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Sleep Quality and Daytime Sleepiness among Medical Students: A Cross-Sectional Study across Three Universities in Eastern Sudan

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Short Report

Keywords: Sleep quality, Sleep duration, Daytime sleepiness, Medical students, Pittsburgh Sleep Quality Index, Epworth Sleepiness Scale, Sudan

Posted Date: November 6th, 2026

DOI: https://doi.org/10.21203/rs.3.rs-11368610/v1

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Additional Declarations: No competing interests reported.

Abstract

Objective

Medical students are at high risk of poor sleep, which may impair daytime alertness. We estimated the prevalence of poor sleep quality and short sleep duration and examined their association with daytime sleepiness (a proxy for alertness; no direct concentration test was used) among medical students at three universities in Eastern Sudan.

Results

In this online cross-sectional survey of a convenience sample of 125 students (June–August 2026), poor sleep quality (PSQI > 5) affected 60.8% (95% CI 52.0–68.9%) and 50.8% (63/124) slept < 7 hours. Excessive daytime sleepiness (ESS > 10) affected 40.8% (95% CI 32.6–49.6%). PSQI correlated weakly with ESS ($\rho = 0.21$, $p = .019$); sleep duration did not ($\rho = -0.06$, $p = .485$). ESS did not differ across universities ($p = .468$). After adjustment for gender, age and study hours, each 1-point higher PSQI was associated with 15% higher odds of excessive sleepiness (OR 1.15, 95% CI 1.02–1.30), but this was not robust in sensitivity analyses. No measured factor predicted poor sleep quality. The cross-sectional design, self-reported measures and small sample preclude causal conclusions.

Introduction

Sleep supports attention, learning, memory and daytime alertness, and the American Academy of Sleep Medicine and Sleep Research Society recommend at least 7 hours per night for adults [1]. Medical students are at particular risk of inadequate sleep because of heavy workloads and frequent examinations. A meta-analysis of 109 studies (59,427 medical students) reported poor sleep quality in about 55.6% and a mean sleep duration of about 6.5 hours [2]; another meta-analysis documented substantial proportions with poor sleep quality, insufficient sleep and excessive daytime sleepiness, linked to impaired academic performance [3]. Experimental evidence shows that restricting sleep to 2–6 hours for a single night increases sleepiness and impairs sustained attention [4], and sleep-deprived medical students performed worse on attention tests than rested peers [5].

Sudanese studies have examined sleep quality and daytime sleepiness in relation to academic performance [6, 7]; one study of 199 medical students reported poor sleep quality in 82.5% [6]. Evidence from Eastern Sudan remains limited. We did not administer a direct, objective test of concentration; instead, the Epworth Sleepiness Scale (ESS) was used as a proxy indicator of daytime alertness, consistent with evidence linking sleepiness to impaired attention [4, 5]. This study aimed to estimate the prevalence of poor sleep quality and short sleep duration, to describe daytime sleepiness, and to examine the association of sleep quality and duration with daytime sleepiness among undergraduate medical students at Port Sudan Ahlia University, Red Sea University and East Sudan University.

Methods

Study design and participants

This cross-sectional analytical study, reported according to the STROBE guideline, surveyed undergraduate medical students (Years 1–6) at Port Sudan Ahlia University, Red Sea University and East Sudan University. Data were collected between 2 June and 24 August 2026 using a self-administered online questionnaire (Google Forms) distributed to eligible students. Eligible students were enrolled, aged ≥ 18 years and gave electronic informed consent; students with a self-reported or clinically diagnosed sleep disorder, or absent from university for more than two consecutive weeks, were excluded. All eligible respondents were included (convenience sampling; n = 125), so the sample is not probability-based. No a priori sample-size calculation was performed. With n = 125, the 95% confidence interval (CI) for a prevalence near 60% is about ± 9 percentage points, and power was roughly 80% (α = 0.05) to detect only correlations of $|\rho| \geq 0.25$; smaller associations and comparisons involving East Sudan University (n = 17) were underpowered.

Measures: The questionnaire recorded age, gender, marital status, residence, university, academic year, daily study hours, repetition of an academic year and self-reported academic performance. Sleep quality was assessed with the Pittsburgh Sleep Quality Index (PSQI) [9]: 19 self-rated items form seven component scores summing to a global score of 0–21; a global score > 5 indicated poor sleep quality. Daytime sleepiness was assessed with the ESS [8]: eight items scored 0–3 (total 0–24); a total score > 10 defined excessive daytime sleepiness (mild 11–12, moderate 13–15, severe 16–24). Because no direct concentration test was administered, the ESS was used as a proxy indicator of alertness; it measures the propensity to fall asleep, which is related to but distinct from concentration, so findings are reported as daytime sleepiness. Sleep duration was taken from PSQI item 4, entered as free text and converted to numeric hours (ranges were replaced by their midpoint; eight entries auto-converted to dates by spreadsheet software were recovered as ranges). One implausible entry of 0 hours was set to missing (n = 124 for duration analyses). Short sleep was defined as < 7 hours [1].

