ASSOCIATION BETWEEN NOCTURNAL STUDY HABITS SLEEP QUALITY AND ITS IMPACT ON CLINICAL DECISION MAKING IN PHYSIOTHERAPY STUDENTS: A CROSS-SECTIONAL STUDY

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Abstract :
This study has been undertaken to investigate the association between nocturnal study habits, sleep quality, and clinical decision-making ability among physiotherapy students.
Methods: This observational cross-sectional study was conducted on 90 undergraduate physiotherapy students (aged 19–25 years) using convenience sampling. Data was collected using three standardized self-administered tools: a Nocturnal Study Habits Questionnaire (NSHQ), the Pittsburgh Sleep Quality Index (PSQI) to assess sleep quality, and a Clinical Decision-Making (CDM) Questionnaire. Statistical analysis was performed using Pearson's correlation and two-sample Z-tests.
Results:The study cohort comprised 78.89% females with a mean age of 21.70 ± 1.10 years (range 19-25). Participants exhibited moderate nocturnal study practices (mean NSHQ: 42.07 ± 8.62). The mean PSQI score was 5.68 ± 2.62, identifying 49 (54.4%) as good sleepers and 41 (45.6%) as poor sleepers. The mean clinical decision-making score was 29.19 ± 6.07 out of 48. Correlational analysis revealed a statistically significant positive relationship between nocturnal study practices and clinical decision-making ($r = 0.2282$, $p = 0.0305$). However, there was no significant correlation between nocturnal studying and biological sleep quality ($r = 0.1811$, $p = 0.0876$), and absolutely no correlation between sleep quality and clinical decision-making scores ($r = 0.0002$, $p = 0.9989$).
Conclusion: While physiotherapy students experience moderate sleep disturbances and reduced sleep duration, these factors do not directly translate to impaired clinical decision-making. Increased nocturnal study habits were mildly but significantly associated with improved clinical decision-making, suggesting that the academic benefits of focused, distraction-free late-night studying may temporarily outweigh the cognitive detriments of minor sleep loss, aided by the neuroplastic resilience of young adults.
IndexTerms - Nocturnal Study Habits, Sleep Quality, Clinical Decision Making, Physiotherapy Students, PSQI.

INTRODUCTION

Sleep is a fundamental physiological process that plays a crucial role in cognitive functioning, learning, performance, memory consolidation, learning efficiency, and overall academic outcomes. Research indicates that better sleep quality, duration, and consistency are associated with improved academic performance and cognitive functions in the college student population.[1]
Observational studies have demonstrated that sleep quality, sleep duration, and sleep consistency are significantly associated with academic performance in college students.[1] Irregular sleep schedules and poor sleep quality have been shown to impair attention, working memory, and learning efficiency, thereby negatively affecting academic outcomes.[1,4] Importantly, sleep consistency and timing have been reported to be as important as total sleep duration in determining cognitive performance.[1]
Mahmoud et al. observed that a significant proportion of medical students engaged in night-time studying, resulting in shortened sleep duration and increased daytime sleepiness, which adversely affected academic functioning.[2]
Students in health-care professions, including physiotherapy, are exposed to demanding academic curricula, extensive theoretical learning, clinical postings, and continuous assessments. Due to these academic pressures, many students adopt nocturnal study practices, characterized by studying late at night or after midnight. Studies examining night study patterns have reported that late-night studying leads to reduced sleep duration, delayed bedtimes, and disturbed sleep–wake cycles.[3]
Similarly, Bahammam et al. reported that late bedtimes and irregular sleep–wake practices were significantly associated with poorer academic performance among medical students[3]
Irregular sleep schedules and poor sleep quality have been shown to impair sleep-wake practices were significantly associated with poorer academic performance among medical students.[4]
Poor sleep quality and sleep deprivation have been consistently associated with impairments in attention, working memory, executive function, psychomotor performance, and decision-making abilities.[5,6]
Clinical decision-making in physiotherapy involves comprehensive patient assessment, interpretation of clinical findings, formulation of treatment plans, and modification of interventions based on patient response. These processes require intact cognitive functioning,alertness, and reasoning ability, all of which are vulnerable to the effects of poor sleep.[5,6]
Indian studies have reported a high prevalence of poor sleep quality among undergraduate physiotherapy students, often associated with academic stress and workload.[7] However, existing literature has largely focused on sleep quality and academic performance, with limited emphasis on nocturnal study practices and their specific impact on clinical decision-making abilities. Therefore, this

study aims to investigate the association between nocturnal study practices, sleep quality, and clinical decision-making among physiotherapy students.

Sleep plays a vital role in maintaining optimal cognitive functioning, alertness, learning efficiency, and decision-making abilities in students. College students commonly experience inadequate and poor-quality sleep due to academic workload, examination stress, and maladaptive study practices such as late-night studying [8,9].

Studies have reported that nocturnal activities, including studying late at night and prolonged use of electronic devices, significantly disrupt normal sleep patterns and lead to delayed bedtimes, reduced sleep duration, and increased daytime sleepiness among students [8,9]. Disturbed sleep patterns are highly prevalent in university students, particularly during examination periods, and are associated with impaired attention, reduced concentration, and decreased cognitive efficiency[9,10].

Sleep deprivation and poor sleep quality have been shown to negatively affect academic functioning and cognitive performance. Gilbert and Weaver demonstrated that students with poor sleep quality had significantly lower academic performance compared to those with good sleep quality, highlighting the impact of sleep on learning and mental performance [10].

Similarly, Almojali et al. reported a significant association between poor sleep quality and reduced academic performance among medical students [11]

Examination stress further aggravates sleep disturbances in students. Satti et al. observed that increased examination stress was associated with poor sleep quality, excessive daytime sleepiness, and fatigue among medical students, which may impair higher cognitive functions[12]

Chronic sleep deprivation has also been linked to deterioration in psychological and cognitive variables such as attention, working memory, executive function, and decision-making abilities[13]

Trockel et al. emphasized that sleep-related behaviors, including irregular sleep schedules and reduced sleep duration, play a significant role in influencing academic and cognitive outcomes in college students [14]. For health-care students, including physiotherapy students, these cognitive impairments may have serious implications, as clinical decision-making requires sustained attention, reasoning, judgment, and problem-solving skills.

