

PHYSICAL ACTIVITY AND SLEEP PATTERNS AS DETERMINANTS OF ACADEMIC PERFORMANCE IN SECONDARY SCHOOL TEENAGERS: A DESCRIPTIVE CROSS-SECTIONAL STUDY

Original Research

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ABSTRACT

Background: Physical health factors, notably physical activity and sleep quality, play a crucial role in adolescents' academic performance. Regular physical activity has been associated with enhanced cognitive functions, including improved concentration and memory, as well as better mood regulation. Adequate sleep, typically 8–10 hours per night for teenagers, is essential for processes such as memory consolidation and maintaining attention. Insufficient sleep and physical inactivity have been linked to diminished academic outcomes and increased absenteeism.

Objective: This study aimed to assess the levels of physical activity and sleep patterns among secondary school teenagers and to evaluate their academic performance.

Methods: A descriptive cross-sectional study was conducted among 384 students from private secondary schools in Bahawalnagar. Participants were selected using a census sampling technique. Data collection instruments included the International Physical Activity Questionnaire (IPAQ) to measure physical activity levels, the Pittsburgh Sleep Quality Index (PSQI) to assess sleep quality, and the Academic Performance Scale (APS) to evaluate academic outcomes. Descriptive statistics, including means, standard deviations, frequencies, and percentages, were calculated using SPSS version 27.

Results: Among the participants, 32.8% exhibited low to moderate levels of physical activity. Regarding sleep quality, 37.2% reported good sleep, while 60% experienced disturbed sleep patterns. Despite these physical health challenges, 65.6% of the students achieved excellent academic performance. The analysis indicated that both physical activity levels and sleep quality had a substantial impact on academic outcomes.

Conclusion: The findings suggest that a significant portion of secondary school teenagers have suboptimal physical activity levels and sleep patterns. Nonetheless, a majority attained excellent academic performance, indicating that additional factors may contribute to academic success. Interventions aimed at improving physical activity and sleep quality could potentially enhance academic outcomes.

Keywords: Academic Performance; Adolescent; Cross-Sectional Studies; Motor Activity; Sleep; Sleep Quality; Students.

INTRODUCTION

Physical health significantly influences academic performance, with regular physical activity supporting overall well-being and enhancing cognitive functions vital for educational success. Academic performance, a critical aspect of secondary school education, reflects the knowledge acquired by students and is evaluated through grades and assessments. It serves as a measure of learning objectives mutually established by educators and students. Research underscores the importance of the Cumulative Grade Point Average (CGPA) as a predictor of future learning outcomes, shaped by classroom behavior and evolving cognitive and academic skills (1,2). These skills, linked to processes such as working memory and reasoning, demonstrate diverse developmental trajectories influenced by age and context. However, the associations between these skills and academic performance are weaker for disadvantaged groups, including children with special needs or those from low-income families (3,4). Furthermore, the quality of schooling emerges as a pivotal determinant of academic outcomes.

Global trends reveal alarming patterns in academic underachievement, particularly among teenagers. Data from the European Commission (2022) highlight that approximately 9.6% of individuals aged 18 to 24 in Europe drop out of education without completing secondary schooling or pursuing further training, raising concerns about the broader implications of poor academic performance. This underscores the necessity of evaluating multifaceted factors that shape academic outcomes to develop a comprehensive understanding of their impact on students' educational journeys.

Physical activity and sleep patterns are particularly significant among the determinants of academic performance. These factors profoundly affect cognitive development during adolescence, a critical stage of growth spanning ages 10 to 19. The World Health Organization (WHO) emphasizes that this period involves substantial changes in autonomy and decision-making, with academic failures often resulting in long-term adverse consequences (5,6,7). Lifestyle choices, including insufficient physical activity and sleep, exacerbate these challenges, contributing to increased dropout rates and diminished cognitive and academic capacities (8,9).

