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Original Article

Physiotherapy Section

Relationship between Sleep Deprivation and Daytime Sleepiness in different Groups of Population: A Cross-sectional Study

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ABSTRACT

Introduction: Research consistently indicates that insufficient sleep, whether it is a persistent or short-term issue, can result in daytime sleepiness among the general population. Contributing factors include demanding work schedules, social commitments, and the habit of using electronic devices before bedtime.

Aim: To find the relationship between sleep deprivation, daytime sleepiness, and socio-economic status, and their association among teachers, bachelor's and master's students, and medical practitioners.

Materials and Methods: This cross-sectional study included the assessment of daytime sleepiness and quality of sleep among different populations using the Eppworth Sleepiness Scale (ESS) and the Pittsburgh Sleep Quality Index (PSQI), respectively. The socio-economic status was assessed using the modified Kuppuswamy Scale (mKS). The participants were categorised into three groups: teachers, students, and medical professionals according to their profession. In the analysis, to find the linear relationship between age, Body Mass Index (BMI), and the other three outcomes, Pearson's correlation was used.

Results: There were 65 (38.5%) males and 104 (61.5%) females among the respondents. On analysis, considering the overall results, it was found that there was a moderate positive correlation between age and BMI (r-value=0.232, p-value <0.05) and no significant correlation between age and ESS, PSQI, mKS. There was a moderately negative correlation between mKS and ESS (r-value=-0.205, p-value=0.016), suggesting that the lower the SES, the more the chances of daytime sleepiness in students' group. In the teacher's group, there was no significant correlation between age and BMI, ESS, PSQI, and mKS in any of the groups.

Conclusion: It can be concluded that daytime sleepiness was related to socio-economic status in students, such that they are inversely proportional to each other. Medical practitioners experienced the most daytime sleepiness compared to other population groups.

Keywords: Collegiates, Economic status, Faculty, Family, Quality of life, Sleep disorder

INTRODUCTION

Sleep is imperative for clear thinking, attention, memory, vigilance, and alertness. It also affects mood. According to a study published, sleep duration and quality also influence adolescents' temperaments [1]. A recent study by Cherdieu M et al., has shown that getting enough sleep shields memories from disruption, enhances performance, and rearranges memory traces to foster creativity and memorisation. These advantages result from the reactivation of hippocampus-related brain networks and their synchronisation with neocortical networks during sleep, which support sleep-dependent memory consolidation and reorganisation [2].

A lack of sleep and sleep deprivation are linked to several forms of psychological disorders. Sleep deprivation is also associated with various health disorders and diseases. It is associated with substance use [3], restlessness, agitation, anxiety, and depression [4,5], and other forms of human behavioural disturbances that directly affect work and the general life of the individual. We tend to become much more sensitive emotionally and socially when we are sleep-deprived [6]. Sleep quality is one of the most basic requirements for good physical and mental health. Sleep deprivation is a major public health concern in the 21st century [7]. Due to work overload and mental strain, the outbreak has significantly affected the medical profession. A study shows that most doctors (65.6%) experienced alterations in their sleep, and 73.1% complained of poor sleep quality [8].

Over the past few years, sleep quality among young adults has been decreasing [9]. Sleep disturbances have a significant impact on the health-related quality of life of college students, posing a hardship. As a result, sleep disturbances among college students are a major public health concern [10-12]. Up to 71% of students do not get the recommended eight hours of sleep, with 60% categorised as experiencing poor sleep [3]. Students report sleep changes at considerably higher odds than non students [13]. The significant drop in the quality and quantity of sleep affects the level of concentration and the performance of students in their academic life [14]. The increasing trend of sleep deprivation among college teachers is observed, with causative factors including multiple academic demands forcing them to work long hours, excessive activities, and pressure to increase productivity, performance, and competitiveness [15]. Medical professionals frequently experience sleep disturbances, particularly in semi-rural areas. Poor sleep quality is experienced by professionals in countries like Malaysia, China, and Nigeria [16]. This deprivation results in excessive daytime sleepiness and impaired judgment, potentially leading to errors in clinical decision-making detrimental to patient's health [17].