Statistical analysis: Analyses were performed in jamovi (version 2.7.28); regression models and CIs were verified in Python (statsmodels). Categorical variables are presented as n (%), with Wilson 95% CIs for the main prevalence estimates, and continuous variables as mean ± SD. Because global PSQI and total ESS departed from normality (Shapiro–Wilk), primary analyses were non-parametric: Spearman's correlation (95% CIs by Fisher z-transformation), the Mann–Whitney U test and the Kruskal–Wallis test; Welch's tests were sensitivity checks. Categorical associations were tested with chi-square or Fisher's exact tests (Monte Carlo simulation for tables larger than 2 × 2 when expected counts were < 5). Multivariable logistic regression examined predictors of (a) poor sleep quality and (b) excessive daytime sleepiness, with covariates (gender, age group, study hours and, for model a, university) specified in advance. Model (b) entered global PSQI (per 1-point increase) with gender, age group and study hours; sensitivity analyses used the binary PSQI classification, added university, used linear regression of ESS, and excluded the 20 students reporting sleep-medication use. Sparse categories were combined (age >

26 years, n = 1, with 24–26 years; >7 study hours/day, n = 6, with 5–7 hours). Marital status could not be modelled because 0 of 7 married students had excessive sleepiness, and was examined with Fisher's exact test. With 76 and 51 outcome events, models (a) and (b) had approximately 11 and 8.5 events per parameter; model (b) is therefore exploratory. No adjustment was made for multiple comparisons, and missing data were excluded pairwise. Cronbach's α was calculated for the ESS items and the numerically coded PSQI items. Significance was set at α = 0.05 (two-sided).

Results

A total of 125 students completed the questionnaire (Table 1): 80.8% were female, 94.4% single, and 44.8%, 41.6% and 13.6% came from Port Sudan Ahlia, Red Sea and East Sudan University, respectively. Cronbach's α was 0.66 for the 8 ESS items and 0.71 for the 12 numerically coded PSQI items.

Table 1
Characteristics of the participants (N = 125)

Characteristic	n (%) or mean ± SD
Gender	
Female	101 (80.8)
Male	24 (19.2)
Age group (years)	
18–20	42 (33.6)
21–23	63 (50.4)
≥ 24 (24–26: 19; >26: 1)	20 (16.0)
Marital status	
Single	118 (94.4)
Married	7 (5.6)
Residence	
With family	109 (87.2)
Hostel	14 (11.2)
Other (aunt/grandmother)	2 (1.6)
University	
Port Sudan Ahlia University	56 (44.8)
Red Sea University	52 (41.6)
East Sudan University	17 (13.6)
Academic year	
First	23 (18.4)
Second	19 (15.2)
Third	23 (18.4)
Fourth	39 (31.2)
Fifth	14 (11.2)

Percentages are of the total sample. Academic performance was recorded as 0 (no category) for 52 respondents in the original dataset and is shown as 'not recorded'. PSQI, Pittsburgh Sleep Quality Index; ESS, Epworth Sleepiness Scale.

Characteristic	n (%) or mean ± SD
Gender	
Sixth	7 (5.6)
Study hours per day	
< 2	21 (16.8)
2–4	68 (54.4)
5–7	30 (24.0)
> 7	6 (4.8)
Repeated an academic year (yes)	22 (17.6)
Self-reported academic performance	
Excellent	15 (12.0)
Good	52 (41.6)
Fair	5 (4.0)
Poor	1 (0.8)
Not recorded	52 (41.6)
Sleep medication use in past month (PSQI item 7; any)	20 (16.0)
Global PSQI score, mean ± SD	6.47 ± 3.26
Sleep duration (h), mean ± SD (n = 124)	6.54 ± 1.84
Total ESS score, mean ± SD	9.07 ± 4.56

Percentages are of the total sample. Academic performance was recorded as 0 (no category) for 52 respondents in the original dataset and is shown as 'not recorded'. PSQI, Pittsburgh Sleep Quality Index; ESS, Epworth Sleepiness Scale.

Sleep quality and duration

Seventy-six students (60.8%; 95% CI 52.0–68.9%) were poor sleepers (mean global PSQI 6.47 ± 3.26; median 6, range 1–15; Figure S1). Mean sleep duration was 6.54 ± 1.84 hours (median 6.5; n = 124), and 63 of 124 (50.8%; 95% CI 42.1–59.4%) slept < 7 hours. Shorter duration correlated strongly with higher PSQI (ρ = −0.51, 95% CI − 0.63 to − 0.37, p < .001; Table 2), partly because PSQI incorporates duration.

