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The Effect of Sleep Deprivation on Blood Pressure Among Medical Students with Normal BMI

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Abstract

Sleep deprivation has become a growing health concern, particularly among medical students, due to academic pressure and irregular sleep patterns. Studies suggest that inadequate sleep may significantly impact blood pressure and irregular sleep patterns.

Studies suggest that inadequate sleep may significantly impact blood pressure levels, potentially leading to long-term cardiovascular complications.

This study was conducted to examine the association between sleep deprivation and high blood pressure among medical students with normal BMI and to emphasize the importance of getting adequate sleep to maintain optimal health and blood pressure levels.

This cross-sectional study was conducted over two months (October–December 2023) at Al-Iraqia Medical School, involving 106 third- and fourth-year medical students with normal BMI aged 20–22 years. Blood pressure measurements were taken using a mercury sphygmomanometer while participants were in a sitting position during college working hours. Participants were categorized into three groups based on their sleep duration: Group A: More than 6 hours of sleep, Group B: 4–6 hours of sleep, Group C: Less than 4 hours of sleep. The study adhered to American Heart Association (AHA) guidelines to classify blood pressure levels. Among the 106 participants (62 females, 44 males): Group A (>6 hours of sleep): 66.6% had normal BP, 26% had elevated BP, and 7.4% had Stage 1 hypertension. Group B (4–6 hours of sleep): 30% had normal BP, 40% had elevated BP, and 30% had Stage 1 hypertension. Group C (<4 hours of sleep): 10.6% had normal BP, 36.8% had elevated BP, and 52.6% had Stage 1 hypertension. A gender-based analysis showed that males in Group C exhibited a higher prevalence of Stage 1 hypertension (32%) compared to females (21%), indicating that the

demonstrates a strong association between sleep deprivation and elevated blood pressure in medical students with normal BMI. The findings indicate that reduced sleep duration significantly increases the risk of hypertension, particularly in males. These results highlight the importance of maintaining adequate sleep duration to prevent early onset of hypertension and associated cardiovascular risks.

Keywords
Sleep Deprivation, Blood Pressure, Medical Students, BMI

Introduction
The World Health Organization (WHO) defines high blood pressure (hypertension) as a condition where the pressure in the blood vessels is too high (140/90 mmHg or higher). Globally, an estimated 1.28 billion adults aged 30–79 years suffer from hypertension, with two-thirds residing in low- and middle-income countries. Alarmingly, only 21% of adults with hypertension have their condition under control. Many individuals with hypertension may not experience symptoms, making regular blood pressure monitoring essential (1).

Sleep deprivation, also known as sleep insufficiency or sleeplessness, is characterized by insufficient sleep duration and/or quality, which affects alertness, performance, and overall health. It is estimated that 50 to 70 million Americans suffer from chronic sleep disorders (2).

According to the Centers for Disease Control and Prevention (CDC), 1 in 3 adults in the United States reports not getting enough sleep daily. Hypertension and sleep deprivation (or insomnia) are highly prevalent conditions that often coexist. Studies suggest that the increasing prevalence of hypertension in the past decade may be linked to modern lifestyle changes, reduced sleep duration, and a rise in insomnia cases.

Evidence Linking Sleep Deprivation to Blood Pressure

A 2013 study involving 42 healthy volunteers (18 males, mean age 30.0 ± 4.5 years) found that peripheral systolic blood pressure, peripheral pulse pressure, and cardiac output were significantly elevated after a night of sleep deprivation compared to a night of regular sleep ($p = 0.032$, 0.007, and 0.003, respectively) (3).

Similarly, a 2011 study examined 8 young adults (mean age 24 years, range 20-28 years) and 8 elderly adults (mean age 64.1 years, range 60-69 years). The study hypothesized that a short sleep duration (<3 hours per night for 7 consecutive days) during night shift work might influence BMI, blood pressure, and pulse wave analysis (PWA) (4-5).

Findings revealed that among individuals with restricted sleep, sleepiness significantly increased by the 4th and 7th day compared to normal sleepers. Furthermore, apart from diastolic blood pressure (DBP), there was a notable rise in heart rate (HR), systolic blood pressure (SBP), pulse pressure (PP), and mean arterial pressure (MAP) by the 7th day of sleep restriction (6).

Additionally, the study found that sleep deprivation significantly increased both systolic and diastolic blood pressure in elderly individuals, but not in young adults. Moreover, sleep deprivation reduced the systolic blood pressure orthostatic response in both age groups (7).