The advent of several electronic devices is also one of the factors contributing to decreasing sleep quality. The overuse of phones and electronic devices leads to daytime sleepiness and other sleep-related problems [18]. Employment is another factor that affects the socio-economic status of an individual. A study determined that there are fewer sleep complaints among employed individuals and more among unemployed individuals [19]. In a review by Sosso FA et al., it was observed that reduced total sleep duration, more sleep fragmentation, longer sleep latency, and more variability in sleep start and sleep latency were all linked to lower SES [20]. Studies show that many children from lower SES households have poor sleep habits, which may have a bigger negative impact on their academic performance and cognitive functioning than on less disadvantaged kids [21,22].

Although factors such as the use of electronic devices, employment status, and SES correlate with sleep quality and/or sleep deprivation, there is variation in the rates of sleep disturbances, sleep quality, and daytime sleepiness among different populations [23-25]. Different results may emerge when comparing Indian students, teachers, and medical practitioners for the same. Therefore, the aim was to understand how these factors affect sleep quality.

MATERIALS AND METHODS

This cross-sectional study was conducted from March to June 2021 at Jamia Hamdard New Delhi, India. The Helsinki Declaration and the institutional ethical norms for human testing were observed throughout all operations. Each participant understood the study's objectives, methods, and their rights as research subjects, after which they signed the consent form.

Inclusion criteria: Medical students (S), medical teachers in colleges (T), and medical practitioners in hospitals (MP) were included in the study.

Exclusion criteria: Any history of neurological, mental, or medical conditions, were taking sedative drugs, had any inflammatory joint illness, or had any other musculoskeletal and vestibular disorders were excluded from the study.

Participants filled out the informed consent after a thorough explanation of the study's objectives. They were asked to provide demographic data and to complete the PSQI, ESS, and mKS questionnaire and scale.

Sample size: The sample size was calculated using G*Power 3.1.9.7. The minimum required sample was 138, considering α=0.05 and a confidence interval of 95%. A total of 221 participants were contacted, out of whom 169 completed the form and sent it back.

Outcome Measures

Pittsburg Sleep Quality Index (PSQI): The PSQI analyses sleep interruptions and sleep quality over the course of a month. Seven components related to sleep are evaluated: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medication, and daytime dysfunction. The total scores of these seven components give a final value between 0 and 21. The higher the score, the worse the sleep quality. The global PSQI score has a sensitivity and specificity of 89.6% and 86.5% (kappa=0.75, p<0.001), respectively, using a cut-off score of 5 [26].

Eppworth Sleepiness Scale (ESS): The ESS is an eight question self-administered questionnaire that asks the responder to rate their usual chances of dozing off on a four-point scale (0-3) while engaging in various activities that vary greatly. The total ESS score provides a more general characteristic, the person's Average Sleep Propensity (ASP) across a varied range of activities in their day-to-day lives. It distinguishes between reports of napping behaviour, sensations of exhaustion, and drowsiness/sleepiness, in the sense of "weariness from exertion." Each item on the ESS is assessed on a Likert scale of dozing (0=would never doze; 1=slight chance of dozing; 2=moderate chance of dozing; and 3=high chance of dozing). A score ranging from 0-10 is defined as normal, whereas a score range of 11-24 is defined as abnormal and indicative of daytime sleepiness [27].

modified Kuppuswamy Scale (mKS): The mKS is used to assess the socio-economic status of a family. This measure uses a composite score that considers the family's monthly income, educational background, and employment to obtain a score of 3-29. Higher scores indicate better SES. The parameters were changed based on the education and occupation of the participants to allow for the assessment of a family's SES rather than an individual's status. The sum of the three factors- education, occupation, and total family income- gives the final score. Based on the result, the family is positioned in the appropriate socio-economic group. It is necessary to tally up all sources of revenue. Regardless of the family member's age, this is divided by the total number of members [28].

STATISTICAL ANALYSIS

The statistical analysis was conducted using Statistical Package for Social Sciences (SPSS) version 22.0. Data presented as Mean±Standard Deviation (SD) The mean values of all outcome variables were compared using independent t-tests. Mean values of males and females among the total participants were compared. After testing for data normality, Pearson's correlation tests were employed to determine correlations between outcome variables. The significance level was set at p<0.05.