Teenagers frequently experience chronic sleep deprivation, with many failing to meet the recommended 8 to 10 hours of sleep per night due to societal and technological pressures (10). Sleep disruptions can impair mood regulation, induce anxiety, and hinder academic performance (11,12,13). Addressing these issues necessitates targeted interventions, such as advocating for later school start times and promoting sleep education. Similarly, regular physical activity not only bolsters general health but also enhances cognitive processes crucial for learning. Promoting fitness and healthy lifestyle habits, including adequate exercise and sufficient sleep, is essential for fostering academic success and overall well-being.

Given the intricate interplay of cognitive, educational, and physical health factors, a holistic approach is imperative to optimize academic outcomes for secondary school students. This study aims to rationally evaluate the influence of these interdependent factors, offering insights into their roles in shaping academic performance and proposing evidence-based strategies to enhance student success during this formative stage of development.

METHODS

A descriptive cross-sectional design was employed to assess the levels of physical health factors, specifically physical activity and sleep patterns, and their association with academic performance among secondary school teenagers in District Bahawalnagar. The target population consisted of students enrolled in grades 8 to 10 in private schools within the district. The sample size of 384 participants was determined using the World Health Organization's online sample size calculator, assuming a population proportion of 50%, a 95% confidence interval, and a 5% margin of error. Census sampling was utilized to select students from the targeted grades, while the schools were chosen through convenient sampling. Initially, ten private schools were approached, but only seven agreed to participate following necessary approvals from their administrators.

The study included participants aged 12 to 19 years, actively enrolled in grades 8, 9, or 10, and free from health conditions that could influence physical health or academic performance. Students with chronic diseases such as chronic renal disease or chronic obstructive pulmonary disease (COPD), as well as those reporting issues such as back pain or difficulty breathing during physical activity, were

excluded to ensure data consistency and validity. Structured and validated questionnaires were employed to collect data on study variables. These included the Academic Performance Scale (APS), International Physical Activity Questionnaire (IPAQ), and Pittsburgh Sleep Quality Index (PSQI), each chosen for their established reliability and validity. The APS measured academic outcomes on a 5-point Likert scale ranging from 0 to 40, with a Cronbach's alpha of 0.89, indicating high reliability. The IPAQ assessed physical activity levels, categorizing responses into vigorous, moderate, mild, and sedentary activity levels, and calculating metabolic equivalent of task scores. The PSQI evaluated sleep quality, with reliability reflected by a Cronbach's alpha of 0.84 (14,15,16).

Pilot testing was conducted with 38 participants from one selected school to evaluate the reliability and validity of the data collection tools. The pilot results confirmed the internal consistency of the instruments, with Cronbach's alpha values of 0.75 for the IPAQ, 0.87 for the APS, and 0.84 for the PSQI. Participants completed the questionnaires within 15 to 20 minutes, and no significant modifications to the tools were deemed necessary based on the pilot feedback. Data collection occurred from May 2024 to June 2024, with meticulous double-checking and comparison against the hard copies of the questionnaires to ensure accuracy.

The collected data were analyzed using SPSS version 27, employing descriptive statistics to summarize the findings. Ethical approval was secured from the Institutional Review Board and Ethical Review Committee of the National University of Medical Sciences, Rawalpindi (Re:470-AAA-ERC-AFPGMI). Written consent was obtained from school principals and participants prior to data collection, ensuring compliance with ethical standards.

RESULTS

The study assessed physical health factors and academic performance among secondary school teenagers, providing detailed insights into sleeping patterns, physical activity levels, and academic outcomes. A total of 384 participants were evaluated, with 37.2% (143 participants) reporting good sleep quality, while a majority of 60.7% (233 participants) indicated poor sleep quality. Severe sleeping difficulties were observed in 2.1% (8 participants). The mean sleep quality score was 1.6, with a standard deviation of 0.52, highlighting significant sleep quality issues in the sample population. These findings suggest that poor sleep quality is a prevalent concern, potentially impacting overall health and cognitive performance in this age group.