This study was conducted to:

- Examine the association between sleep deprivation and high blood pressure among medical students with normal BMI.
- Emphasize the importance of getting adequate sleep to maintain optimal health and blood pressure levels.

Materials &Methods

Study Design

This study was a cross-sectional study conducted over a duration of two months (from October to December 2023).

Participants and Setting

The research was conducted at Al-Iraqia Medical School among third- and fourth-year medical students with normal BMI.

The age group of the participants ranged between 20–22 years.

Data Collection Method

Blood pressure measurement was performed using a direct blood pressure test method with a mercury sphygmomanometer.

Measurements were taken while volunteers were in a sitting position within the medical college building during college working hours.

Source of Information

The primary source of data was medical students in the third and fourth years, within the specified age group.

Blood Pressure Classification

This study adhered to the American Heart Association (AHA) guidelines to define blood pressure categories:

Blood Pressure Category	Systolic BP (mmHg)	Diastolic BP (mmHg)
Normal BP	<120	<80
Elevated BP	120-129	<80
Stage1 Hypertension	130-139	80-89

Questionnaire

The following parameters were recorded for each participant:

1. Demographics (Gender, Age, Height, Weight)
2. Sleep Duration (Hours of sleep in the previous night)
3. BMI Calculation (Derived from height and weight using standard BMI formula)
4. Height was measured using a tape measure.
5. Weight was recorded using a digital scale.
6. BMI was calculated based on the recorded values.

Results

Sample Size and Characteristics

- Total Participants: 106 Medical Students
- Gender Distribution: 62 Females, 44 Males
- Age Range: 20–22 years
- BMI: Normal

Sleep Duration Classification

The participants were divided into three groups based on sleep duration:

- Group A: More than 6 hours of sleep
- Group B: Between 4–6 hours of sleep
- Group C: Less than 4 hours of sleep

Table 1: Distribution of Blood Pressure by Sleep Duration

Blood Pressure Analysis by Group

Group A: More than 6 hours of sleep

- Normal Blood Pressure: 66.6%
- Elevated Blood Pressure: 26%
- Stage 1 Hypertension: 7.4%

Group B: 4–6 hours of sleep

- Normal Blood Pressure: 30%
- Elevated Blood Pressure: 40%
- Stage 1 Hypertension: 30%

Group C: Less than 4 hours of sleep

- Normal Blood Pressure: 10.6%
- Elevated Blood Pressure: 36.8%
- Stage 1 Hypertension: 52.6%

Blood Pressure	Group A (>6 hrs)	Group B (4-6 hrs)	Group C (<4 hrs)	Total
Normal	18	18	2	38
Elevated	7	24	7	38
Stage 1 Hypertension	2	18	10	30
Total	27	60	19	106

Blood Pressure Distribution by Sleep Duration

Blood Pressure	Male	Female	Total
Normal	18.5%	48.2%	38
Elevated	14.8%	11%	38
Stage 1 Hypertension	7.4%	0%	30

Gender-Based Analysis

Table 2: Comparison of Blood Pressure by Gender

Group A (>6 hours sleep):

- No female participants had Stage 1 hypertension.
- 7.4% of males had Stage 1 hypertension.

Group B (4-6 hours' sleep):

- Normal Blood Pressure: 5% (Male), 25% (Female)
- Elevated Blood Pressure: 20% (Male), 20% (Female)
- Stage 1 Hypertension: 17% (Male), 13% (Female)

Group C (<4 hours sleep):

- No males had normal blood pressure.
- Elevated Blood Pressure: 10.5% (Male), 26% (Female)
- Stage 1 Hypertension: 32% (Male), 21% (Female)

Discussion

This study shows a significant elevation in blood pressure in young adults, which contrasts with findings from the Sleep -Research Society

study (8-9), which stated that elevated blood pressure was more prominent in elderly patients.

Our study supports findings from the Sleep and Cardiovascular Disease study (10-11), which confirms a direct relationship between sleep deprivation and elevated blood pressure.

Conclusion

There appears to be a clear association between blood pressure levels and sleep duration.

The effect of sleep deprivation on blood pressure is more significant in males than in females.

Recommendations

1. Medical professionals should emphasize the importance of adequate sleep in maintaining normal blood pressure and overall health.
2. Public awareness campaigns should be launched in collaboration with the media to highlight the negative impact of sleep deprivation on blood pressure.
3. Further research should be conducted to explore the long-term effects of sleep deprivation on cardiovascular health.

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