RESULTS

A total of 250 forms were sent online via various social media platforms and emails, 221 participants were contacted, out of which 169 from India responded with completed forms (S: 137, T: 18, and MP: 14). The response rate was 67.6%. Among the respondents, there were 65 males (38.5%) and 104 females (61.5%). The ratio of males to females (M:F) in each group was 50:87 for S, 10:8 for T, and 5:9 for MP. The mean values of age and BMI for the S, T, and MP groups are presented in [Table/Fig-1]. Teachers had the highest mean age compared to the other two groups, but the mean values of ESS and PSQI were higher in MPs. A significant difference in PSQI and mKS values was observed when groups were compared (p-value <0.05).

Variables	S (n=137)	T (n=18)	MP (n=14)	p-value
Age (years)	24.0±7.43	25.3±5.04	24.9±5.12	0.650
BMI (kg/m^2)	25.78±11.0	22.43±2.92	22.44±8.35	0.220
ESS	8.22 ±4.52	9.17 ±5.03	10.14± 4.36	0.415
PSQI	6.39±4.10	5.44±2.61	9.21±5.05	0.001**
mKS	25.06±5.41	24.22±4.41	21.78±5.27	0.009**

[Table/Fig-1]: Demographic data of the students, teachers, and medical practitioners (Mean±SD).
**p<0.01, S: Student group; T: Teacher group; MP: Medical practitioner group; BMI: Body mass index; ESS: Eppworth sleepiness scale; PSQI: Pittsburgh sleep quality index; mKS: The modified Kuppuswamy scale

The comparison of values between male and female respondents is shown in [Table/Fig-2]. Although males had the higher mean values of BMI, ESS, and PSQI compared to female counterparts, no significant differences in any of the outcomes were observed (p-value >0.05).

Variables/Sex	Females (n=104)	Males (n=65)	p-value
Age (years)	23.69±6.32	25.14±8.03	0.189
BMI (kg/m^2)	24.09±7.88	26.82±13.18	0.363
ESS	8.17±4.49	8.97±4.71	0.873
PSQI	6.34±3.99	6.83±4.35	0.103
mKS	24.43±5.64	25.14±4.89	0.083

[Table/Fig-2]: Comparison of females and males on variables (Mean±SD).
BMI: Body mass index; ESS: Eppworth sleepiness scale; PSQI: Pittsburgh sleep quality index; mKS: The modified Kuppuswamy scale

The relationships between age, BMI, ESS, PSQI, and mKS are outlined in [Table/Fig-3]. There was no significant correlation between the variables in all the groups except in the students' group, where a significant correlation was found between BMI and PSQI (r=0.191, p=0.025) and between ESS and mKS (r=-0.205, p=0.016). In the teacher's group, there was a non significant negative correlation between age and PSQI (r=-0.263), suggesting that the older the age, the lower the quality of sleep in this population. There was a negative correlation of mKS to ESS (r=-0.222) and PSQI (r=-0.187), suggesting that the better the SES, the better the sleep quality and the lower the daytime sleepiness. However, these correlations were non significant. In the medical practitioner group, there was

a moderate positive, non significant correlation between age and PSQI (r=0.476), suggesting that the older the age, the lower the sleep quality. There was also a non significant negative correlation between BMI and ESS (r=-0.058), suggesting that the higher the BMI of a person, the more likely they are to experience daytime sleepiness [Table/Fig-3].

S group					
Variables	**Age**	**BMI**	**ESS**	**PSQI**	**mKS**
Age	1	0.141 (0.100)	0.130 (0.129)	0.022 (0.802)	0.133 (0.123)
BMI		1	0.111 (0.197)	0.191* (0.025)	-0.039 (0.650)
ESS			1	0.080 (0.355)	-0.205* (0.016)
PSQI				1	-0.113 (0.189)
mKS					1
T group					
Age	1	0.075 (0.766)	0.132 (0.602)	-0.263 (0.291)	0.184 (0.466)
BMI		1	-0.069 (0.785)	0.172 (0.495)	0.045 (0.858)
ESS			1	-0.055 (0.828)	-0.222 (0.377)
PSQI				1	-0.187 (0.377)
mKS					1
MP group					
Age	1	0.354 (0.214)	-0.013 (0.964)	0.476 (0.085)	0.127 (0.664)
BMI		1	-0.058 (0.844)	0.179 (0.541)	-0.033 (0.910)
ESS			1	0.361 (0.205)	-0.216 (0.459)
PSQI				1	0.391 (0.167)
mKS					1

