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Original Article

The Relationship of Body Mass Index and Sleep Quality with Blood Pressure in the Operating Room and Nursing Students

Reza Mohammadi[1], Soheyla Zamanipaydar[1], Nazanin Cheloi[1], Arezou Karampourian[2*]

[1]Student Research Committee, Hamadan University of Medical Sciences, Hamadan, Iran
[2]Department of Nursing, School of Nursing and Midwifery, Urology and Nephrology Research Center, Hamadan University of Medical Sciences, Hamadan, Iran

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***Corresponding author:**
Arezou Karampourian,
Email: a.karampourian@umsha.ac.ir

Abstract

Background: Blood pressure (BP) is an important measure of health that can be affected by various factors, including weight and sleep. Some students are exposed to problems related to sleep, weight, and BP. This study aimed at investigating the relationship between body mass, sleep quality, and BP in the operating room and nursing students of Hamedan University of Medical Sciences.

Methods: The present cross-sectional study involved 191 operating room and nursing students from Hamadan University of Medical Sciences. The data were gathered using a demographic checklist and the Pittsburgh Sleep Quality Index (PSQI) questionnaire. BP and height were measured using the Bewell model W.M-61 hand-held BP monitor and a Stature Meter wall meter, respectively. Students' weight was determined with a digital scale. The obtained data were analyzed using SPSS 24, with a significance level of 0.05.

Results: Most of the students participating in the study were female (58.1), single (93.7), unemployed (90.6), and nursing students (59.7). The findings of the correlation test indicated a significant indirect relationship between sleep quality and systolic BP (SBP) ($P=0.03$, $r=0.15$). Additionally, there was a significant direct relationship between body mass index (BMI) and SBP ($P=0.004$, $r=0.207$).

Conclusion: It seems that a high BMI in the operating room and nursing students can affect their sleep quality and BP. Thus, it is suggested that educational managers participate in physical activities and sports in the course, with appropriate plans for students. Their education should be in such a way to place the BMI in the normal range, prevent chronic diseases, and reduce the academic efficiency of the students.

Keywords: Body mass index, Sleep quality, Blood pressure, Nursing, Operating room, Students

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Introduction

The transition to student life brings significant changes for young people. They face increased academic and social pressures while gaining independence, leading to lifestyle changes such as poor diets and irregular sleep patterns. These changes can negatively impact their health. Obesity, defined as excessive fat accumulation in the body, is a global public health concern. The rising trend of obesity has made it a major health challenge worldwide (1). Research indicates that 39% of adults globally and 35% of adults in Iran are overweight (2).

Obesity is characterized by abnormal fat accumulation influenced by genetics, diet, and other factors and enhances the risk of chronic diseases (3). Body mass index (BMI) is a common method to determine body fat, estimated by dividing weight by height squared (4). BMI has a positive relationship with mortality and disability caused by high blood pressure (BP) and other chronic conditions. Overweight and obesity are defined as having a BMI ≥ 25. Studies show that about one-third of students are in this range. While calorie imbalance is a key driver, sleep disorders may also contribute to obesity, which is a complex issue influenced by many interrelated factors (5).

The American Psychiatric Association classifies

sleep disorders into four categories, namely, insomnia, excessive sleepiness, circadian rhythm sleep-wake disorders, and movement disorders associated with sleep (6). Reducing the length of sleep through mechanisms such as reduced appetite control, increased eating time, or lower basal metabolism can impact energy balance and lead to weight gain. The National Institutes of Health recommends 7–8 hours of sleep for adults (7). An international study involving 99 066 students found a prevalence of 26.4% of sleep problems, with medical students, including nursing and operating room students, being particularly vulnerable due to long and stressful study periods, hospital shifts, and work-related emotional stress (8). Insomnia and sleep disorders are associated with hypertension (HTN) and cardiovascular disorders (9). According to a study by Bathgate et al, insomnia is a significant risk factor for high BP (10). Additionally, there is a correlation between frequent, chronic insomnia, and short sleep duration with high BP (11).