Despite growing evidence on sleep quality and academic performance, limited literature has explored the combined effect of nocturnal study practices and sleep quality on clinical decision- making abilities among physiotherapy students. Therefore, the present study aims to examine the association between nocturnal study practices, sleep quality, and clinical decision-making ability in this population.

NEED FOR STUDY

Nocturnal study practices are commonly observed among health-professional students, especially during examination periods. Studies have shown that night-time studying leads to reduced sleep duration, irregular sleep timing, and increased daytime sleepiness, which may compromise cognitive efficiency and performance. Mahmoud et al. specifically highlighted that night study patterns negatively influence sleep duration and academic functioning. Evidence suggests that these cognitive domains are significantly affected by sleep deprivation and poor sleep quality. Physiotherapy students are future health-care professionals who must demonstrate sound clinical reasoning and accurate decision-making to ensure effective and safe patient care. Clinical decision-making is a cognitively demanding process that relies on attention, memory, executive functioning, and judgment.

Among physiotherapy students in India, poor sleep quality has been reported to be prevalent and associated with academic stress. However, these studies have not specifically examined nocturnal study practices or evaluated their influence on clinical decision-making abilities. Given that physiotherapy training involves significant clinical exposure requiring high levels of cognitive alertness and reasoning, understanding the relationship between nocturnal study practices, sleep quality, and clinical decision-making is essential.

There is a clear gap in the literature regarding the combined assessment of nocturnal study practices, sleep quality, and clinical decision-making among physiotherapy students. Addressing this gap will help in promoting healthier study behaviors, improving sleep hygiene awareness, and potentially enhancing academic and clinical performance. Therefore, this observational study is needed to explore these associations in physiotherapy students.

AIM AND OBJECTIVES

To study the association between nocturnal study practices, sleep quality, and clinical decision-making ability among physiotherapy students.

OBJECTIVES

To observe nocturnal study practices among physiotherapy students.

To assess sleep quality using a standardized sleep quality questionnaire.

To assess clinical decision-making ability using a validated questionnaire.

To analyze the association between nocturnal study practices and sleep quality.

To evaluate the impact of sleep quality on clinical decision-making ability.

REVIEW OF LITERATURE

1. Okano et al. in the year 2019 conducted an observational study named Sleep Quality, Duration, and Consistency Are Associated with Better Academic Performance in College Students. Aim and objectives was to investigate the relationship between sleep quality, sleep duration, sleep consistency, and academic performance among college students.The researchers used wearable activity trackers to objectively monitor sleep patterns in students enrolled in an introductory college chemistry course. Sleep parameters were assessed and correlated with academic performance, including in-class quizzes and midterm examinations. The study found that students who maintained better sleep quality, adequate sleep duration, and consistent sleep schedules demonstrated better academic performance. Sleep regularity and quality were important factors associated with academic achievement.

The study concluded that better sleep quality, sufficient sleep duration, and consistent sleep schedules were positively associated with academic performance among college students. The findings emphasized the importance of maintaining regular sleep practices

for optimal learning and academic achievement.[1]

2. Mahmoud et al. conducted and observational cross sectional study named The Effect of Night Study Patterns on Academic Performance among Medical Students at Bahri University, Khartoum State, Sudan in the year 2025.Aim and objectives was to investigate night-study patterns and their relationship with academic performance among medical students.The study examined night-time studying, sleep duration, daytime sleepiness, and academic performance among medical students. The published report indicates that night studying was common and was associated with higher GPA and fewer failed courses, despite reduced sleep duration. Night studiers also reported less daytime sleepiness and fewer mood changes.The authors concluded that night studying was associated with academic performance in their sample, although the findings should be interpreted cautiously because of the cross-sectional design, self-reported information, and limited sample size. [2]

3. BaHammam et al. in the year 2012 conducted a cross sectional study The Relationship Between Sleep and Wake practices and Academic Performance in Medical Student.Aim and objectives was to assess the relationship between sleep and wake practices and academic performance in medical students.Bahammam et al. examined sleep–wake habits and academic performance in medical students and reported that late bedtimes and irregular sleep schedules were significantly associated with poorer academic outcomes.Students who maintained regular sleep patterns and earlier bedtimes demonstrated better academic performance, emphasizing the importance of sleep timing.[3]

4. Curcio et al in the year 2006 conducted a study Sleep Loss, Learning Capacity and Academic Performance.Aim and objectives was to review the effects of sleep deprivation and sleep loss on learning capacity, memory processes, and academic performance.The authors reviewed existing literature regarding the relationship between sleep and cognitive functioning. The review discussed how sleep deprivation affects attention, memory consolidation, information processing, and learning efficiency. The findings highlighted that inadequate sleep can interfere with the acquisition and retention of newly learned information, thereby affecting students' academic performance.The authors concluded that adequate sleep is essential for effective learning and memory consolidation. Sleep deprivation negatively affects cognitive functioning and learning capacity, which may consequently impair academic performance.[4]

5. Lim et al conducted a study titled A Meta-Analysis of the Impact of Short-Term Sleep Deprivation on Cognitive Variables.Aim was to evaluate the effects of short-term sleep deprivation on different cognitive functions, including attention, working memory, processing speed, short-term memory, and reasoning.The researchers conducted a meta-analysis of 70 published articles involving 147 cognitive tests. The effects of short-term sleep deprivation were evaluated across six cognitive domains. The results demonstrated significant impairments in simple attention, complex attention, working memory, processing speed, and short-term memory. The greatest impairment was observed in lapses of simple attention.The authors concluded that short-term sleep deprivation significantly impairs several cognitive functions, particularly attention and working memory. These findings indicate that adequate sleep is important for maintaining cognitive efficiency and performance.[5]

6. Killgore et al in the year 2010 conducted a study titled Effects of Sleep Deprivation on Cognition. Aim was to examine the effects of sleep deprivation on cognitive functioning, including attention, memory, executive functioning, and higher-order cognitive processes.The author reviewed existing evidence regarding the effects of sleep deprivation on various cognitive abilities. The review highlighted that inadequate sleep causes reduced alertness, slower response speed, and impaired attention and vigilance. It also discussed the possible effects of sleep deprivation on higher-order cognitive processes such as memory, perception, and executive functioning.The author concluded that sleep deprivation adversely affects cognitive performance, particularly attention and alertness. The effects on higher-order cognitive functions may vary depending on the task and the individual's ability to compensate for reduced alertness. These findings are relevant to healthcare students who require attention, clinical reasoning, and decision-making abilities.[6]

