Original Article

Association Between Exercise Habits and Sleep Quality Among Undergraduate MBBS Students at Rawalpindi Medical University

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Abstract

Introduction: Many medical students experience poor sleep quality, often due to their demanding academic schedules and unhealthy lifestyle habits. Although exercise is thought to help improve sleep quality, findings regarding its specific effects on medical students have been inconsistent

Objectives: This cross-sectional study aims to assess the association between exercise habits and sleep quality among undergraduate medical students at Rawalpindi Medical University.

Materials and Methods: A cross-sectional study was conducted among 363 undergraduate medical students enrolled at Rawalpindi Medical University. An online questionnaire was distributed to students via a Google Form. Sleep quality was assessed using a 7-question-based composite scoring system, while exercise variables- including frequency, duration, intensity, consistency, type, and time of day- were converted into numerical values. SPSS version 26 was used for data analysis. Pearson's and Spearman's correlation and multiple linear regression analysis were performed to assess the associations between exercise variables and sleep quality.

Results: No significant correlation was found between sleep quality and exercise frequency, duration, intensity, consistency, or time of day ($p>0.05$). Multiple linear regression showed that exercise variables could not significantly predict sleep quality, with an adjusted R^2 of -0.002

Conclusion: This study finds no significant association between sleep quality and exercise habits among undergraduate medical students at Rawalpindi Medical University. These results suggest that, within this population, sleep quality may be influenced more by factors other than exercise habits.

Keywords: Exercise, physical activity, sleep, sleep quality, students, medical, sleep disorders, stress, psychological, regression analysis

Introduction

Medical students worldwide often experience poor sleep quality. This harms their academic performance as well as their overall quality of life. Their daily routines often include multiple stress factors such as demanding schedules, high workload, and frequent high-stakes examinations. Some literature shows that individuals in demanding environments with multiple stressors often face poor sleep.[1,2] Multiple studies have shown credible evidence that poor sleep is associated with reduced cognitive function, inability to concentrate, and increased risk of anxiety and depression.[2,3] On the other hand, physical activity has been suggested as a non-pharmacological intervention to improve sleep quality. Regular physical activity can improve sleep quality by increasing the production of the hormone melatonin, which regulates sleep-wake cycles; reducing stress, a common barrier to falling and staying asleep; improving mood, which creates a positive feedback loop for better sleep habits; and helping to regulate body temperature, as the post-exercise drop in core body temperature facilitates easier sleepiness and mimics the body's natural pre-sleep thermal decline.[4] Research indicates that regular exercise helps regulate circadian rhythms, reduces stress, and improves overall sleep quality.[5-7] In fact, exercise has been shown to improve sleep latency, increasing slow-wave sleep, and reducing daytime sleepiness.[3,7] Similarly, another study reported that moderate to high intensity exercise was positively associated with improved mental health and sleep quality.[8] However, there has been an inconsistent association between exercise habits and sleep quality when it comes to medical students and similar populations. Some studies report a significant positive relationship between increased physical activity and improved sleep quality among students.[2,6,9,10] On the other hand, others have found weak or no associations at all.[11-14] These inconsistent results might be due to multiple variables, such as population differences, stress levels, or even variation in methodology from study to study. In Pakistan, however, there is a lack of data regarding specifically the association between exercise habits and sleep quality among undergraduate medical students. Most available research focuses on general sleep problems or stress without assessing multiple exercise-related variables. Hence, this study has been designed to explore the association between exercise habits and sleep quality in undergraduate MBBS students at Rawalpindi Medical University to fill the existing literature gap.

Materials and Methods

This cross-sectional study was conducted over 4 months from April to July 2025 at Rawalpindi Medical University and included undergraduate MBBS students from all 5 academic years. Students who self-reported a formal diagnosis of any psychiatric disorder, as well as those who reported suffering from any physical disability that affected their ability to perform exercise, were excluded from the study.

Using the Epi Info tool, the sample size was calculated to be 316. The confidence level was set at 95% and the margin of error at 5%. The hypothesized frequency was set to 50%+/-5 to maximize the sample size. Previous studies have reported a high prevalence of poor sleep quality, ranging from approximately 65%-76%, and insufficient physical activity in over 50% of participants.[12-14] The population size was determined to be approximately 1,750 undergraduate MBBS students at Rawalpindi Medical University. A total of 363 responses were collected, exceeding the required sample size. Non-probability convenience sampling was employed.

