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Original Article

Physiology Section

Perceived Stress and Sleep Quality among Medical Students and their Relationship with Body Mass Index and Body Fat: A Cross-sectional Study

YUSRA AMIN[1], SONIA MUSHTAQ[2], RUKHSANA TAJ[3], SUNIL SACHDEV[4], SAMI MANZOOR MAGRAY[5]

ABSTRACT

Introduction: Medical students tend to reduce their sleep in an effort to cope with their workload and stressful environment. This results in unhealthy lifestyles among students, which may lead to changes in Body Mass Index (BMI) and Body Fat Percentage (BF%). Thus, there is a need to investigate the stress level and sleep quality among medical students and their relationship with BMI and body fat.

Aim: The aim of the present study was to assess the perceived stress level and sleep quality in medical students and to correlate the stress and sleep quality with BMI and body fat.

Materials and Methods: This cross-sectional study was conducted at Government Medical College, Jammu from November 2019 to October 2020 using stratified random sampling. A total of 200 medical students, aged 17-25, were recruited for this study. A self-administered questionnaire was distributed to assess sleep quality using the Pittsburgh Sleep Quality Index (PSQI) and stress level using the Perceived Stress Scale (PSS). Statistical analysis was performed using the Statistical Package for Social Sciences (SPSS) software, version 21.0. Categorical variables were analysed using the Chi-square test, and Pearson correlation was used to find correlations among the variables. A p-value less than 0.05 was considered significant.

Results: Out of the total 200 medical students, 116 (58%) had a PSQI score of <5, 62 (31%) had a score in the range of 5-7, and 22 (11%) had a score >7. The PSS score showed moderate stress (14-26) in 138 (69%) students, low stress (0-13) in 32 (16%) students, and high stress level (27-40) in 30 (15%) students. A statistically significant correlation was observed between PSS and PSQI (p-value=0.001). However, there was no statistically significant correlation observed between PSQI and PSS with BMI and body fat.

Conclusion: While a notable correlation was observed between perceived stress and sleep quality, the impact of sleep quality and stress levels on BMI and BF% appears to be insignificant. Therefore, it is important to understand the impact of stress on sleep quality, particularly among medical students. There is a need for interventions and support systems aimed at managing stress and promoting better sleep hygiene to improve overall well-being.

Keywords: Psychological impact, Sleep disorders, Stress

INTRODUCTION

Stress is defined as "any uncomfortable emotional experience accompanied by predictable biochemical, physiological, and behavioural changes" [1]. It occurs when there is a real or perceived threat to homeostasis, which can be related to various stressors such as academic, financial, social, and personal factors [2]. While some level of stress is believed to be beneficial for learning (favourable stress), high levels of stress (distress) can have negative effects on the well-being of medical students, including depression, sleep disturbances, changes in eating patterns, social and environmental maladjustments, and disruptions in mood and overall mental health [2,3]. Among these, sleep disturbances are very common. Stress often causes difficulty in falling asleep or maintaining restful sleep [1]. Changes in eating patterns can occur, such as increased or decreased appetite, overeating, or undereating. Furthermore, stress can contribute to social and environmental maladjustments, leading to difficulties in maintaining relationships and adapting to new situations [2]. It is important to understand the multifaceted impact of stress on individuals, particularly medical students who face unique challenges in their academic and personal lives.

The issue of stress among medical students is a widely recognised problem. Medical students face a multitude of stressors during their studies, including academic demands, financial constraints, peer pressure, and social problems such as alcohol abuse. These stressors can lead to feelings of self-doubt and anxiety, and if they are prolonged and intense, they can have a detrimental effect on the physical and mental health of the students [2]. A study conducted in the United States found that 49.6% of medical students reported experiencing burnout, a type of chronic stress, during their studies [2].