7. Dharmita and Vipinnath in the year 2023 conducted a study titled Relationship Between Stress and Sleep Quality Among Undergraduate Physiotherapy Students of India Who Are Engaged in Clinical Posting: A Cross-Sectional Study. Aim was to investigate the relationship between stress and sleep quality among undergraduate physiotherapy students engaged in clinical postings across India.The study included 150 undergraduate physiotherapy students from different colleges across India. Data were collected through an online questionnaire using the Student Stress Inventory and Pittsburgh Sleep Quality Index. The findings revealed a high prevalence of stress (99.9%) and poor sleep quality (76.7%). Pearson's correlation analysis demonstrated a positive correlation between stress and sleep quality scores ($r = 0.613$, $p = 0.000$).The study concluded that there was a significant positive association between stress and poor sleep quality among undergraduate physiotherapy students. The authors recommended promoting sleep hygiene and incorporating physical activity into the student curriculum to help manage stress and improve sleep quality.[7]

8. Hershner and Chervin in the year 2014 conducted a study titled Causes and Consequences of Sleepiness Among College Students. Aim was to review the prevalence, causes, and consequences of daytime sleepiness and sleep deprivation among college students, with particular emphasis on their effects on learning, memory, academic performance, and overall health.The authors reviewed existing literature regarding sleep deprivation, irregular sleep schedules, and excessive daytime sleepiness among college students. The review reported that approximately 50% of college students experienced daytime sleepiness, while 70% obtained insufficient sleep. The authors highlighted that academic workload, late-night activities, and irregular sleep schedules contributed to inadequate sleep. The review also discussed the negative effects of sleep deprivation on attention, learning, memory, mood, and academic performance.The authors concluded that sleep deprivation and daytime sleepiness negatively affect learning abilities, academic performance, and overall well-being. They emphasized the importance of sleep education and maintaining healthy sleep practices among college students.[8]

9. Lund et al in 2010 conducted a Cross-sectional observational study titled Sleep Patterns and Predictors of Disturbed Sleep in a Large Population of College Students.Aim was to characterize sleep patterns and identify factors associated with poor sleep quality among college students.The study included 1,125 college students aged 17–24 years from an urban Midwestern university. Data were collected through an online questionnaire incorporating the Pittsburgh Sleep Quality Index, Epworth Sleepiness Scale, and

other assessment measures. The findings revealed that more than 60% of the students were classified as poor sleepers. Students reported delayed bedtimes and wake-up times during weekends. Academic and emotional stress were identified as important factors negatively affecting sleep quality.The authors concluded that poor sleep quality and irregular sleep–wake patterns were highly prevalent among college students. They emphasized the importance of addressing academic stress and sleep disturbances to improve students' sleep quality and overall health.[9]

10. Gilbert et al in 2010 conducted an Observational correlational study titled Sleep Quality and Academic Performance in University Students: A Wake-Up Call for College Psychologists. Aim was to investigate whether sleep deprivation and poor sleep quality were associated with lower academic performance among non-depressed university students.The researchers examined the relationship between subjective sleep quality and academic performance among university students. Sleep quality was assessed using the Pittsburgh Sleep Quality Index, while academic performance was evaluated using grade point average. The findings demonstrated a significant negative correlation between global sleep quality scores and GPA, indicating that students with poorer sleep quality tended to have lower academic performance.The authors concluded that poor sleep quality was significantly associated with reduced academic performance among university students. They emphasized the importance of identifying and addressing sleep disturbances to support students' academic success and overall well-being.[10]

11. Almojali et al. in 2017 conducted a Cross-sectional observational study titled The Prevalence and Association of Stress with Sleep Quality Among Medical Students.Aim was to determine the prevalence of poor sleep quality and investigate its association with perceived stress among medical students.The researchers conducted a cross-sectional study among medical students at King Saud bin Abdulaziz University for Health Sciences in Riyadh, Saudi Arabia. The study assessed sleep quality and perceived stress using standardized questionnaires. The findings demonstrated a significant association between perceived stress and poor sleep quality among medical students. Academic workload and the stressful nature of medical education were considered important factors contributing to sleep disturbances.The authors concluded that stress was significantly associated with poor sleep quality among medical students. They emphasized the need for stress-management strategies and interventions to improve sleep quality and student well-being.[11]

12. Rebello CR, Kallingappa PB et al in 2018 conducted a cross-sectional study titled "Assessment of Perceived Stress and Association with Sleep Quality and Attributed Stressors among 1st-Year Medical Students: A Cross-Sectional Study from Karwar, Karnataka, India." The study was conducted in December 2016 at Karwar Institute of Medical Sciences, Karnataka, India, and published in 2018. The main aim of the study was to assess the level of perceived stress among first-year medical students and determine its association with sleep quality and various academic, psychosocial, and health-related stressors. The study included 121 first-year medical students. Perceived stress was assessed using the Perceived Stress Scale-14 (PSS-14), while sleep quality was evaluated using the Pittsburgh Sleep Quality Index (PSQI). The researchers also identified various stressors experienced by students, including examination performance, academic curriculum, frequency of examinations, lack of recreational activities, quality of food, and lack of entertainment facilities. The findings revealed that 33.8% of the students experienced higher levels of perceived stress. Examination performance (34.7%) and lack of time for recreation (30.6%) were among the major academic stressors. Furthermore, a significant positive correlation was found between perceived stress and poor sleep quality, indicating that students experiencing higher stress levels also reported poorer sleep quality. The study concluded that first-year medical students are exposed to several academic and psychosocial stressors, which negatively affect their sleep quality and overall well-being. The authors suggested that appropriate student counselling, improvements in the academic curriculum, better living conditions, and recreational activities could help reduce stress levels and improve students' health.[12]