HTN is a significant contributor to cardiovascular diseases, which are responsible for a substantial number of deaths worldwide (12). Studies in Iran indicate a high prevalence of HTN, with 31% and 27% of men and women being affected, respectively (13). Primary HTN is among the most prevalent chronic conditions, affected by factors such as stress, anxiety, lifestyle choices, and the quality of sleep (14). The prevalence of high BP appears to be increasing among younger individuals, making students an important population to study (15). Recognizing the widespread impact of HTN and the complex factors involved highlights the need for comprehensive strategies to promote cardiovascular health, especially among the younger generation (16).

This study has focused on exploring the health status and overall well-being of young individuals, particularly students. Although there is a lack of extensive research in this domain, it is crucial to comprehend the current health conditions and requirements of students. This research seeks to examine the relationship between BMI, sleep quality, and BP among the operating room and nursing students at Hamadan University of Medical Sciences.

Methods

The cross-sectional study investigated the relationship between BMI and sleep quality with BP. The participants included 191 undergraduate operating room and nursing students of Hamadan University of Medical Sciences in 2023, who were selected by available sampling and considering the following formula:

$$N = \left[\left(\frac{Z_{1-\frac{\alpha}{2}} + Z_{1-\beta}}{C}\right)\right]^2 + 3$$

The study included students who met several criteria, including showing a willingness to participate, being an undergraduate nursing or operating room student, living in the dormitory, and having no chronic diseases. However, students who did not complete the questionnaires or had acute illnesses affecting their weight and BP were excluded from the investigation. The research tools included a demographic checklist and the Pittsburgh Sleep Quality questionnaire. BP and height were measured using a calibrated W.M-61 hand BP monitor and a wall-mounted stature meter height meter, respectively. Weight was evaluated using a digital scale with an accuracy of 0.1 kg, which was calibrated using a witness weight before the weighing process began.

The demographic information checklist collected from the students included data on their age, gender, marital status, field of study, employment status, height, and weight. This checklist was reviewed and approved by 10 faculty members.

The Pittsburgh Sleep Quality Index

The Pittsburgh Sleep Quality Index (PSQI) is a self-evaluation tool designed for individuals aged 18 and older, measuring sleep quality over the past month. It includes 19 self-reported questions along with 5 additional questions that are typically answered by a bed partner or roommate. However, in this study, the last 5 questions were omitted since all participants were single. This exclusion is not problematic, as those questions are exclusively intended for clinical insights and do not contribute to the PSQI scoring. The 19 self-rated questions cover aspects of sleep quality and are categorized into 7-part scores, each weighted equally on a scale from 0 to 3. Components include overall sleep quality, sleep latency (time from lights out to falling asleep), typical sleep efficiency, sleep disturbances, sleep medication use, and daytime dysfunction. The scores of 7 components range from 0 to 21 and are summed up. Higher scores indicate poorer sleep quality. A score of 5 or higher represents poor sleep quality in the last month (17,18).

Validity and Reliability of Instruments

The validity and reliability of the PSQI questionnaires were evaluated by Farrahi et al (19). The alpha coefficient, which demonstrates reliability, was 0.70 for the ESS and 0.88 for the PSQI. Based on these results, both questionnaires had acceptable to good internal consistency when used in an Iranian population.

The PSQI questionnaire was administered to students after obtaining ethical approval and informed consent and training on how to complete the questionnaire. Students' height was measured using a wall-mounted tape measure while standing with their legs together and shoulders relaxed. Weight was assessed using a standard scale that provides an accuracy of 0.1 kg on a flat, hard surface, free of any obstructions. BMI was calculated using the formula: weight (kg)/height $(m)^2$. BP measurements were taken in a calm, quiet setting after the students had rested for at least 5 minutes. Students were instructed to sit with their backs supported and their arms bare, resting

at heart level. The cuff was positioned 2.5 cm above the elbow crease, covering 80% of the arm's circumference. Systolic BP (SBP) was determined as the point when the first Korotkoff sound was heard, while diastolic BP (DBP) was recorded as the fifth Korotkoff sound. To reduce potential measurement inaccuracies, the students were instructed to refrain from consuming caffeine or smoking prior to the BP assessment. The BP measurements were conducted by a single researcher.