Data was collected via a self-administered online questionnaire form created on Fillout.com. The questionnaire was comprised of three sections: (1) demographics, (2) exercise habits, and (3) sleep quality indicators. While a standardized and validated instrument was not utilized, this was a deliberate decision to ensure a high response rate and minimize survey fatigue among the participant pool. We required a concise scale capable of capturing the specific essential metrics necessary for our analysis without the burden of a lengthier tool. A standardized instrument was not deemed strictly necessary as this study is exploratory and non-clinical in nature, rather than diagnostic. The success of this approach is evidenced by the final response count of 363 participants, which exceeded the calculated required sample size. Furthermore, given the specific logistical and time constraints inherent in the undergraduate research timeline, formal validation of the composite scale was not conducted. This choice has been explicitly acknowledged as a limitation in the discussion section of the manuscript

Participants accessed the google form via class WhatsApp groups. Before proceeding, the participants were required to confirm eligibility and consent by a mandatory exclusion criteria tick box and a consent tick box at the beginning of the questionnaire. Only those participants who fulfilled the inclusion criteria and gave consent were allowed to proceed further. All responses were anonymously collected.

The data was thoroughly cleaned after exporting it from the Fillout.com website, and 363 responses were included in the analysis, which was done using SPSS version 26.

The sleep score was calculated by summing up the seven questionnaire items, each of which was scored to reflect sleep quality. Each item assessed a specific characteristic of sleep quality, which included sleep duration, sleep latency, difficulty falling asleep, perceived sleep quality, morning restfulness, and daytime sleepiness. The 7-item composite scale employed a directional scoring system to quantify sleep quality. Each question provided multiple-choice options corresponding to a Likert-type scale. To ensure consistency in the final index, responses were coded so that 'positive' sleep attributes—such as longer sleep duration or high perceived restfulness—were assigned the lowest numerical values. Conversely, 'negative' attributes—such as frequent nighttime

awakenings or excessive daytime sleepiness—were assigned the highest numerical values.

By summing the responses from all seven items, a cumulative Sleep Quality Score was generated for each participant. This additive approach created a continuous scale ranging from 7 (representing best possible sleep quality) to 32 (representing worst possible sleep quality). This method allowed for the conversion of qualitative sleep experiences into a robust quantitative metric suitable for Pearson's correlation and regression analysis. Then the scores for all seven sleep-related questions were summed up, forming a Sleep Quality Score ranging from 7 (best possible sleep quality) to 32 (poorest possible sleep quality).

The exercise variables included frequency, duration, intensity, consistency, and time of day of exercise. They were all converted to numeric codes for further analysis.

Descriptive statistics were computed for both sleep score and exercise-related variables. Both Pearson's and Spearman's correlation analyses were performed for any association between exercise habits and sleep quality.

Multiple regression analysis was conducted as the primary inferential analysis. Sleep Quality Score was kept as the dependent variable, and the exercise variables were used as predictors, all of which were entered simultaneously. A p-value<0.05 was considered significant. Cases with missing values for any variable were handled by listwise deletion.

Since the sleep quality score was continuous and exercise variables were treated as numeric, correlation and regression analyses were deemed the most appropriate statistical tests.

Results

A total of 363 undergraduate MBBS students participated in the study. The study population consisted of 185 (51.0%) males and 178 (49.0%) females. The participants were distributed across all five academic years, with the highest participation from the First-Year students (n=89; 24.5%), followed by the Fourth- and Fifth-Year students (each n=76; 20.9%). The detailed distribution of students according to gender and year of study is presented in Figure 1.

The mean sleep quality score was 19.46 +/- 3.39, which reflects a slight to moderate sleep disturbance. The average exercise frequency was 2.46 +/- 1.93 days per week. This indicates infrequent to moderate physical activity. Full descriptive statistics are presented in Table 1.

Pearson's correlation analysis was done to determine any association between sleep quality score and exercise variables. However, the results showed no significant correlation. Spearman's rank correlation coefficient also showed similar results. These findings are summarized in Table 2.

A multiple linear regression was also performed to determine if the exercise variables significantly predicted the sleep quality score or not. The predictors were: Exercise Frequency,

Exercise Duration, Exercise Intensity, Exercise Consistency, and Time of Day of Exercise. Sleep quality score was kept as the dependent variable. The results here were also not statistically significant, $F(5, 276) = 0.880$, $p = 0.495$, and explained only 1.6% of the variance in sleep quality (Adjusted $R^2 = -0.002$). None of the predictors was individually significant either, at the 0.05 level. These findings are shown in Table 3.