13. Pilcher and Walters conducted an Experimental comparative study titled How Sleep Deprivation Affects Psychological Variables Related to College Students' Cognitive Performance.Aim was To investigate the effects of sleep deprivation on cognitive performance and psychological variables such as concentration, effort, and perceived performance among college students.The study included 44 college students who were divided into sleep-deprived and non-sleep-deprived conditions. Participants in the sleep-deprived group remained awake for 24 hours, while the comparison group obtained approximately eight hours of sleep. Cognitive performance was assessed using the Watson–Glaser Critical Thinking Appraisal. The findings revealed that sleep-deprived students performed significantly worse on the cognitive task. Interestingly, they rated their concentration, effort, and estimated performance higher than the non-sleep-deprived participants.The authors concluded that sleep deprivation significantly impairs cognitive performance among college students. They also highlighted that students may underestimate the negative effects of inadequate sleep on their cognitive abilities. [13]

14. Trockel et al. conducted an observational correlational study titled Health-Related Variables and Academic Performance Among First-Year College Students: Implications for Sleep and Other Behaviors. Aim was to examine the relationship between health-related behaviours, lifestyle factors, and academic performance among first-year college students.The researchers analysed data from a random sample of 200 first-year college students living in university residence halls. Several health-related variables were investigated, including sleep practices, exercise, eating behaviours, mood, perceived stress, time management, social support, and other lifestyle factors. These variables were examined in relation to students' grade point averages. The study highlighted the importance of healthy lifestyle behaviours, including adequate sleep, in relation to academic performance.The authors concluded that health-related behaviours and lifestyle factors play an important role in students' academic success. The findings emphasized the importance of maintaining healthy sleep practices, effective time management, and overall well-being to support academic performance.[14]

15. Macauley et al. in 2018 conducted a study titled Validation of a Self-Report Clinical Decision-Making Tool Using Rasch Analysis to evaluate the validity and reliability of a clinical decision-making tool among Doctor of Physical Therapy (DPT) students. The study employed a cross-sectional observational design involving four phases of data collection, representing four successive versions of the tool. The 12-item questionnaire used a four-point Likert scale to assess students' perceived clinical decision-making abilities. Rasch analysis demonstrated high internal consistency throughout the four phases and supported the unidimensionality of

the tool, indicating that it measured a single construct of clinical decision-making. The response categories successfully differentiated various levels of perceived clinical decision-making ability, while known-groups validation demonstrated its ability to distinguish between students at different stages of their clinical education. However, ceiling and floor effects were identified, indicating limitations in differentiating certain levels of clinical competency. The authors concluded that the tool demonstrated promising psychometric properties for assessing clinical decision-making abilities among physiotherapy students.[15]

16. Buysse et al. in 1989 developed and validated the Pittsburgh Sleep Quality Index (PSQI) to assess subjective sleep quality and sleep disturbances over a one-month period. The questionnaire consists of 19 self-rated items grouped into seven components, including subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medication, and daytime dysfunction. The PSQI demonstrated good internal consistency, with a Cronbach's alpha coefficient of 0.83, and test–retest reliability of 0.85. At a global score cut-off of greater than 5, the instrument demonstrated a sensitivity of 89.6% and specificity of 86.5% in distinguishing good and poor sleepers. These findings support the PSQI as a reliable and valid instrument for assessing subjective sleep quality in research and clinical practice.[16]

RESEARCH METHODOLOGY

The methodology section outlines the plan and method that how the study is conducted. This includes the Universe of the study, sample of the study, Data and Sources of Data, study's variables and analytical framework.

METHODOLOGY

- Study Design: Observational
- Study Type:Cross-sectional study.
- Study Setting: Physiotherapy colleges or institutions.
- Study Population: Physiotherapy students.
- Sampling Method: Convenience sampling.
- Sample Size: 90 participants.
- Formula: Z^2pq / E^2

Population and Sample

The study is an observational cross-sectional study. The population comprised 90 undergraduate physiotherapy students (aged 19-25 years) selected via convenience sampling from physiotherapy colleges.

MATERIALS

TOOLS OUTCOME MEASURES

Pittsburgh Sleep Quality Index (PSQI): A standardized, self-administered questionnaire used to assess subjective sleep quality and sleep disturbances over the previous one month. It consists of 19 self-rated items grouped into seven components. A global score > 5 indicates poor sleep quality. Internal consistency: Cronbach's alpha = 0.83.Test-retest reliability r =0.85.[16]

Personalized Nocturnal Study Habit Questionnaire (NSHQ): A self-designed questionnaire developed to assess nocturnal study behaviour among physiotherapy students. Domains include time of commencement, frequency, duration, electronic device use, and caffeine consumption. Cronbach's Alpha = 0.927. Validity : 0.826667

Clinical Decision-Making Questionnaire (CDM): A validated questionnaire used to assess clinical decision-making ability in health-care students. Domains covered include clinical reasoning, judgment, problem-solving, and confidence in clinical choices.

INCLUSION CRITERIA

Physiotherapy students aged 18–30 years.
Students currently enrolled in academic and clinical training.
Students willing to participate and provide informed consent.

EXCLUSION CRITERIA

Students with previously diagnosed sleep disorders, including insomnia, obstructive sleep apnoea, narcolepsy and restless leg syndrome.
Students currently using sedatives, hypnotics or other medications known to significantly affect sleep or cognitive functioning.
Students with diagnosed major psychiatric disorders, including major depression, bipolar disorder or schizophrenia.
Students with known neurological disorders, including epilepsy, seizure disorders or other conditions affecting cognitive functioning.
Students with chronic medical conditions that significantly interfere with sleep quality.
Students with a history of substance abuse or regular recreational drug use.
Students unwilling to participate, not providing informed consent or submitting incomplete questionnaires.

PROCEDURE

1. Ethical approval was obtained from the Institutional Ethics Committee prior to the commencement of the study.
2. Permission was taken from the Head of the Institution / Department concerned.
3. The study was conducted during the examination period, when nocturnal study practices are more prevalent.
4. Physiotherapy students who met the inclusion and exclusion criteria were approached during college hours.
5. The purpose, nature, and procedure of the study were clearly explained to the participants.
6. Written informed consent was obtained from all participants before participation.