Sleep is a combination of the passive withdrawal of afferent stimuli to the brain and activation of certain neurons in selective brain areas [4]. Ideal sleep refers to the amount of sleep necessary for an individual to remain alert and fully awake, enabling adequate functioning throughout the day. The difference between the ideal sleep duration and the actual duration of sleep is known as sleep debt [5]. The sleep requirement for an average adult is approximately eight hours, irrespective of environmental or cultural differences. Our bodies require long periods of sleep to restore and rejuvenate, promote muscle growth, tissue repair, and hormone synthesis [6].

In recent decades, there has been increased interest in evaluating sleep quality. Sleep patterns are now considered an important factor in determining young adults' susceptibility to stress. Medical students often experience a reduction in sleep, which can lead to sleep and stress disorders. A study reported that poor sleep quality was associated with increased stress levels, with 77% of participants reporting poor sleep quality and 63.5% reporting some level of stress [7]. These factors also affect BMI and body fat percentage in individuals [5,8].

Therefore, it is crucial to investigate sleep quality and stress levels, as well as their relationship with BMI and body fat percentage. Hence, the aim of the study was to assess sleep quality and stress levels and examine the correlation between stress and sleep quality with BMI and body fat among medical students in northern India.

MATERIALS AND METHODS

The present study was a cross-sectional study conducted in the Department of Physiology at Government Medical College, Jammu in India from November 2019 to October 2020. A total of 200 students, who were selected using a stratified random sampling technique, with 60 students from each batch, were included in the study. Ethical clearance was obtained from Institutional Ethics Committee, Government Medical College, Jammu (Serial No: EGD/2022/9/144). All eligible subjects provided written informed consent after being briefed on the study's purpose and methodology.

All medical undergraduate students aged between 17 and 25 years who were willing to participate in the study, communicated effectively and understand the study requirements, and have no history of chronic illness or sleep disorders, were included while pregnant females, smokers, or alcoholics, individuals with a history of psychiatric or neurological disorders, individuals with any chronic illness and those not willing were excluded from the study.

The eligible participants were contacted. The participants who expressed their willingness to participate were screened to determine their eligibility based on the inclusion and exclusion criteria. They were given a questionnaire comprising demographic details, assessment of sleep and stress. Ample time was given to each participant to ask any questions about the study before providing their consent.

Assessment of sleep durations and patterns was done by using the PSQI [9]. This is a self-administered and validated questionnaire that contains 19 self-rated questions, which are combined to form seven "component" scores, having a range of 0 to 3, "0" indicating no difficulty and "3" indicating severe difficulty. The seven component scores were added together to yield one "global" score with a range of 0 to 21 points, "0" indicating no difficulties in all areas of sleep. The seven components of the PSQI which were used to analyse various aspects of sleep patterns and durations were subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medications and daytime dysfunction. Grading and scoring of the PSQI were done according to the preformed scoring instructions of the PSQI. The sums of scores of these seven components yield one global score. It has high test-retest reliability and good validity for people with primary insomnia [10].

The assessment of stress level was conducted using the PSS-14 [11,12]. The scale includes several direct queries about the levels of experienced stress. The items are easy to understand, and the response alternatives are simple to grasp. The questions are of a general nature and are therefore relatively free of content specific to any particular subpopulation group. The questions range from rating feelings of being 'upset' and 'stressed' to 'coping' and 'controlling stress.' For each item, participants were asked to rate their feelings of stress on a four-point scale (0=never, 1=almost never, 2=sometimes, 3=fairly often, 4=very often). Fourteen items were designed to measure how unpredictable, uncontrollable, and overloaded respondents find their lives. Out of the fourteen, seven items were stated positively and seven were stated negatively. The seven positive items were reversed, and the total score was calculated by summing all 14 items for each participant. In each case, respondents were asked how often they felt a certain way. The scores were then categorised as low stress (0-13), moderate stress (14-26), and high stress (27-56). A higher total score represented a higher level of perceived stress as indicated by the participants.

