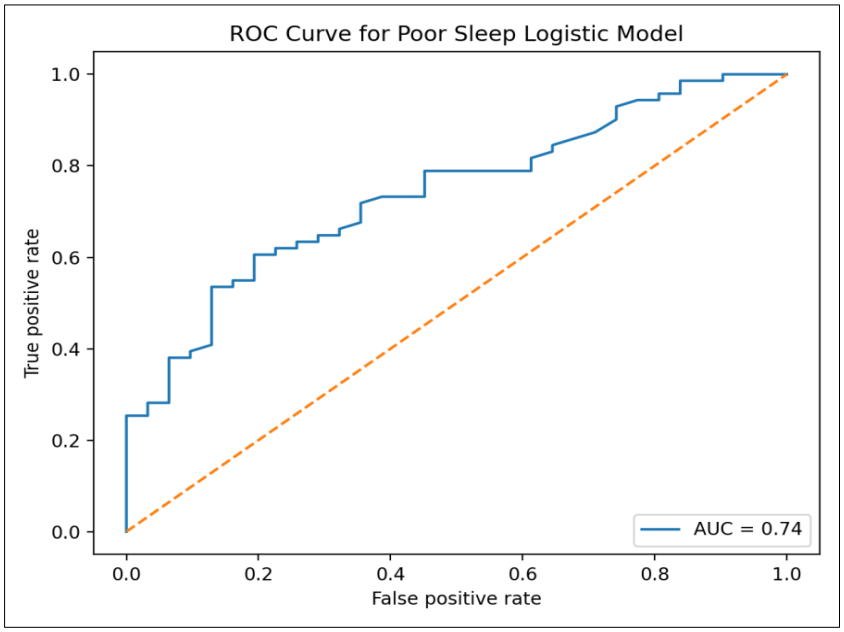


Figure 7: Receiver operating characteristic curve for the multivariable logistic regression model predicting poor sleep

A sensitivity analysis was conducted on the 83 students who directly reported GPA on a 0-100 scale to test whether or not mixed GPA scales had a material impact on the results. In that subgroup, both PSQI and ESS remained inversely correlated with GPA (ρ = -0.235, p = 0.032; and ρ = -0.281, p = 0.010, respectively). The ESS was also significantly independent (B = -0.68, p = 0.030) in the percentage-only adjusted regression, and the hours spent in the study were also significant to a considerable extent (B = 0.17, p = 0.042). This sensitivity analysis corroborates the overall finding that sleep disturbance is a scholarly subject in this sample.

DISCUSSION

This Paper provides a comprehensive image of sleep and academic achievement among an Iraqi group of medical students. The general trend was evident. Insomnia was prevalent. Low GPA was associated with poor sleepers. There was also lower GPA amongst students who were too sleepy. Depression and anxiety screening results were highly clustered with poor sleep. Adjusted PHQ-2 positivity was the most significant independent predictor of poor sleep.

The prevalence estimates were high. Poor sleep affected 69.6% of students in the present sample. This is above the pooled global estimate of 52.7% reported by Rao *et al*., and also above the 55.64% worldwide estimate reported by

Binjabr *et al*., [3, 4]. The mean sleep duration in this sample was only 5.40 hours, which is lower than the approximately 6.5 hours per night reported in the worldwide review [4]. This suggests that the present students were not only poor sleepers by score, but also short sleepers by time.

When the findings were compared with the Middle East and North Africa, the same burden remained visible. The 2025 MENA meta-analysis estimated 59.1% poor sleep, 59.8% insufficient sleep, and 38.4% excessive daytime sleepiness in medical students [5]. Our sample had a higher poor-sleep prevalence than that regional average, a much higher short-sleep prevalence, and a slightly lower daytime sleepiness prevalence. So, this Iraqi sample seems especially affected by night sleep disturbance and short sleep duration, even if daytime sleepiness is closer to the regional average.

Country-level comparisons from nearby settings are also useful. The poor-sleep prevalence in this dataset was slightly lower than the recent Saudi figure of 78.5% and the Egyptian Tanta figure of 71.2%, but it was very close to both studies overall [1, 2]. It was much lower than the 96.5% of Menoufia University in Egypt, where sleep quality was also attributed to academic performance [6]. These variations could be due to difference in year mix of study, timing of the academic year, local academic schedule, and student behavior. Nonetheless, all these studies are heading towards the same direction. Nightmares are common in medical schools throughout the area.

The scholarly conclusions in this article should be highlighted. Both PSQI and ESS in this sample of Iraqis had negative correlations with GPA. There were also significantly higher GPA values in good sleepers and students who were not sleepy in the daytime. This trend can be aligned with results reported by Lahore, where students who had a positive sleep quality also had positive academic results, and the French study that reported the presence of correlations between sleep-quality variables and academic means [7, 8]. Meanwhile, not all new studies obtained the same finding. Almalki *et al*., found no significant association of GPA among Saudi students, and Hasnain *et al*., found the academic effect primarily in final-year students [2-9]. The current Iraqi signal is significant and not insignificant because of this ambivalent external literature.

Daytime sleepiness that may be of particular importance. The bivariate analysis indicated a more negative relationship between ESS and GPA than between ESS and PSQI. Students who were too sleepy in the daytime scored nearly 7 GPA points below the students. This is medically plausible. Daytime sleepiness has a direct effect on the level of alertness, concentration on lectures, the ability to memorise and the ability to study longer. The global analysis by Binjabr *et al*., also highlighted that sleep deprivation and excessive drowsiness may decrease attention and academic achievement in medical learners [4]. In the current regression model, the ESS effect was adjusted to borderline. The most safe explanation is therefore that daytime sleepiness is a powerful superficially observed indicator of academic risk although some of its impact may be shared with other student variables.