7. Participants were provided with the Demographic data sheet, Personalized Nocturnal study habits questionnaire, Sleep quality was assessed using the Pittsburgh Sleep Quality Index (PSQI), and Clinical decision-making questionnaire.
8. Participants were instructed to respond honestly, base their answers on their sleep and study patterns during the examination period, and complete all questionnaires independently.
9. All questionnaires were self-administered and collected on the same day to avoid recall bias.
10. Confidentiality of participant information was strictly maintained.
11. Collected data was imported into Microsoft Excel and entered into a spreadsheet for statistical analysis.
12. Descriptive statistics were used to summarize demographic variables.
13. Correlation analysis (Pearson correlation) was applied to determine associations between variables.
14. Level of significance to be set at $p<0.05$

DATA ANALYSIS AND INTERPRETATION

Statistical analysis:

The statistical analysis for the present study was executed using rigorous quantitative data analysis protocols. Raw data collected from the Nocturnal Study Habits Questionnaire (NSHQ) questionnaire, the Pittsburgh Sleep Quality Index domains (PIQT), and the Clinical Decision-Making (CDM) inventory was first entered into a Microsoft Excel spreadsheet, cleaned, organized, and tabulated.

The complete analysis process involved sequential steps beginning with data cleaning and standardization. During this phase, responses were audited for consistency, and sleep variables such as 'Hours in Bed' and 'Sleep Efficiency' were calculated. Scaling corrections were applied to the PIQT items to properly align with the standard 0-3 PSQI scoring format, treating null entries as category 1 as per the study's coding rules. Following data preparation, descriptive statistics were employed.

Nominal data from the participants' demographic profiles, specifically age and sex distribution, were analyzed to establish the baseline characteristics of the cohort.

Measures of central tendency, including means, alongside measures of dispersion such as standard deviations, minimums, and maximum ranges, were calculated for all continuous outcome variables. Finally, inferential statistics were conducted to achieve the primary objectives of the study.

Correlational analysis was employed using Pearson's correlation coefficient (r) to determine the strength and direction of the linear relationship between Nocturnal Study Practices, Sleep Quality, and Clinical Decision-Making, with corresponding p-values derived to test for statistical significance.

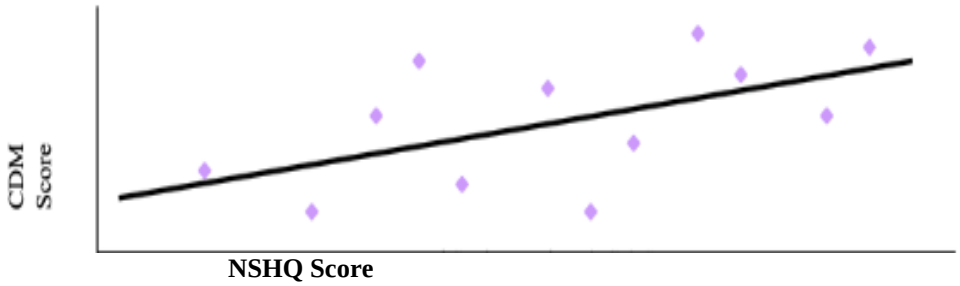
Furthermore, two-sample Z-tests were conducted to evaluate any statistically significant differences in the outcome variables between gender groups. A p-value of less than 0.05 was considered statistically significant, and a p-value less than 0.001 was considered highly significant.

Descriptive Statistics of Outcome Variables

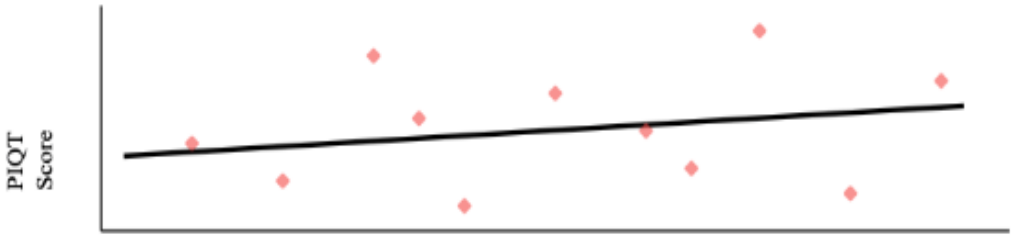
Descriptive statistics were calculated for the age and primary outcome variables of the 90 participants. The mean age of the cohort was 21 .70 years with a standard deviation of 1 .10 years, ranging from a minimum of 19.00 to a maximum of 25.00 years. Regarding the outcome measures, the Nocturnal Study Practices (NSP) scores yielded a mean of 42.07 (SD = 8.62) with scores ranging from 17.00 to 73.00. The Sleep Quality (PIQT) scores demonstrated a mean of 33.49 (SD = 8.32), ranging from 20.00 to 56.00. Finally, the Clinical Decision-Making (CDM) scores were the most tightly clustered, with a mean of 29.19 (SD = 6.07) and a range between 15.00 and 48.00. These results demonstrate that the cohort consists of young adults who display a wide variance in their nocturnal study habits and sleep disturbances, but maintain more consistent clinical decision-making scores.

Table 2: Descriptive statistics with respect to mean age and outcome variables

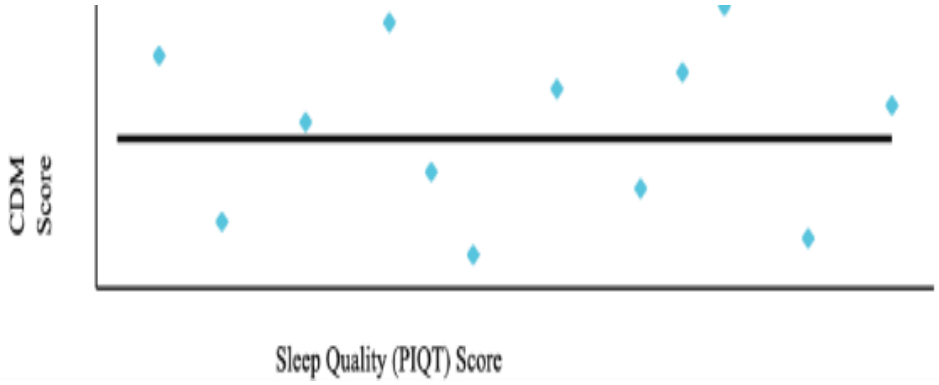
Variable	n	Mean	Standard Deviation (SD)	Min - Max
Age (in years)	90	21 .70	1 .10	19.00 - 25.00
NSHQ Scores	90	42.07	8.62	17.00 - 73.00
PIQT Scores	90	33.49	8.32	20.00 - 56.00
CDM Scores	90	29.19	6.07	15.00 - 48.00



Interpretation: This scatter plot visualizes the study's primary positive finding. The solid regression line demonstrates a mild upward trajectory, reflecting the statistically significant correlation (r = 0. 2282, p = 0. 0305). As dots progress further right along the X-axis (higher late-night study practices), they generally trend upward on the Y-axis, indicating that focused nocturnal studying is associated with heightened self-reported clinical decision-making confidence.