BMI was computed using self-reported height and weight as follows: weight (lb)/{height (in)}^{2}×703, which was validated with actual measurements. A dichotomous variable was created using a BMI cut-off of 25 to distinguish those who were overweight or obese [13]. The BF% of the subjects was assessed using bio-impedance analysis. A commercial single-frequency, 8-electrode bio-impedance analyser system (BC-418, Tanita Corp, Tokyo, Japan) measured the total BF%. This technique has been tested in several ethnicities to measure BF% [8]. This type of device works based on the principle that electrical currents pass differently through tissues with varying water content and conductivity. By passing a small electrical current through the body and measuring its impedance (resistance), the bio-impedance analyser can estimate BF%. Adipose tissue (body fat) has lower electrical conductivity than muscle and water, allowing BIA devices to estimate the proportion of body fat based on the measured resistance. The BC-418 is a single-frequency bio-impedance analyser with eight electrodes. The use of multiple electrodes allows for more accurate and precise measurements compared to analysers with fewer electrodes. All measurements were obtained in the morning (08:30-12:00) with no vigorous activity in the prior 12 hours. The observed PSS and PSQI scores were correlated with BMI and BF%.

STATISTICAL ANALYSIS

Statistical analysis was performed using SPSS statistical software, version 21.0. Continuous variables were presented as mean±SD, and categorical variables were presented as numbers and percentages. The normality of the data was checked using the Shapiro-Wilk test. The results showed that the data were normally distributed; thus, parametric tests were used for statistical analysis. Categorical variables were analysed using the Chi-square test, and Pearson correlation was used to determine the correlation among the variables. For all statistical tests, a p-value less than 0.05 was considered statistically significant.

RESULTS

The study included 200 healthy subjects, of whom 86 (43%) were male and 114 (57%) were female students. It was observed that the PSQI score fell within the range of <5 for 116 (58%) subjects, within the range of 5-7 for 62 (31%) subjects, and within the range of >7 for 22 (11%) subjects [Table/Fig-1]. The difference in PSQI scores between male and female students was not statistically significant (p=0.769).

PSQI score (N=200)	Males n (%)	Females n (%)	Total (%)	p-value
Less than 5	48 (55.81)	68 (59.65)	116 (58)	0.769
5-7	29 (33.72)	33 (28.95)	62 (31)	
More than 7	9 (10.47)	13 (11.40)	22 (11)	
Total	86 (100)	114 (100)	200 (100)	

[Table/Fig-1]: Grades of PSQI among the students according to gender.
Test applied=Chi-square test, Set level of p-value <0.05

The mean PSS was 24.04±9.59, and 138 (69%) subjects fell within the range of 14-26, 32 (16%) subjects fell within the range of 0-13, and 30 (15%) subjects fell within the range of 27-56. Girls had higher perceived stress scores than boys [Table/Fig-2]. However, no significant difference was observed when comparing the participants' BMI with PSQI [Table/Fig-3].

PSS	Males n (%)	Females n (%)	Total (%)	p-value
0-13 (Low stress)	22 (25.58)	10 (8.77)	32 (16)	0.0057
14-26 (Moderate stress)	53 (61.63)	85 (74.56)	138 (69)	
27-56 (High stress)	11 (12.79)	19 (16.67)	30 (15)	
Total	86 (100)	114 (100)	200 (100)	

[Table/Fig-2]: Gender-wise stress level reported by students as per PSS.
Test applied=Chi-square test, Set level of p-value <0.05

BMI (kg/m²)	PSQI			Total	p-value
	Less than 5	5-7	More than 7		
<18.5	7 (3.5%)	5 (2.5%)	5 (2.5%)	17 (8.5%)	0.141
18.5-24.9	89 (44.5%)	43 (21.5%)	15 (7.5%)	147 (73.5%)	
<25-29.9	16 (8%	13 (6.5%)	2 (1%)	31 (15.5%)	
≥30	4 (2%)	1 (0.5%)	0 (0%)	5 (2.5%)	
Total	116 (58%)	62 (31%)	22 (11%)	200 (100%)	

[Table/Fig-3]: Correlation of PSQI distribution and BMI.
Test applied=Pearson correlation, Set level of p-value <0.05

A statistically significant correlation was observed between PSS and PSQI, with a p-value of 0.001. However, there was no statistically significant correlation between PSQI and PSS with BMI and BF% [Table/Fig-4].