Physical activity levels varied significantly across the participants, with 27.3% (105 participants) classified as insufficiently active, while 15.9% (61 participants) demonstrated low levels of activity. Moderate activity levels were observed in 16.9% (65 participants), and high levels in 20.1% (77 participants). A slightly lower percentage, 19.8% (76 participants), reported very high levels of physical activity. The mean physical activity score was 2.9, with a standard deviation of 1.5, indicating substantial variability. These results underscore the diversity in physical activity engagement, with a considerable proportion of participants maintaining regular exercise routines.

Academic performance was categorized into three levels, revealing that 65.6% (252 participants) achieved excellent academic outcomes, indicating a high level of academic success among the majority. Good academic performance was observed in 25.5% (98 participants), while 8.9% (34 participants) exhibited moderate performance. The mean academic performance score was 2.6, with a standard deviation of 0.65. Despite prevalent sleep challenges and variability in physical activity levels, a significant majority of participants excelled academically, suggesting the presence of other compensatory or supportive factors influencing educational outcomes.

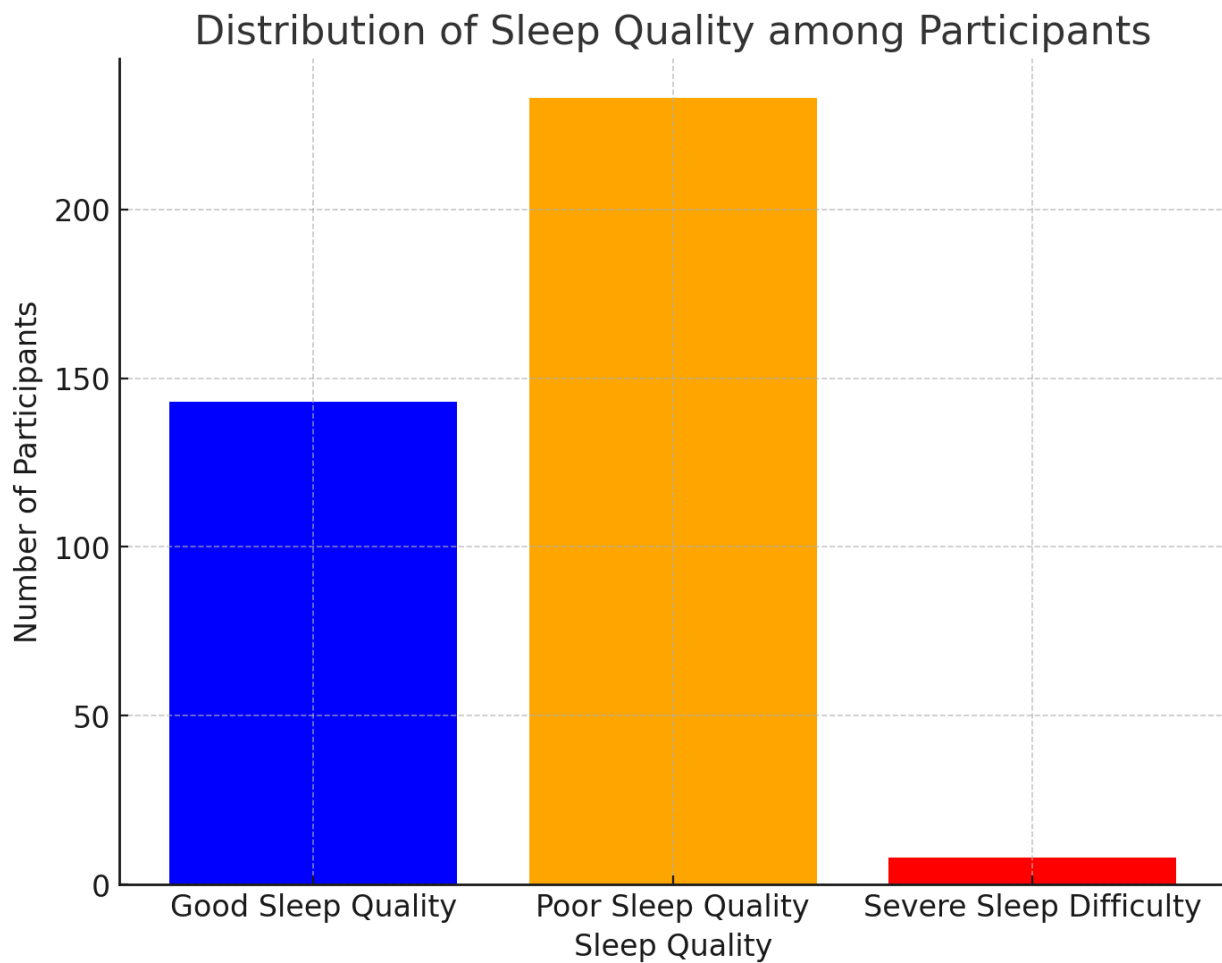


Figure 1 Distribution of Sleep Quality among Participants

The chart illustrates the distribution of sleep quality among the participants, revealing that 37.2% (143 individuals) reported good sleep quality, while a significant majority, 60.7% (233 individuals), experienced poor sleep quality. Additionally, 2.1% (8 individuals) suffered from severe sleeping difficulties. These findings indicate that a substantial portion of the population is affected by inadequate sleep quality, which may have implications for their overall health and daily functioning.

Table 1 Levels of physical factors and academic performance among the secondary school teenagers

Sr. No.	Variable	No of participants	Percentage
		n	%
	Physical activity		
	Insufficiently active	105	27.3
	Low levels of physical activity	61	15.9
	Moderate levels of physical activity	65	16.9
	High levels of physical activity	77	20.1
	Very high levels of physical activity	76	19.8
	Academic performance		
	Moderate	34	8.9
	Good	98	25.5
	Excellent	252	65.6

The data reveals that 27.3% (105 participants) were classified as insufficiently active, while 15.9% (61 participants) exhibited low levels of physical activity. Moderate physical activity levels were observed in 16.9% (65 participants), with 20.1% (77 participants) engaging in high levels, and 19.8% (76 participants) in very high levels of physical activity. Regarding academic performance, 8.9% (34 participants) achieved moderate results, 25.5% (98 participants) attained good results, and a majority of 65.6% (252 participants) reached excellent academic performance. These findings indicate a diverse range of physical activity engagement among participants, with a significant proportion achieving high academic success.