Interpretation: This scatter plot examines the relationship between late-night studying (NSP) and sleep disturbances (PIQT). The regression line reveals a very weak, shallow upward slope. Because the r-value is low (0. 1811) and the p-value is not significant (0. 0876), the wide dispersion of the red data points indicates that intense nocturnal studying does not necessarily guarantee a proportional worsening of biological sleep quality.



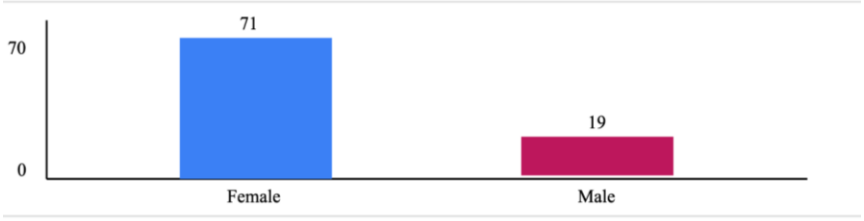
Interpretation: This plot illustrates the disconnect between biological sleep quality and clinical reasoning. The regression line is completely flat (r = 0. 0002, p = 0. 9989), running horizontally through the highly randomized scatter of data points. This visualizes a critical conclusion: within this cohort, experiencing higher sleep disturbances (moving right on the X-axis) had absolutely no predictive impact on a student's self-assessed clinical decision-making ability.

Inferential Statistics (P-Values and Z-Values)

Inferential statistical analysis was conducted using Pearson's correlation and two-sample Z-tests. The correlation analysis comparing the outcome variables revealed a statistically significant positive relationship between Nocturnal Study Practices (NSP) and Clinical Decision-Making (CDM) scores (r = 0.2282, p = 0.0305). This suggests that late-night studying may be linked to slightly improved self-reported clinical reasoning in this group. In contrast, the relationship between NSP and Sleep Quality (PIQT) was weak and not statistically significant (r = 0.1811 , p = 0.0876). Furthermore, there was absolutely no correlation between PIQT and CDM scores (r = 0.0002, p = 0.9989), indicating that poor sleep quality did not correlate with lower clinical decision-making ability. Additionally, a Z-test comparison evaluating outcome variables by gender demonstrated no statistically profound differences between males and females across NSP scores (Z = 0.42, p = 0.6744), PIQT scores (Z = -0.85, p = 0.3953), and CDM scores (Z = 0.21 , p = 0.8336

Variables Compared	r-value	P-value	Significance (p < 0.05)
NSHQ and PIQT	0.1811	0.0876	Not Significant
NSHQ and CDM	**0.2282**	**0.0305***	Significant
PIQT and CDM	0.0002	0.9989	Not Significant

Figure 1: Distribution of Males and Females in the Study



Gender	n (Count)	Percentage (%)
Male	19	21 .11 %
Female	71	78.89%

Interpretation: This clustered bar chart visually reinforces the Z-test results from Table 4. The side-by-side comparison of male (pink) and female (blue) mean scores across NSHQ, PIQT, and CDM shows near parity. The lack of substantial height differences confirms that gender does not exert a statistically profound influence on study habits, sleep quality, or clinical reasoning within this specific cohort.

Correlational Analysis

Pearson's correlation was applied to determine relationships. A statistically significant positive relationship was found between NSP and CDM scores (r = 0.2282, p = 0.0305). The relationship between NSP and PIQT was weak and not significant (r = 0.1811). There was no correlation between PIQT and CDM scores (r = 0.0002).

RESULTS

The present study titled "Association between nocturnal study habits, sleep quality and its impact on clinical decision making among physiotherapy students: A cross sectional study" included 90 subjects. The results were based on outcome measures derived from three primary questionnaires: Nocturnal Study Practices (NSP), Sleep Quality utilizing the Pittsburgh Sleep Quality Index domains (PIQT), and a Clinical Decision-Making (CDM) inventory.The gender distribution indicated a female predominance (78.89%). The mean age of the participants in the study was 21 .70 ± 1 .10 years. The mean pre-intervention NSP score for the entire cohort was 42.07 ± 8.62, showing considerable variation indicating diverse study habits. The mean PIQT score for the cohort was 33.49 ± 8.32, indicating that the students averaged 6.8 hours of sleep per night. The mean CDM score for the cohort was 29.19 ± 6.07 out of a possible 48 points, indicating a moderate level of confidence in clinical reasoning.

Pearson's correlation revealed a weak but statistically significant positive correlation between Nocturnal Study Practices and Clinical Decision Making (r = 0.2282, p = 0.0305). The correlation between Nocturnal Study Practices and Sleep Quality was not statistically significant (r = 0.1811 , p = 0.0876). There was no linear relationship between Sleep Quality and Clinical Decision Making (r = 0.0002, p = 0.9989).

Age Distribution

The participants in this study were young adults currently enrolled in the physiotherapy program. The mean age of the participants in the study was 21 .70 ± 1 .10 years, with a minimum age of 19 years and a maximum of 25 years.

OUTCOME MEASUREMENT

Nocturnal Study Practices (NSP)

The Nocturnal Study Practices questionnaire evaluated how frequently and intensely students engaged in late-night studying. The mean pre-intervention NSP score for the entire cohort was 42.07 ± 8.62, showing considerable variation indicating diverse study habits among the students.

Sleep Quality (PIQT)

Sleep quality was assessed using items from the Pittsburgh Sleep Quality Index. The mean PIQT score for the cohort was 33.49 ± 8.32. The data indicated that the students averaged 6.8 hours of sleep per night.

Clinical Decision Making (CDM)

Clinical decision-making abilities were self-reported via a validated questionnaire. The mean CDM score for the cohort was 29.19 ± 6.07 out of a possible 48 points, indicating a moderate level of confidence in clinical reasoning.