		PSQI	PSS
BMI (kg/m²)	Pearson correlation	-0.075	-0.80
	p-value	0.289	0.263
	N	200	200
Body fat %	Pearson correlation	-0.033	-0.31
	p-value	0.645	0.664
	N	200	200
		PSQI	
PSS	Pearson correlation	0.231	
	p-value	0.001	
	N	200	

[Table/Fig-4]: Relationship between PSS and PSQI with BMI and body fat%.
Test applied=Pearson correlation, p-value <0.05

DISCUSSION

This study investigated the perceived stress levels and sleep quality in medical students. The correlation between stress, sleep quality, BMI, and body fat was also examined. The findings of the study indicated a statistically significant correlation between PSS (Perceived Stress Scale) and PSQI (Pittsburgh Sleep Quality Index). However, no significant correlation was found between PSQI and PSS with BMI and BF%.

In this study, it was found that 116 participants (58%) had minimal sleep disorders, 62 participants (31%) had moderate sleep disorders, and 22 participants (11%) had significant sleep disorders. This is in line with a previous study where 56% of subjects had poor sleep quality, with females (63.1%) experiencing poorer sleep quality compared to males (44.5%) [14]. Another study by Kalyani N et al., reported that 53.6% of their subjects had minimal sleep disorders (score <=4), while 46.4% suffered from severe sleep disorders (score >=4) [15]. Lund HG et al., also observed that individuals with poor sleep quality had higher levels of stress compared to those with optimal sleep quality [16].

It is known that during sleep, there is a balance in glucose utilisation and production, which provides energy for the upcoming day [17]. However, if this pattern is disrupted, it may lead to unhealthy changes in the body's metabolism and potentially contribute to diabetes, obesity, or other cardiovascular disorders [18]. Therefore, having an adequate number of sleeping hours is essential for maintaining an active and healthy lifestyle. Additionally, sleep patterns are also important, not just sleep duration, in determining an individual's well-being.

Since sleep plays a crucial role in cognitive processes, as well as physical and mental health, sleep deprivation can negatively affect the academic performance of medical students. Physiologically, sleep and stress are closely linked through the Hypothalamic-Pituitary-Adrenal (HPA) axis, which explains the strong relationship between these two factors [19].

Overall, the data from the present study revealed a positive correlation between PSQI and PSS. The PSS score was observed to increase with an increase in the PSQI score, indicating difficulty in sleep and an irregular sleep pattern. This result aligns with other published data [15,20]. A study by Lund HG et al., has suggested that perceived stress can act as a predisposing, precipitating, and perpetuating factor for sleep difficulties [16].

Individuals who consistently experience less than eight hours of sleep may suffer from exhaustion and be prone to aerial diseases [21-24]. Moreover, these individuals also have higher rates of cancer, depression, and anxiety, lower work efficiency, and are more susceptible to vehicular and work-related accidents due to low alertness levels. Those who sleep an adequate number of hours may have a lower chance of experiencing stress and becoming overweight. The benefits of good sleep include higher productivity at work, better coping skills, improved concentration and memory, and the ability to make careful health decisions. One vital role of sleep is to help solidify and consolidate memories. Research has shown that sleep is necessary to maintain metabolic-caloric balance, thermal equilibrium, and immune competence [21].

In the present study, mild stress was experienced by 32 subjects (16%), moderate stress by 138 subjects (69%), and severe stress by 30 subjects (15%). The mean PSS was 24.04±9.59 and was higher in females compared to males. Saeed AA et al., reported the mean PSS score to be 25.6±9.7 [22]. Another study reported a stress prevalence of 29.6% [11]. The results were more or less consistent with the present study. An increase in chronic daily stress, regardless of its origin, combined with the increased availability of high-calorie foods, created an environment conducive to the development of obesity and other metabolic disturbances [13].