Table 2
Correlation between sleep quality, sleep duration, and daytime sleepiness (ESS) scores

Variable pair	Spearman's ρ	95% CI	n	p
Global PSQI vs. Total ESS	0.21	0.04 to 0.37	125	.019
Sleep duration (hours) vs. Total ESS	−0.06	−0.24 to 0.11	124	.485
Sleep duration (hours) vs. Global PSQI	−0.51	−0.63 to − 0.37	124	< .001

CI, 95% confidence interval (Fisher z-transformation). Spearman's rho was used because Global PSQI and Total ESS were not normally distributed (Shapiro–Wilk p < .05). Sleep duration was parsed from free-text entries (see Methods).

Daytime sleepiness: The mean ESS score was 9.07 ± 4.56 (median 9, range 0–20). Fifty-one students (40.8%; 95% CI 32.6–49.6%) had excessive daytime sleepiness: mild 15 (12.0%), moderate 25 (20.0%) and severe 11 (8.8%); 74 (59.2%) were in the normal range (Figure S2).

Sleep and daytime sleepiness

Global PSQI correlated weakly with ESS (ρ = 0.21, 95% CI 0.04–0.37, p = .019), explaining about 4% of the rank variance; sleep duration was not correlated with ESS (ρ = −0.06, 95% CI − 0.24 to 0.11, p = .485; Table 2). Poor sleepers were more often in the moderate and severe categories (18/76 [23.7%] and 9/76 [11.8%]) than good sleepers (7/49 [14.3%] and 2/49 [4.1%]), but the difference was not significant (χ^2 = 4.88, df = 4, p = .300; Cramér's V = 0.20; Figure S3). Excessive sleepiness occurred in 35/76 (46.1%) poor and 16/49 (32.7%) good sleepers (Fisher's exact p = .192). Mean ESS was 9.62 ± 4.57 in poor and 8.22 ± 4.45 in good sleepers (Mann–Whitney U = 2204, p = .083).

Universities

Excessive sleepiness was present in 22/56 (39.3%) students at Port Sudan Ahlia University, 8/17 (47.1%) at East Sudan University and 21/52 (40.4%) at Red Sea University (χ^2 = 0.33, df = 2, p = .847; Figure S4). Mean ESS scores were 8.39 ± 4.47, 9.88 ± 4.09 and 9.54 ± 4.78, respectively (Kruskal–Wallis p = .468). Given the small East Sudan University subsample, meaningful differences cannot be excluded.

Predictors

In the adjusted model for poor sleep quality (Table S1), no predictor was significant and the model did not improve on the null model ($\chi^2(7)$ = 7.13, p = .416); the OR for male students was 1.99 (95% CI 0.72–5.51) and for East Sudan University 2.26 (95% CI 0.62–8.20). Descriptively, global PSQI was higher in male (8.17 ± 3.06) than female students (6.07 ± 3.19; Mann–Whitney p = .005), an exploratory finding based on only 24 male students.

In the model for excessive daytime sleepiness (Table 3), each 1-point increase in global PSQI was associated with 15% higher odds after adjustment for gender, age group and study hours (OR 1.15, 95% CI 1.02–1.30, p = .026; unadjusted OR 1.14, 95% CI 1.01–1.27, p = .028); the overall model was borderline ($\chi^2(6) = 11.97$, p = .063). Results were similar when university was added (OR 1.15, 95% CI 1.01–1.30, p = .035) and in linear regression of ESS (0.31 ESS points per PSQI point, 95% CI 0.06–0.55, p = .014; R^2 = 0.13), but weaker when the binary PSQI classification was used (OR 1.80, 95% CI 0.82–3.96, p = .142) and when students reporting sleep-medication use were excluded (OR 1.13, 95% CI 0.99–1.29, p = .068; ρ = 0.17, p = .081). The association is therefore small and not robust. Age and study hours were not significant predictors. None of the 7 married students had excessive sleepiness, versus 43.2% (51/118) of single students (Fisher's exact p = .041), an unadjusted exploratory finding from a very small subgroup.

Table 3
Multivariable logistic regression: predictors of excessive daytime sleepiness (ESS > 10)

Predictor	B	OR	95% CI	p
Global PSQI (per 1-point increase)	0.141	1.15	1.02–1.30	.026
Gender: Male (vs. Female)	−0.429	0.65	0.23–1.85	.420
Age: 21–23 yrs (vs. 18–20 yrs)	−0.614	0.54	0.23–1.26	.153
Age: ≥24 yrs (vs. 18–20 yrs)	−1.037	0.35	0.11–1.20	.096
Study hours: 2–4 h/day (vs. <2 h)	−0.808	0.45	0.16–1.28	.132
Study hours: ≥5 h/day (vs. <2 h)	−0.629	0.53	0.17–1.66	.278

B, regression coefficient (log-odds); OR, odds ratio; CI, confidence interval. Reference categories: female; 18–20 years; <2 hours/day study. Marital status was not modelled (complete separation: 0/7 married students with ESS > 10). n = 125, 51 events. Omnibus likelihood-ratio test: $\chi^2(6) = 11.97$, p = .063. Sensitivity analyses are described in the Results.