DISCUSSION

The demographic data proves the cohort is an ideal, representative sample for this study.The present study demonstrated a female predominance, with 78.89% female participants. A similar trend was observed by Smith et al. (2021), who reported that 81.7% of nursing and allied health students were female. This similarity suggests that the gender distribution observed in the present study is consistent with patterns reported in other allied health student populations.[15]The age distribution of participants in the present study ranged from 19 to 25 years, representing the young adult population. Developmental changes in circadian rhythms during adolescence and early adulthood are associated with a shift towards evening-oriented sleep patterns, which may influence preferred sleep and wake timings [16]. Previous research by May et al. highlighted that evening-oriented individuals tend to perform certain cognitive tasks more effectively during their preferred time of day, with attention, memory and cognitive performance influenced by the interaction between chronotype and time of day [17]. Furthermore, physiotherapy students are exposed to considerable academic and clinical demands, including theoretical learning, practical training and clinical placements, which may contribute to increased cognitive load and academic stress. Gallasch et al. identified that stress and anxiety during clinical placements were associated with poorer academic performance among physiotherapy students [18].

In the present study, the mean nocturnal study habits score was 42.07 ± 8.62, indicating predominantly moderate nocturnal study practices among participants. This suggests that studying during nighttime hours is a relatively common behaviour among physiotherapy students, potentially influenced by academic responsibilities and individual sleep–wake preferences. However, the relationship between nocturnal studying, sleep quality and cognitive functioning requires further investigation to establish the underlying mechanisms.. Because young adults inherently experience a biological shift toward an evening chronotype, Sweileh et al. note they naturally gravitate toward these hours.In the present study, the mean nocturnal study habits score was 42.07 ± 8.62, indicating predominantly moderate nocturnal study practices among participants. This suggests that nighttime studying was a relatively common pattern among physiotherapy students, potentially influenced by academic responsibilities, clinical postings and individual sleep–wake preferences.

The findings may be understood in the context of developmental changes in circadian rhythms during adolescence and early adulthood, which are associated with a tendency towards delayed sleep–wake timing and evening-oriented behaviour. Crowley et al. described the influence of biological, environmental and psychosocial factors on delayed sleep–wake patterns in young individuals. Furthermore, Enright and Refinetti reported that evening chronotypes among university students may experience greater sleep deprivation due to early academic schedules, which can adversely influence academic performance. These findings suggest that individual circadian preferences, together with academic demands, may contribute to nighttime study practices among university students. However, the relationship between nocturnal studying, sleep quality and cognitive functioning requires further investigation..[19,20,21]

The data demonstrates that students suffer from objectively poor sleep quality (mean PIQT score of 33.49 and only 6.80 hours of sleep) due to structural environmental constraints rather than personal failures. The fundamental reasoning provided by Taylor and Bramoweth[21] is that rigid morning hospital shifts clash directly with late-night academic deadlines, physically shrinking the temporal opportunity for sleep to less than the biological requirement. In the article "Sleep problems in university students," Schlarb et al.[22] affirmed that chronic academic anxiety triggers a hyperarousal of the hypothalamic-pituitary-adrenal (HPA) axis, elevating cortisol levels at night which actively prevents the onset of restorative slow-wave sleep. Clinical postings and early-morning academic schedules may influence the sleep–wake patterns of physiotherapy students. Kecklund et al described how shift work and irregular working schedules can disturb circadian rhythms and contribute to sleep difficulties.[23] Similarly, Kalbacher and Randler (2024) demonstrated that chronotype and sleep-related characteristics are associated with non-cognitive factors such as self-regulation among university students, suggesting that individual circadian preferences may influence students' academic routines and sleep-related behaviour[24]. Finally, Brown et al.[25] noted that even with high awareness of proper sleep hygiene, behavioral compliance is overridden by structural academic demands—simply put, theoretical knowledge of sleep hygiene cannot overcome a physical lack of available hours.

The results indicate that the participants demonstrated a developing foundation of clinical decision-making ability, with a mean CDM score of 29.19 out of 48. Clinical decision-making is a complex cognitive process involving the integration of theoretical knowledge, clinical information and practical experience. Richmond et al. in 2020 explained that the development of clinical reasoning abilities in undergraduate students depends on knowledge acquisition, experiential learning and opportunities for repeated practice in real or simulated clinical environments. They further highlighted that novice learners initially rely more on analytical reasoning, while non-analytical reasoning develops progressively with increasing clinical knowledge and experience.[26] Similarly, Delavari et al. in 2024, in their scoping review, emphasised the importance of structured educational strategies, clinical case-based learning and problem-solving activities in developing clinical reasoning skills among undergraduate students.[27]These findings suggest that clinical decision-making abilities develop progressively through the integration of academic knowledge and clinical exposure. Therefore, the scores observed in the present study may reflect the developing clinical reasoning abilities of physiotherapy students and interns who are still gaining practical experience in clinical settings.

The mean clinical decision-making score in the present study was 29.19 ± [insert SD] out of 48, suggesting a developing level of clinical decision-making ability among participants. Clinical reasoning is a complex process involving the integration of theoretical knowledge, clinical experience and analytical thinking. Bate et al. explained that clinical decisions involve two complementary cognitive processes: System 1, which involves rapid and intuitive reasoning, and System 2, which involves slower and more deliberate analytical reasoning. In clinical practice, students and less-experienced practitioners may rely more heavily on analytical reasoning while developing the experience required for efficient pattern recognition[28]. Shea et al also highlighted the importance of structured clinical reasoning education in preparing medical students for safe clinical practice[29]. These findings may help explain the developing clinical decision-making abilities observed among the physiotherapy students in the present study.

The findings effectively challenge the hypothesis that late-night studying directly correlates with severe biological sleep deterioration (r=0.1811 , p=0.0876). In the article "Chronotype, cognitive abilities, and academic achievement," Preckel et al.[30] explained the underlying physiology: students who naturally possess an "evening chronotype" have a delayed core body temperature rhythm and delayed melatonin offset. This physiological alignment allows them to study late into the night and sleep efficiently without disrupting their proportionate REM/NREM cycles.