The correlation between sleep and mental health emerged as one of the strongest findings of this analysis. Both PHQ-2 and GAD-2 were positively related with PSQI and ESS. PHQ-2 positive and GAD-2 positive students were much more likely to have poor sleep. Even with the PHQ-2 positivity in the multivariable logistic model, odds of poor sleep rose over seven times. This trend is consistent with the Iraqi Fallujah study, which revealed that stress, anxiety, and depression were all applicable to the quality of sleep and academic performance [10]. It also concurs with the Lahore study, whose poor sleep was detrimental to both psychological health and grades [7].

The trend in stress was more subtle. The PSQI deteriorated with the stress category and prevalence of poor sleep was at 83.0% in the high-stress group in this sample. The latter direction is consistent with the regional meta-analysis that found that sleep disturbances depended on stress levels [5]. However, the result of the stress test was greater in nonparametric testing than in Welch ANOVA in this case. This implies that the pattern of stress is actual, but not perfectly consistent between statistical methods. There should not be overstatement in the discussion. Stress seems to be correlated with worse sleep, but this relationship might be disproportionate.

Special attention should also be paid to the stage-of-study discovery. There was the highest GPA at the early-stage students and the overall GPA varied between the stages. There were however only four students in the early-stage group. The statistical finding is therefore a fact, but the subgroup is too small to generalize. Recent Egyptian research proposed that the burden of poor sleep quality might be greater in earlier academic years, whereas the Pakistani study by Hasnain *et al*., proposed that the effect of academic factors might be more pronounced in final-year students [1-9]. Senior students were prevalent in the current dataset and therefore stage results can only be viewed as exploratory and not conclusive.

A single outcome can be mentioned based on the multivariable model. Independent study hours were predictive of greater GPA. It would be common sense. Performance can be supported by increased time spent at school. At the same time, the mean sleep duration in the present sample was still very short. The message is not, therefore, that students need

to sacrifice sleep and study more. Balance is the superior interpretation. More studying students can have better performance, but extreme sleep deprivation can still impair cognition and daytime performance. The medical schools are challenged to ensure that they assist the students attain both normal study habits and sufficient sleep, rather than to compel them to make a trade-off between the two.

CONCLUSION

This study showed that sleep problems are very common among Iraqi medical students and have an important impact on academic performance. A significant percentage of students also had low quality sleep and also most of the students experienced excessive daytime sleepiness. These findings were clear that the quality of sleep and more daytime sleepiness were both related to less GPA. The students who said they got more sleep and were less sleepy in the daytime had a higher academic performance. Moreover, psychological aspects like depression and anxiety were also significantly connected with poor sleep. Depression, especially, was determined as a predicting independent variable of poor sleep quality. This implies that sleep and mental health are highly related and can both have an effect on the academic performance. On the whole, these results indicate the role of sleep as a significant determinant of student success. To enhance sleep behaviors and mental health in medical students, medical schools should look at the introduction of screening and awareness programs. It is suggested that future studies using bigger sample sizes can validate these results and consider potential interventions.

APPENDIX

Appendix Table A1: Shapiro-Wilk normality tests

Variable	W	p	Interpretation
Harmonized GPA (%)	0.978	0.081	Approximately normal
PSQI global score	0.911	<0.001	Non-normal
ESS global score	0.984	0.252	Approximately normal
PHQ-2 score	0.897	<0.001	Non-normal
GAD-2 score	0.886	<0.001	Non-normal
Stress level (1-10)	0.949	<0.001	Non-normal
Attendance (%)	0.842	<0.001	Non-normal
Failed exams	0.585	<0.001	Non-normal
Study hours/week	0.853	<0.001	Non-normal
Sleep duration (hours)	0.961	0.004	Non-normal
Sleep latency (min)	0.536	<0.001	Non-normal

Appendix Table A2: GPA harmonization rules applied to the raw dataset.

GPA harmonization rule	Value
0-100 entered	83 (81.4%)
0-4 scale ×25	13 (12.7%)
0-10 scale ×10	5 (4.9%)
0-1 fraction ×100	1 (1.0%)

Appendix Table A3: Sensitivity analysis using only students who entered GPA directly on a 0-100 scale.

Predictor	Spearman's rho	p
PSQI global score vs raw GPA (0-100 only)	-0.235	0.032
ESS global score vs raw GPA (0-100 only)	-0.281	0.010

Appendix Table A4: Percentage-only adjusted regression model predicting raw GPA (0-100 subgroup).

Predictor	B	95% CI	p
Male sex (vs female)	0.48	-4.55 to 5.51	0.852
PSQI global score	-0.50	-1.59 to 0.58	0.363
ESS global score	-0.68	-1.29 to -0.07	0.030
Age (years)	-0.59	-2.06 to 0.87	0.426
Year of study	-2.27	-4.94 to 0.41	0.097
Attendance (%)	0.12	-0.02 to 0.26	0.084
Study hours/week	0.17	0.01 to 0.34	0.042
Stress score (1-10)	-0.54	-1.80 to 0.73	0.408

Unstandardized B coefficients are shown because this sensitivity model used the raw 0-100 GPA scale.

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