DISCUSSION

This study identified a significant prevalence of poor sleep quality among secondary school teenagers in Bahawalnagar, with 60.7% of participants reporting inadequate sleep (17,18,19). This finding aligns with existing literature indicating that adolescents often experience poor sleep quality due to excessive academic pressure and the overuse of electronic devices before bedtime (20,21,22). Such sleep deprivation has been associated with increased daytime sleepiness, impaired concentration, and diminished learning capabilities, ultimately leading to lower academic performance (23,24,25).

In terms of physical activity, the study revealed that 32.8% of participants engaged in low to moderate levels of physical activity, while a notable proportion maintained higher activity levels. This variability reflects previous research highlighting both active and sedentary lifestyles among secondary school students (26). Some studies suggest that insufficient emphasis by educational policymakers contributes to sedentary behaviors (27), whereas others indicate that contemporary students effectively balance physical activity with academic responsibilities (28). Regular physical activity has been shown to enhance cognitive function, improve mood, and reduce stress, all of which are beneficial for academic success (29).

Despite the high incidence of poor sleep quality and varying levels of physical activity, 65.6% of participants achieved excellent academic performance. This suggests that while sleep and physical activity are influential, other factors may play compensatory roles in academic achievement. Variables such as age, gender, socioeconomic status, parental involvement, and student motivation

significantly impact academic outcomes. This multifaceted nature of academic performance is consistent with findings that emphasize the interplay of cognitive, behavioral, and environmental factors in shaping educational success (30).

A strength of this study is its focus on a specific demographic, providing detailed insights into the sleep and physical activity patterns of secondary school teenagers in Bahawalnagar. However, the reliance on self-reported data may introduce bias, and the cross-sectional design limits the ability to infer causality. Future research could benefit from longitudinal approaches and objective measurements to further elucidate the relationships among sleep, physical activity, and academic performance.