Figure 1 *Demographic distribution of participants*

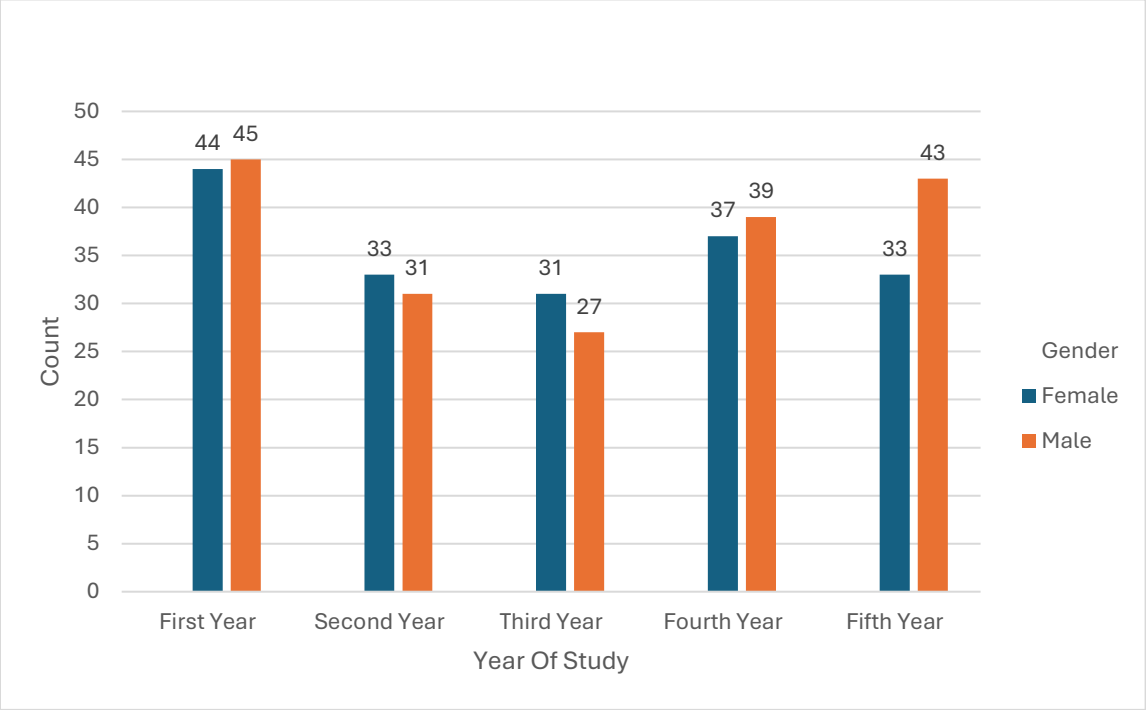

Table 1 *Descriptive Statistics*

Variables	Mean	Std. Deviation
Sleep Quality Score	19.4628	3.38841
Exercise Frequency (days/week)	2.4573	1.93406
Exercise Duration (per session)	1.0220	1.18674
Time of Day of Exercise	2.3440	1.07980
Exercise Intensity	2.4787	1.10059
Exercise Consistency	2.0213	.83062

Table 2 *Correlation Analysis*

Variable	Pearson r	p-value	Spearman ρ	p-value
Exercise Frequency	−0.032	0.549	−0.029	0.588
Exercise Duration	−0.047	0.377	−0.027	0.608
Exercise Intensity	0.012	0.845	0.012	0.847
Exercise Consistency	0.026	0.665	0.030	0.613
Time of Day of Exercise	0.054	0.370	0.059	0.327

Bivariate analysis (both Pearson's and Spearman's correlation) was indeed conducted as the initial step of our analysis, which revealed no significant individual associations. The subsequent multiple linear regression was performed as a confirmatory multivariate analysis to ensure that, even when all exercise-related variables were considered simultaneously, no hidden predictive patterns or confounding effects existed. This dual-step approach was taken to provide a more robust and comprehensive verification of the study's findings, ensuring that the 'null' result was consistent across both simple and complex statistical models. We utilized both Pearson's and Spearman's correlation tests as a form of sensitivity analysis to ensure the robustness of our findings. Recognizing that sleep quality scores and exercise variables can occasionally deviate from a normal distribution or represent ordinal data, we applied both parametric and non-parametric methods to confirm that our conclusions were not dependent on a specific statistical assumption. The consistency of the non-significant results across both tests provides higher confidence in the reported lack of association.

Table 3 *Regression Analysis*

Predictor Variable	Unstandardized Coefficients		Standardized Coefficients	p-value
	B	SE B	β	
Constant	19.341	0.922	—	<0.001
Exercise Frequency	−0.169	0.125	−0.082	0.175
Exercise Duration	−0.206	0.167	−0.074	0.218
Exercise Intensity	0.079	0.182	0.026	0.664
Exercise Consistency	0.166	0.241	0.042	0.492
Time of Day of Exercise	0.183	0.185	0.060	0.324

Model Summary: $R^2 = 0.016$, Adjusted $R^2 = -0.002$, $F(5, 276) = 0.880$, $p = 0.495$

Multiple Linear Regression was utilized to assess the collective effect of all exercise-related variables while controlling for potential confounding between them. By treating the

sleep quality score as a continuous variable rather than categorizing it, we preserved the full depth and variance of the data. This allowed us to quantify the total variance explained (R^2) and rigorously confirm that exercise habits, even when considered together, were not a significant predictor of sleep quality in this population. We believe this linear approach provides a more granular and statistically robust representation of the associations than a categorical analysis would allow.