These current studies provide valuable insights into the perceived stress levels and sleep quality among medical students, as well as their correlation with BMI and body fat. These findings are important as they shed light on the impact of stressful environments and unhealthy lifestyles on the health of medical students. The study also highlights the need for interventions to improve sleep quality and reduce stress levels among medical students, which can ultimately lead to better health outcomes.

Compared to earlier literature, the current study's findings are consistent with previous studies that have reported high levels of stress among medical students [7,8,23]. However, no significant correlation was found between BMI and body fat. This further helps in developing a better understanding of the relationship between stress and physical health.

Limitation(s)

While the study had a limited sample size and was conducted at a single institution, its findings may not be generalised to other populations. Additionally, the study relied on self-reported measures of stress and sleep quality, which could introduce bias. Nevertheless, the study's findings contribute to our understanding of how stress and sleep quality affect the physical health of medical students, providing a foundation for future research in this field.

CONCLUSION(S)

The majority of the participants had a moderate stress level and good sleep quality. However, a significant correlation was observed between stress level and sleep quality. Interestingly, no correlation was found between sleep quality and BMI or body fat. Moreover, stress levels differ significantly between males and females, emphasising the need for gender-specific approaches to address stress-related issues and promote overall well-being.

REFERENCES

[1] Nargund VH. Effects of psychological stress on male fertility. Nat Rev Urol. 2015;12(7):373-82. Doi: 10.1038/nrurol.2015.112. Epub 2015 Jun 9. PMID: 26057063.

[2] Dyrbye LN, Thomas MR, Massie FS, Power DV, Eacker A, Harper W, et al. Burnout and suicidal ideation among US medical students. Ann Intern Med. 2008;149(5):334-41. Doi: 10.7326/0003-4819-149-5-200809020-00008.

[3] Mosley TH Jr, Perrin SG, Neral SM, Dubbert PM, Grothues CA, Pinto BM. Stress, coping, and well-being among third-year medical students. Acad Med. 1994;69(9):765-67. Doi: 10.1097/00001888-199409000-00024.

[4] Stephansen JB, Olesen AN, Olsen M, Ambati A, Leary EB, Moore HE, et al. Neural network analysis of sleep stages enables efficient diagnosis of narcolepsy. Nat Commun. 2018;9(1):5229. Doi: 10.1038/s41467-018-07229-3.

[5] Marks R, Landaira M. Disturbances of sleep, stress and obesity: A narrative review. J Obes. 2015;1:01-05.

[6] Ganong WF. Central and peripheral neurophysiology. In: Barret KE, Boitano S, Barman SM, Brooks HL, Editors, Review of Medical Physiology, 23rd edition. New Delhi: 2010; 59(2): 91-7 Appleton and Lange 2010; Pp. 235-37.

[7] Alotaibi AD, Alosaimi FM, Alajlan AA, Bin Abdulrahman KA. The relationship between sleep quality, stress, and academic performance among medical students. J Family Community Med. 2020;27(1):23-28. Doi: 10.4103/jfcm.JFCM_132_19. Epub 2020 Jan 13. PMID: 32030075; PMCID: PMC6984036.

[8] Ranasinghe C, Gamage P, Katulanda P, Andraweera N, Thilakarathne S, Tharanga P. Relationship between Body mass index (BMI) and body fat percentage, estimated by bioelectrical impedance, in a group of Sri Lankan adults: A cross-sectional study. BMC Public Health. 2013;13:797. https://doi.org/10.1186/1471-2458-13-797.

[9] 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;28(2):193-213. http://dx.doi.org/10.1016/0165-1781(89)90047-4.

[10] Backhaus J, Junghanns K, Broocks A, Riemann D, Hohagen F. Test-retest reliability and validity of the Pittsburgh sleep quality index in primary insomnia. J Psychosom Res. 2002;53(3):737-40.

[11] Andreou E, Alexopoulos EC, Lionis C, Varvogli L, Gnardellis C, Chrousos GP, et al. Perceived stress scale: Reliability and validity study in Greece. Int J Environ. Res. Public Health. 2011;8(8):3287-98.