Discussion

In this convenience sample of 125 medical students at three Eastern Sudan universities, 60.8% had poor sleep quality, 50.8% slept < 7 hours and 40.8% had excessive daytime sleepiness, which we used as a proxy for alertness because no direct concentration test was administered. The prevalence of poor sleep quality is close to the worldwide pooled estimate of 55.6% [2], higher than the 39.8% pooled in another review (which reported 29.1% insufficient sleep and 35.9% excessive sleepiness) [3], and lower than the 82.5% reported in a randomly sampled Sudanese cohort [6]. Sleepiness was similar to the pooled estimate [3], whereas short sleep was more common. Definitions and sampling differ between studies, and our convenience sample may over- or under-represent affected students in unknown ways.

Global PSQI correlated weakly but significantly with ESS, consistent with experimental evidence that sleep restriction increases sleepiness and impairs sustained attention [4] and with attention-test findings

in sleep-deprived medical students [5]. However, the association explained only about 4% of the variance in ESS, was attenuated when the binary PSQI classification was used or when sleep-medication users were excluded, and should be considered small and not robust. Sleep duration was not correlated with ESS, but a significant and a non-significant correlation cannot be compared directly, so these results do not show that quality matters more than duration; duration was self-reported as free text and overlaps with PSQI ($\rho = -0.51$).

ESS scores did not differ significantly between good and poor sleepers or across universities. These null findings are not evidence of equivalence: the study was underpowered, and a difference of about 1.5 ESS points between universities (9.88 at East Sudan University versus 8.39 at Port Sudan Ahlia University) cannot be excluded. No measured factor significantly predicted poor sleep quality, although male students had a higher mean PSQI, which merits confirmation in a sample with more male participants. Non-significant coefficients for age and study hours, with wide confidence intervals, are not interpreted as protective effects, and the absence of excessive sleepiness among married students is an exploratory observation requiring replication.

These preliminary, hypothesis-generating data do not establish an effect of sleep on concentration or justify specific interventions, but they support larger multi-centre studies with probability sampling and objective concentration testing.

Limitations

This study did not include a direct, objective test of concentration (e.g., Stroop, digit-span or d2 tests); the ESS measures self-reported daytime sleepiness, which is only a proxy for concentration or sustained attention [5, 7]. The cross-sectional design precludes causal inference. All data were self-reported, which may have introduced recall or social-desirability bias. The convenience sample was small and predominantly female (80.8%), particularly limiting precision and power for East Sudan University (n = 17) and for the multivariable models, and findings may not generalise to medical students in other regions or educational systems.

Conclusion

In this convenience sample of medical students at three Eastern Sudan universities, poor sleep quality (60.8%) and short sleep duration (50.8%) were common. Poorer sleep quality was weakly associated with greater daytime sleepiness, a proxy that is not a direct measure of concentration; the association persisted after adjustment for gender, age and study hours but was not robust in sensitivity analyses. Causal conclusions cannot be drawn. Future studies should use probability sampling and objective concentration testing.

Abbreviations

PSQI

Pittsburgh Sleep Quality Index
ESS
Epworth Sleepiness Scale
OR
odds ratio
CI
confidence interval
SD
standard deviation
STROBE
Strengthening the Reporting of Observational Studies in Epidemiology.

Declarations

Disclaimers

The views expressed in this article are those of the authors and do not necessarily represent an official position of their institutions.

Clinical Trial Registration Number

Not applicable — this is an observational cross-sectional study.

Author Contributions (CRediT)

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All authors contributed to study concept/design, data acquisition, analysis, or interpretation; critically revised the manuscript for important intellectual content; gave final approval of the version to be published; and agree to be accountable for the accuracy and integrity of all aspects of the work.

Acknowledgements: The authors thank all participating medical students and the three participating institutions for their support.

Ethics approval and consent to participate: Ethical approval was granted by the Ethics Committee at the Faculty of Medicine, Port Sudan Ahlia University (approval date: 1 June 2026). The study was conducted in accordance with the principles of the Declaration of Helsinki. All participants provided electronic informed consent before participation; participation was voluntary and no personally identifying information was collected.

Consent for publication: Not applicable.

Competing interests: The authors declare that they have no competing interests.

Availability of data and materials: The dataset generated and/or analysed during the current study is available from the corresponding author upon reasonable request, subject to applicable ethical and confidentiality requirements.

Funding: This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

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