CONCLUSION

The study revealed that a significant proportion of secondary school teenagers in Bahawalnagar experience poor sleep quality, which is consistent with existing literature linking inadequate sleep to diminished cognitive function and academic performance. Despite these sleep challenges, a majority of participants demonstrated commendable academic success, suggesting the presence of other compensatory factors. Addressing sleep issues and promoting physical activity could further enhance cognitive function and academic outcomes in this population.

AUTHOR CONTRIBUTIONS

Author	Contribution
Iffat Naz	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Fouzia Naz	Substantial Contribution to study design, acquisition and interpretation of Data Critical Review and Manuscript Writing Has given Final Approval of the version to be published
Nafisa Bardaie	Substantial Contribution to acquisition and interpretation of Data Has given Final Approval of the version to be published
Mahreen Aslam	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Mohammad Shahid Chaudhary	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Mohammad Abid	Substantial Contribution to study design and Data Analysis Has given Final Approval of the version to be published
Muhammad Farrukh Habib	Contributed to study concept and Data collection Has given Final Approval of the version to be published

REFERENCES

1. Mappadang A, Khusaini K, Sinaga M, Elizabeth E. Academic interest determines the academic performance of undergraduate accounting students: Multinomial logit evidence. *Cogent Bus Manag.* 2022;9(1):2101326. doi:10.1080/23311975.2022.2101326.
2. Salcedo A, Salcedo SS, Marasigan RP, Guevarra RM, Datu ET, Aquino RB. Cumulative grade point average and comprehensive examination results as predictors of certified public accountant board examinees' performance. *Int J Multidiscip Appl Bus Educ Res.* 2021 Jul 12;2(7):542-8.
3. Qureshi MA, Khaskheli A, Qureshi JA, Raza SA, Yousufi SQ. Factors affecting students' learning performance through collaborative learning and engagement. *Interact Learn Environ.* 2023;31(4):2371-91.
4. Peng P, Kievit RA. The development of academic achievement and cognitive abilities: a bidirectional perspective. *Child Dev Perspect.* 2020;14(1):15-20.
5. Singh AS, Saliasi E, Van Den Berg V, Uijtdewilligen L, De Groot RH, Jolles J, et al. Effects of physical activity interventions on cognitive and academic performance in children and adolescents: a novel combination of a systematic review and recommendations from an expert panel. *Br J Sports Med.* 2019;53(10):640-7.
6. Hoyniak CP, Bates JE, Staples AD, Rudasill KM, Molfese DL, Molfese VJ. Child sleep and socioeconomic context in the development of cognitive abilities in early childhood. *Child Dev.* 2019;90(5):1718-37.
7. World Health Organization. Mental health of adolescents. 2021. Available from: https://www.who.int/news-room/fact-sheets/detail/adolescent-mental-health/?gad_source=1&gclid=Cj0KCQjw8pKxBhD_ARIsAPrG45nAzTBHdjwLZsETMk8GKw6OL675EPcxL5Vehv9iFclTWsYKogOJlaAhNfEALw_wcB.
8. Li IW, Carroll DR. Factors influencing dropout and academic performance: an Australian higher education equity perspective. *J High Educ Policy Manag.* 2020;42(1):14-30.
9. Briguglio M, Vitale JA, Galentino R, Banfi G, Zanaboni Dina C, Bona A, et al. Healthy eating, physical activity, and sleep hygiene (HEPAS) as the winning triad for sustaining physical and mental health in patients at risk for or with neuropsychiatric disorders: considerations for clinical practice. *Neuropsychiatr Dis Treat.* 2020;16:55-70.
10. Devu BK, Joseph JK. Sleep patterns and its influence on sleep problems among children in India: A systematic review & meta-analysis. *Indian J Public Health Res Dev.* 2020;11(10):11-7.
11. Illingworth G. The challenges of adolescent sleep. *Interface Focus.* 2020;10(3):20190080.
12. Hall JA. *Relating through technology: Everyday social interaction.* Cambridge: Cambridge University Press; 2020.
13. Freeman D, Sheaves B, Waite F, Harvey AG, Harrison PJ. Sleep disturbance and psychiatric disorders. *Lancet Psychiatry.* 2020;7(7):628-37.
14. Fayyaz I. *Influence of social anxiety on the perceived academic performance of university students [dissertation].* Lahore: Forman Christian College; 2018.
15. Craig CL, Marshall AL, Sjöström M, Bauman AE, Booth ML, Ainsworth BE, et al. International physical activity questionnaire: 12-country reliability and validity. *Med Sci Sports Exerc.* 2003 Aug;35(8):1381-95.
16. Hamdani SM, Jie Z, Hadier SG, Tian W, Hamdani SD, Danish SS, Fatima SU. Relationship between moderate-to-vigorous physical activity with health-related physical fitness indicators among Pakistani school adolescents: Yaali-Pak study. *Sci World J.* 2022;2022:6402028.
17. Hadier SG, Yinghai L, Long L, Hamdani SD, Hamdani SM. Mediation role of cardiorespiratory fitness on association of physical activity and physical literacy among 8–12 years old children: the PAK-IPPL cross-sectional study. *Front Pediatr.* 2024 Sep 13;12:1383670.