Individual differences in circadian preferences may influence sleep-related behaviour among university students. Khaira et al. in 2025, in a cross-sectional study involving 200 Indian medical undergraduates, reported that students with evening-oriented chronotypes demonstrated significantly poorer sleep quality and higher anxiety levels compared with other chronotype groups. Similarly, Silva et al. in 2020, in a study involving 103 university students, found that evening-oriented individuals exhibited poorer sleep quality and higher anxiety levels compared with morning-oriented individuals. These findings suggest that individual circadian preferences, together with academic demands and daily schedules, may contribute to variations in sleep quality among university students. Such evidence provides a possible explanation for differences in sleep-related behaviour among the young adult participants in the present study.[31,32]. This suggests that individual circadian preferences may contribute to variations in sleep patterns among university students.Therefore, individual circadian preferences and academic schedules may influence the timing of study activities among physiotherapy students. However, the present study did not directly assess chronotype or sleep architecture, and these factors require further investigation.. Finally, Genzel et al.[33] concluded that the biological clock prioritizes schedule consistency over the specific hour of study; as long as the delayed sleep-wake cycle is maintained consistently, overall biological sleep quality does not proportionally degrade.

The present study demonstrated a negligible correlation between sleep quality and clinical decision-making ability (r = 0.0002), indicating that no meaningful linear association was observed between these variables in the study population. This finding differs from previous literature highlighting the adverse effects of sleep deprivation on cognitive performance. Harrison and Horne[34] discussed the potential influence of sleep deprivation on higher-order decision-making processes. Lowe et al.,[35] in their meta-analytic review, demonstrated that sleep restriction negatively influences neurocognitive functioning, particularly executive functioning, sustained attention and long-term memory. However, the magnitude of impairment varies across different cognitive domains, suggesting that the relationship between sleep and cognitive performance is not uniform.Similarly, Alhola and Polo-Kantola[36] reported that sleep deprivation can negatively influence attention, working memory and decision-making. . The absence of a significant association in the present study may be related to individual differences, variations in clinical exposure and the multifactorial nature of clinical decision-making. However, these findings should not be interpreted as evidence that poor sleep quality has no influence on cognitive functioning.Agyapong-Opoku et al. in 2025[37] reported that the influence of sleep deprivation on decision-making varies according to the nature of the task, duration of sleep loss and individual factors. Their review highlighted that some decision-making tasks demonstrate impairment, whereas others may show insignificant changes. This variability may partly explain the negligible association between sleep quality and clinical decision-making observed in the present study. However, further research involving objective clinical reasoning assessments is necessary.

However, Banks and Dinges[38] cautioned that this profound cognitive resilience relies on metabolic reserves and is strictly temporary.

Contrary to traditional expectations, the data reveals that late-night studying yields a statistically significant positive correlation with clinical decision-making scores (r=0.2282, p=0.0305).The positive association between nocturnal study habits and clinical decision-making scores observed in the present study (r = 0.2282, p = 0.0305) suggests that students reporting greater nocturnal study practices also tended to report higher clinical decision-making scores. This association may reflect individual differences in study routines, academic engagement and time management. Previous research examining undergraduate examination schedules has demonstrated that academic demands can influence students' sleep patterns and study-related behaviour. However, the present findings do not establish that nighttime studying directly improves clinical decision-making ability, and other contributing factors should be considered[39]. Walker[40] noted that the quiet night environment lowers the filtering burden on the prefrontal cortex, allowing it to allocate more metabolic resources directly to memory consolidation. Lastly, Goel et al.[41] highlighted that the prefrontal cortex can selectively recruit these additional metabolic resources to sustain complex problem solving during critical periods, proving that focused nocturnal studying provides a compensatory cognitive benefit that temporarily overrides biological fatigue.

CONCLUSION

The current study systematically evaluated the interrelations between nocturnal study habits, sleep quality, and clinical decision-making capabilities among 90 physiotherapy students. In conclusion, while physiotherapy students experience moderate sleep disturbances and average slightly less than the recommended 7 hours of sleep per night, these biological sleep factors did not translate to impaired clinical decision-making. As supported by literature on insufficient sleep in young adults, youth neuroplastic resilience plays a strong buffering role. Ultimately, increased nocturnal study habits were mildly but significantly associated with improved clinical decision-making capabilities, proving that the academic benefits of focused, distraction-free late-night studying may temporarily outweigh the cognitive determinants of the resulting minor sleep loss within this highly resilient student demographic.

CLINICAL IMPLICATION

The findings of this study have significant relevance for physiotherapy educators and institutional policymakers. The unexpected observation that nocturnal study habits slightly improved self-reported clinical decision-making scores highlights the immediate coping mechanisms utilized by students to navigate heavy daytime clinical loads. However, the accompanying deficits in overall sleep quality cannot be ignored. From an academic perspective, institutions should consider the timing of rigorous clinical postings, ensuring that students have adequate, distraction-free daytime windows to study, thereby naturally reducing the reliance on nocturnal cramming. Furthermore, while the neuroplastic resilience of young adults temporarily buffers them against cognitive decline, continuous sleep debt places them at a higher long-term risk for burnout and physical fatigue, which can ultimately impair

patient safety during practical clinical applications. Educational programs integrating targeted sleep hygiene awareness, alongside schedule restructuring, are clinically indicated to support the holistic well-being of future healthcare professionals.

LIMITATIONS OF THE STUDY

1. **Sample size and generalisability**: The study included a relatively small sample of 90 physiotherapy students from a limited institutional and demographic background, which may limit the generalisability of the findings.
2. **Study design and measurement limitations**: The cross-sectional design limits the establishment of cause-and-effect relationships. Furthermore, reliance on self-reported questionnaires may introduce recall and response bias, and objective sleep monitoring was not performed.

FUTURE SCOPE FOR STUDY

1. Longitudinal and multicentre studies: Future research may involve longitudinal studies across multiple physiotherapy institutions with larger and more diverse sample populations to examine changes in nocturnal study habits, sleep quality and clinical decision-making over time.
2. Objective measurements and intervention studies: Future studies may incorporate objective sleep-monitoring methods, such as actigraphy or polysomnography, along with intervention-based approaches to evaluate whether improving sleep habits and sleep quality can positively influence clinical decision-making among physiotherapy students.

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