[Table/Fig-3]: Correlation between the age, BMI, ESS, PSQI and mKS in each group {r (p-value)}.
**Correlation is significant at the 0.01 level (2-tailed); *Correlation is significant at the 0.05 level (2-tailed); S: Student group; T: Teacher group; MP: Medical practitioner group; BMI: Body mass index; ESS: Eppworth sleepiness scale; PSQI: Pittsburgh sleep quality index; mKS: The modified Kuppuswamy scale

DISCUSSION

In this study, there was no significant correlation between age and other variables in all the groups. However, BMI was significantly related to sleep quality among the students. The higher the BMI, the more likely individuals were to experience daytime sleepiness. In the US, there is a prevalence of short sleep duration (<9 hours for children aged 6-12 years; <8 hours for teens aged 13-18 years; and <7 hours for adults aged 18-60-year-old) as high as 72.7% [29]. A large-scale survey study conducted by Peltzer K and Pengpid S, including 19,417 undergraduate students in 26 low-, middle-, and high-income countries, found that 39.2% of university students had a sleep duration of ≤6 hours [30]. The current study demonstrated a similar pattern, with the student group sleeping an average of 6.86 hours, while the MP and T groups slept 6.57±1.6 and 6.00±2.9 hours, respectively. A study conducted among high school teachers and professors found that there is a short sleep duration of ≤6 hours. This may be due to work intensification, technological developments that have expanded the use of electronic devices and dissolved the boundaries between private and work life, and primarily by the volume of demands inherent in teaching work [15].

In this study, the students were currently enrolled in Bachelor's and Master's programs, while the medical practitioners were mainly those who were working following their MBBS. Thus, there were no notable differences in the age range among the three groups. However, among the student group, a significant correlation between age and ESS, PSQI, and mKS was found. A moderately negative correlation was observed between mKS and ESS, suggesting that lower socio-economic status affects daytime sleepiness in this group. A study conducted by Nasim M et al., in Asian countries showed that adolescents who considered themselves to be "poorer than others" reported experiencing sleep deprivation. It is believed that this may be mediated by screen time and workload [31] because low socio-economic status children reported more screen time and consequently less sleep time [32]. Students attending regular schools are susceptible to sleep disturbances and deprivation due to greater academic and social pressures and irregular schedules [32]. Significant sleep disturbance was observed in all three groups in this study, as the mean values were >5. However, the teachers' group exhibited higher daytime sleepiness compared to the medical practitioners' group. A study conducted by De Almondes KM and Araujo JF revealed similar findings, showing that teachers' sleep quality was lower than that of shift workers [33]. The study by Souza JC et al., found that up to 46% of educators were diagnosed with excessive daytime drowsiness, and 40% of teachers who completed the health and sleep questionnaire reported feeling drowsy during the day [34]. These findings could indicate a lack of sleep.

Although there was a correlation with daytime drowsiness, the relationship between socio-economic status (mKS) and sleep quality (PSQI) was not statistically significant in the study. It was observed that not only family income influences physical and mental health, but it also affects the sleep quality of the individual [35]. This was in line with the results by Felden ÉP et al., which show that lower socio-economic status is associated with higher levels of daytime sleepiness, shorter sleep duration, and a worse subjective perception of sleep quality [36]. According to Ko SB, sleeping at night is preferable to sleeping during the day, and sleep duration has an impact on obesity, night shifts, and sleep quality. It was discovered that night shift workers had poorer quality sleep [37]. In this study, females showed slightly lower sleep quality compared to their male counterparts, although the difference was not significant. This finding aligns with a previous study in young adults, which reported poorer sleep quality in females compared to males (65.1% vs 49.8%). The gender differences may be attributed to lifestyle factors, psychosocial disparities, among other reasons [38].

Limitation(s)

First, the number of participants in each category was unevenly distributed, making it impossible to ignore the bias in the collected data. Secondly, there were more female participants compared to males. Thirdly, the online survey allowed participants to fill out the forms regardless of their mood, anxiety, or stress, which are significant factors affecting an individual's sleep quality. Future studies could be conducted with these modifications and a larger sample size.

CONCLUSION(S)

The group of medical practitioners had significantly worse sleep quality compared to students and teachers. BMI may affect sleep quality, and economic status was inversely related to daytime sleepiness in the student group. Controlling BMI, optimising sleep length, and reducing screen time are important ways to improve sleep quality for people of all ages.

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