Discussion

This study assesses the association between exercise habits and sleep quality among undergraduate MBBS students at Rawalpindi Medical University. The findings show no statistically significant correlation between sleep quality and any of the exercise variables. In addition, Multiple regression analysis also showed that these variables do not significantly predict sleep quality. Thus, these results suggest that exercise habits may not be the main factor that determines sleep quality within this population. Other academic, psychological, or lifestyle-related factors could be more influential.

Our findings of a non-significant association align with several studies among similar populations that have reported weak or no direct correlation between physical activity and sleep quality, with some even suggesting that excessive exercise may not only impair sleep efficiency but may also lead to sleep difficulties as well.[15-18] A previous study found no significant improvement in sleep quality with increased exercise frequency among university students, highlighting the possible role of stress and irregular schedules as overriding factors.[11] Similarly, another study reported observing no significant correlation between physical activity levels and PSQI scores among Pakistani medical students.[13] In fact, one study reports that while physical activity does benefit health, its effects were minimal among medical students who have high academic demands.[9] These studies closely align with our similar findings. Therefore, it is likely that exercise alone may be insufficient to have a significant positive effect on sleep quality, especially in a high-stress academic environment.

In stark contrast, many studies have reported a positive association between exercise and sleep quality in the general population. One study reported significantly improved PSQI scores in adults with regular exercise.[1] Likewise, another found similar benefits in a cohort of healthcare students.[12] Ezati et al. (2020) reported that moderate intensity aerobic exercise improved both sleep duration and efficiency among sedentary adults.[6] Similarly, other studies also found consistent physical activity to enhance subjective sleep quality.[10]

One possible explanation for the discrepancy between our findings and those of studies reporting positive associations is the influence of factors other than exercise. High academic workload, frequent high-stakes exams, irregular study hours, and psychosocial stress are some of the factors that have been well-recognized to

result in poor sleep quality in this type of population.[2,3,13] These stressors may override and even negate the benefits of exercise on sleep. In addition, the mean frequency of exercise was very low among our participants. This means that students may not be engaging in the level of activity required to cause a significant effect on sleep quality, as is suggested by previous studies.[5,7]

Differences in study design and measurement tools may also be the reason for the starkly different results. Most of the studies reporting a positive association have employed intervention designs with structured exercise programs. Meanwhile, our study and those with null results are observational and rely on self-reported physical activity.

Moreover, it should also be noted that the time of day of exercise was not significantly associated with sleep quality either, despite some studies suggesting that late evening exercise can delay sleep onset.[3,11] This might reflect the fact that among medical students, bedtime is often more determined by irregular study routines and academics rather than psychological readiness to sleep.

One major strength of this study is that it includes multiple exercise-related variables rather than focusing solely on total activity level. This allows for an in-depth analysis of different aspects of exercise and sleep quality. Additionally, our study had a relatively large sample size, which reinforces the reliability of our findings.

Nonetheless, several limitations are present in this study that must be considered. The cross-sectional design means that it cannot be proved if exercise habits directly affect sleep quality. Furthermore, since all the information was self-reported by the participants, there is a possibility of reporting bias. Additionally, the sleep quality was assessed using a self-developed composite scoring system rather than a validated and standardized tool such as the PSQI. While the composite scoring system was able to capture the core aspects of sleep, its non-standardized nature limits its comparability to other studies. Also, other important determinants of sleep quality are not assessed in this study, such as caffeine intake, screen time, or stress levels, to name a few. Even though students diagnosed with psychiatric disorders were excluded, undiagnosed mental health issues could still have played a decisive role. Additionally, the low average exercise frequency means that most participants were not meeting the recommended physical activity guidelines, thereby limiting the ability to detect significant effects.

Hence, based on these findings, it is recommended that future research involving the sleep quality of medical students should incorporate a wider range of lifestyle variables and employ a validated tool for sleep scoring, such as the PSQI. This would improve reliability and enable comparability across research. In addition, the use of a longitudinal study design would help to better establish a cause-and-effect relationship.

Conclusion

This study found no significant association between exercise habits and sleep quality among undergraduate MBBS students at Rawalpindi Medical University. Although physical activity has been linked to better health, its direct impact on sleep quality, especially in this specific population, appears to be somewhat limited. This suggests that some other factors, which were not discussed here, might play a larger role. Addressing these factors through targeted interventions and further research can lead to the development of programs to help improve sleep quality in medical students.

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