18. Buysse DJ, Reynolds CF 3rd, Monk TH, Berman SR, Kupfer DJ. The Pittsburgh Sleep Quality Index: a new instrument for psychiatric practice and research. *Psychiatry Res.* 1989 May;28(2):193-213.
19. Carpenter JS, Andrykowski MA. Psychometric evaluation of the Pittsburgh Sleep Quality Index. *J Psychosom Res.* 1998 Jul;45(1):5-13.
20. Shadzi MR, Rahmanian M, Heydari A, Salehi A. Structural validity of the Pittsburgh Sleep Quality Index among medical students in Iran. *Sci Rep.* 2024 Jan 11;14(1):1538.
21. Zhou T, Cheng G, Wu X, Li R, Li C, Tian G, et al. The associations between sleep duration, academic pressure, and depressive symptoms among Chinese adolescents: results from China family panel studies. *Int J Environ Res Public Health.* 2021;18(11):6134.
22. Caumo GH, Spritzer D, Carissimi A, Tonon AC. Exposure to electronic devices and sleep quality in adolescents: a matter of type, duration, and timing. *Sleep Health.* 2020;6(2):172-8.
23. Duraccio KM, Krietsch KN, Zhang N, Whitacre C, Howarth T, Pfeiffer M, Beebe DW. The impact of short sleep on food reward processes in adolescents. *J Sleep Res.* 2021 Apr;30(2):e13054.
24. Beebe DW, Wells SL, Wells M. Sleep and academic performance in children and adolescents: a review of the literature. *J Pediatr Psychol.* 2018;43(2):145-57.
25. aheshwari G, Shaikat F. Impact of poor sleep quality on the academic performance of medical students. *Cureus.* 2019;11(4):e4527.
26. Krietsch KN, Duraccio KM, Zhang N, Saelens BE, Howarth T, Combs A, et al. Earlier bedtimes and more sleep displace sedentary behavior but not moderate-to-vigorous physical activity in adolescents. *Sleep Health.* 2022 Jun;8(3):270-6.
27. Manohar SG, Zokaei N, Fallon SJ, Vogels TP, Husain M. Neural mechanisms of attending to items in working memory. *Neurosci Biobehav Rev.* 2019 Jun;101:1-2.
28. de Mora F, Balsa A, Cornide-Santos M, Carrascosa JM, Marsal S, Gisbert JP, et al. Biosimilar and interchangeable: inseparable scientific concepts? *Br J Clin Pharmacol.* 2019 Nov;85(11):2460-3.
29. Shantakumar SR, Sahabdeen HB, Abidin FA, Perumal G, Kumar N. Association of type and duration of exercise with the mental and physical health and academic performance of medical undergraduate students: cross-sectional study. *Bangladesh J Med Sci.* 2022 Jan;21(1):135-9.
30. Li IW, Carroll DR. Factors influencing dropout and academic performance: an Australian higher education equity perspective. *J High Educ Policy Manag.* 2020;42(1):14-30.