The association between sleep quality, BMI, and BP was assessed using Pearson's correlation test. Descriptive statistics, such as means, frequencies, percentages, and standard deviations, were employed to analyze the demographic characteristics of the participants. The data were analyzed using SPSS version 24 software, with a significance level of 0.05 established for the relationships investigated in this study.

Results

The results showed that most participants were female (58.1%), single (93.7%), unemployed (90.6%), and nursing students (59.7%). The mean age and mean BMI of the students were 21.4 ± 1.42 years and 22.88 ± 4.21, respectively. In addition, their mean SBP and mean DBP were 114.47 ± 9.35 mm Hg and 75.22 ± 10 mm Hg, respectively (Table 1).

The findings indicated that the average BMI of the students was 22.88 ± 4.21, with the lowest and highest BMI being 15.70 and 35.82, falling within the normal range. The average, lowest, and highest SBP were 114.47 ± 9.35 mmHg, 90 mm Hg, and 140 mm Hg, respectively. The average DBP was 75.22 ± 10 mmHg, with the lowest being 60 mm Hg and the highest being 95 mm Hg. The students' self-reported average sleep quality score was 8.75 ± 1.78, with the lowest and highest scores being 5 and 14, indicating poor sleep quality (Table 2).

The Pearson's correlation test revealed that there was a statistically significant, but indirect, connection between sleep quality and SBP ($P = 0.03$, r = 0.15). Additionally, a direct and significant relationship was found between BMI and SBP ($P = 0.004$, r = 0.207). However, there was an indirect and non-significant relationship between sleep quality and BMI ($P = 0.48$, r = 0.05, Table 3).

Table 1. Demographic Data of Students

Variables		Results
Age, Mean ± SD		21.4 ± 1.42
Gender, n (%)	Male	80 (41.9)
	Female	111 (58.1)
Marital status, n (%)	Married	12 (6.3)
	Single	179 (93.7)
Job status, n (%)	Working	18 (9.4)
	Not-working	173 (90.6)
Field of study, n (%)	Nursing	114 (59.7)
	Operating room	77 (40.3)

Note. SD: Standard deviation.

Discussion

The present research examined the relationship between BMI, sleep quality, and BP among undergraduate nursing and operating room students at Hamadan University of Medical Sciences in 2023.

The results showed that the status of BMI in undergraduate nursing and operating room students was normal. In agreement with the findings of the current study, Salem et al found that the body mass profile of medical science nursing students in Rafsanjan was in a normal state (20). Rokhzadi and Zehni also reported a normal body mass profile of Kurdistan Medical Students in their study (21). The results of the study by Momeni et al also confirmed that the body mass profile of Alborz University of Medical Sciences students was in a normal state (22). In their study, Mahmoud and Taha examined the BMI of nursing students and concluded that the BMI of these students was normal (23).

According to the findings of this study, the SBP and DBP measurements of nursing and operating room students at Hamadan University of Medical Sciences were within the normal range. Similarly, Abbaszaeh et al reported that the SBP of students living in the dormitories at Semnan University of Medical Sciences was also within normal limits (24). Similarly, Shinde et al investigated the BP status of medical students and demonstrated that the SBP and DBP of the students were normal (25). Likewise, Wright et al, evaluating the BP of African-American students in their study, reported that the BP of this group of students was in a normal state (26).

Table 2. Mean and SD Descriptions of Body Mass Index, Systolic Blood Pressure, Diastolic Blood Pressure and Sleep Quality in Students

Variable	Mean ± SD
BMI	22.88 ± 4.21
SBP	114.47 ± 9.35
DBP	75.22 ± 10
Sleep quality	8.75 ± 1.78

Note. SD: Standard deviation; SBP, Systolic blood pressure; DBP, diastolic blood pressure; BMI, body mass index.