[12] Yussoff MS, Rahim AF, Yaacob MJ. Prevalence and sources of stress among Universiti Sains Malaysia medical students. The Malay J Med Sci. 2010;17(1):30.

[13] National Institutes of Health. National Heart, Lung and Blood Institute, North American Association for the Study of Obesity: The practical guide identification, evaluation, and treatment of overweight and obesity in adults. Bethesda, MD: National Institutes of Health; 2000. NIH publication no. 00-4084.

[14] Galland BC, Gray AR, Penno J, Smith C, Lobb C, Taylor RW. Gender differences in sleep hygiene practices and sleep quality in New Zealand adolescents aged 15 to 17 years. Sleep Health. 2017;3(2):77-83.

[15] Kalyani N, Jamshidi N, Salami J, Pourjam E. Investigation of the relationship between psychological variables and sleep quality in students of medical sciences. Depress Res Treat. 2017;2017:7143547.

[16] Lund HG, Reider BD, Whiting AB, Prichard JR. Sleep patterns and predictors of disturbed sleep in a large population of college students. J Adolesc Health. 2010;46(2):124-32.

[17] Knutson KL, Rarhouz PJ, Yan LL. Intra individual daily and yearly variability in actigraphically recorded sleep measures: The cardia study. Sleep. 2007;30(6):793-96.

[18] Vagras PA, Flores M, Robles E. Sleep quality and body mass index in college students. The role of slep disturbances. J Am Coll Health. 2014;62(8):534-41.

[19] Steiger A. Sleep and endocrinology. J Intern Med. 2003;254(1):13-22.

[20] Abdulghani HM, AlKanhal AA, Mahmoud ES, Ponnamperuma GG, Alfaris EA. Stress and its effects on medical students: A cross-sectional study at a college of medicine in Saudi Arabia. J Health Popul Nutr. 2011;29(5):516-22. Doi: 10.3329/jhpn.v29i5.8706.

[21] Besedovsky L, Lange T, Haack M. The sleep-immune crosstalk in health and disease. Physiol Rev. 2019;99(3):1325-80. Doi: 10.1152/physrev.00010.2018.

[22] Saeed AA, Bahnassy AA, Al-Hamdan NA, Almudhaibery FS, Alyahya AZ. Perceived stress and associated factors among medical students. J Family Community Med. 2016;23(3):166-71. Doi: 10.4103/2230-8229.

[23] Chattu VK, Manzar MD, Kumary S, Burman D, Spence DW, Pandi-Perumal SR. The global problem of insufficient sleep and its serious public health implications. Healthcare (Basel). 2018;7(1):1. Doi: 10.3390/healthcare7010001. PMID: 30577441; PMCID: PMC6473877.

[24] Institute of Medicine (US) Committee on Sleep Medicine and Research; Colten HR, Altevogt BM, editors. Sleep Disorders and Sleep Deprivation: An Unmet Public Health Problem. Washington (DC): National Academies Press (US); 2006. 3, Extent and Health Consequences of Chronic Sleep Loss and Sleep Disorders. Available from: https://www.ncbi.nlm.nih.gov/books/NBK19961/.

PARTICULARS OF CONTRIBUTORS:

1. Senior Resident, Department of Physiology, Government Medical College, Anantnag, Jammu and Kashmir, India.
2. Senior Resident, Department of Physiology, ASCOMS, Jammu, Jammu and Kashmir, India.
3. Senior Resident, Department of Microbiology, SKIMS Medical College, Srinagar, Jammu and Kashmir, India.
4. Professor, Department of Physiology, Government Medical College, Jammu, Jammu and Kashmir, India.
5. Associate Professor, Department of Physiology, Government Medical College, Anantnag, Jammu and Kashmir, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:

Dr. Sami Manzoor Magray,
Associate Professor, Department of Pharmacology, Government Medical College, Anantnag-192210, Jammu and Kashmir, India.
E-mail: rukhsana.taj.skims@gmail.com; samimagray070@gmail.com

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