Table 3. Correlation Between Systolic Blood Pressure, Diastolic Blood Pressure, Body Mass Index, and Sleep Quality in Students

Variable		SBP	DBP	BMI	Sleep Quality
SBP	r	1	-	-	-
	P value	-	-	-	-
DBP	r	0.234	1	-	-
	P value	0.001	-	-	-
BMI	r	0.207	0.13	1	-
	P value	0.004	0.07	-	-
Sleep quality	r	-0.15	-0.05	-0.05	1
	P value	0.03	0.44	0.48	-

Note. SBP, Systolic blood pressure; DBP, diastolic blood pressure; BMI, body mass index.

Concerning sleep quality, the findings of this study indicated that the sleep quality of undergraduate nursing and operating room students was in a poor state. Panahi et al also concluded that the sleep status of health students in medical sciences in Urmia was unfavorable, and the prevalence of sleepiness in these students was high (27). Moreover, Jahantigh et al studied the sleep quality of undergraduate students of medical sciences in Guilan and found an unfavorable state of sleep quality (28). In international studies, Alotaibi et al also confirmed that medical students experience poor sleep quality (29).

The results of this study revealed a positive and significant correlation between BMI and SBP among undergraduate nursing students in operating rooms. This suggests that an increase in BMI is associated with a rise in SBP. In agreement with the results of this study, Abbaszaeh et al reported a significant relationship between anthropometric indices and high BP (24). Additionally, Alhawari et al found a significant relationship between SBP and BMI in students (30). In addition, Isezuo et al observed a positive and significant relationship between BMI and BP in their research results (31). Kaushik and Chawla also reported a significant relationship between BMI and BP in Indian university students (32), which conforms to the results of the present study. To the best of our knowledge, there are no studies in the literature that contradict the findings of this research concerning the relationship between BMI and BP. Furthermore, this study did not identify any significant relationship between body mass and sleep quality among nursing students in the operating room. In agreement with the findings of this study, Afsari et al reported no significant relationship between BMI and sleep quality in military students (33). Contrary to the results of the present study, those of the research by Vargas et al demonstrated sleep disorders as a relative predictor of BMI (34). Wang et al also found a significant relationship between BMI and sleep quality in medical students (35). The difference between the findings of international and domestic studies in this area may be attributed to the generally better sleep quality of students abroad compared to their counterparts in the country. This disparity could influence the significance of the relationship between the two variables in question.

Further, the findings of this study demonstrated a significant inverse relationship between SBP and sleep quality among undergraduate nursing students and those in operating rooms. This suggests that as SBP rises, sleep quality tends to decline. In line with the results of this study, Aulia et al reported a significant relationship between BP and sleep quality of medical students (36). Contrarily, Irwan et al found no significant relationship between BP and sleep quality in students (37). Kushkestani et al also concluded that there was no significant relationship between BP and sleep quality in the community of Allameh Tabatabai students (38). The variation may likely stem from the differences between the communities of medical and non-medical science students. In studies examining the relationship between BP and sleep quality among medical science students, this relationship was found to be significant. It is also essential to recognize that a limitation of this research was the dependence on self-reported questionnaires, which can lead to potential inaccuracies and is beyond the researchers' control.

Conclusion

The findings revealed that a high BMI among operating room and nursing students may impact their sleep quality and BP levels. Given the results of this study, it is important to maintain a normal BMI to prevent students from developing chronic conditions and potentially affecting their academic performance. Accordingly, it is recommended that university officials and educational administrators implement appropriate plans encouraging students to engage in physical activities during their studies to ensure that their BMI remains within a healthy range.

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Authors' Contribution

Conceptualization and supervision: Arezou Karampourian and Reza Mohammadi; Data collection: Soheyla Zamanipaydar and Nazanin Cheloi; Methodology, funding acquisition and resources: Arezou Karampourian and Reza Mohammadi; Data analysis, investigation and writing: Arezou Karampourian and Reza Mohammadi

Competing Interests

There is no conflict of interests between the authors.

Ethical Approval

This research was approved by Hamadan University of Medical Sciences under registration number 140207045548 and the ethics code IR.UMSHA.REC.1402.467. All participants provided written informed consent before taking part in the study.

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