

Study on Diurnal Variation of Blood Pressure Pattern among College Students from 18 to 25 Years in Gauhati Medical College

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Abstract: ***Introduction:** Blood pressure varies according to many internal and external factors, and behavioral factors have an important role in diurnal BP variation. BP rises sharply on waking in the morning and falls during sleep at night, although it varies throughout the day and night. These changes in BP are closely related to mental and physical activities. Other behavioral factors, such as food consumption and obesity, dietary intake of sodium, drinking and smoking habits, consumption of coffee and tea also influence variation in blood pressure. High blood pressure in adolescents is now a growing health problem. Elevated blood pressure during adolescence increases the chance of hypertension in adulthood. **Aim And Objectives:** To study the diurnal variation of blood pressure pattern among college students from 18 to 25 years in Gauhati Medical College. **Materials And Methods:** This is a cross-sectional study conducted among 220 students of ages 18 to 25 in the department of Physiology of Gauhati Medical College from the period August 2023 to August 2024. **Results:** In most students, blood pressure presents a morning increase and deeper descent during nocturnal rest. Physical and mental stress also elevates blood pressure during the day time. **Conclusion:** The diurnal variation of blood pressure are closely related to mental and physical activities. Obesity, alcohol consumption, smoking increases daytime blood pressure without altering night time blood pressure. Understanding these changes in blood pressure caused by behavioral factors is important and leads to better management of hypertension.*

Keywords: Blood pressure, Obesity, Smoking

1. Introduction

High blood pressure once considered rare in adolescents is now a growing health problem. It is usually asymptomatic in adolescents. The term blood pressure refers to the pressure of blood against the walls of the arteries which results from two forces: one created by the heart as it pumps blood into the arteries through the circulatory system and the second one is the force resist the blood flow (1)

BP generally varies according to a circadian rhythm characterized by a reduction during sleep and an increase during wakefulness (2)

Medical education can be imposed serious psychological stress for students at the time. It can lead to increased stress and anxiety, poor academic achievement, drug dependence, impact, loss of interpersonal relationships and medical lessons, reduced self-esteem, and suicidal tendencies. Excessive unresolved stress may lead to physical and mental health problems in medical students. (3) Prolonged exposure to psychological stress can lead to blood pressure (BP) derangements and finally to hypertension. [4]

Aim of the Study

The aim of this study is to study the diurnal variation of blood pressure pattern among college students from 18 to 25 years in Gauhati Medical College.

Objectives

- To determine any difference of blood pressure between the genders.
- To assess the factors associated with blood pressure.

2. Materials and Methods

The design of the study is cross-sectional.

- 1) **Study group:** Students aged 18 to 25 irrespective of gender, race and religion studying in Gauhati Medical College and Hospital.
- 2) **Sample size:** 220 (two hundred twenty)
Male: 130
Female: 90
- 3) **Study period:** August 2023 to August 2024

Inclusion criteria:

- Subjects should be students of GMCH.
- Subjects should be of the age group 18-25 years
- Those who agreed to give the consent

Exclusion criteria

- Subjects who refused to give the consent for the study.
- Who are taking anti-hypertensive drugs

Collection of data:

- Blood pressure will be measured by an aneroid sphygmomanometer.
- The subject was kept at physical rest and in relaxed position for at least 10 minutes.
- The recording of blood pressure was done in sitting position on the right arm of the subject and the instrument was kept at the heart level (5)
- As recommended by American Society of Hypertension, the systolic blood pressure was taken as the appearance of Korotkoff sound and the disappearance of the sound was taken as the diastolic pressure. (6)

- The first reading will be taken around 6.30-8 am in the morning before class and the second reading will be taken around 6.30-8 pm after the evening class.

Statistical analysis

- The statistical analysis done using IBM SPSS Statistics-version 28.0.1.
- The standard guidelines of BLOOD PRESSURE classification by JNC8 will be followed through the study. (7)

| Classification | Systolic BP | | Diastolic BP |
|-----------------------|-------------|-----|--------------|
| Normal | <120 | And | <80 |
| Prehypertension | 120-139 | or | 80-89 |
| Stage1 | 140-159 | or | 90-99 |
| Stage2 | >=160 | or | >=100 |
| Isolated Systolic HTN | >=140 | And | <90 |

3. Results and Observation

Gender Distribution

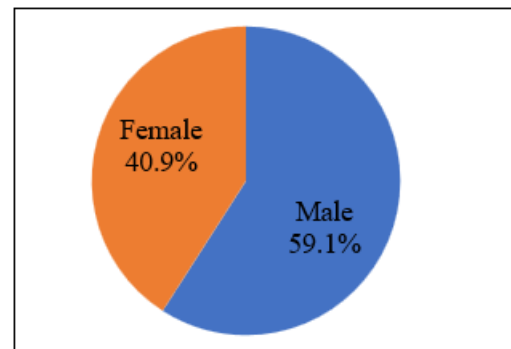


Figure 1: Shows gender distribution

Diurnal variation of blood pressure

Table 1: Shows diurnal variation of blood pressure

| Classification | Morning | Evening |
|-----------------|---------|---------|
| Normal | 213 | 207 |
| Prehypertension | 6 | 12 |
| Stage 1 | 1 | 1 |
| Stage 2 | - | - |

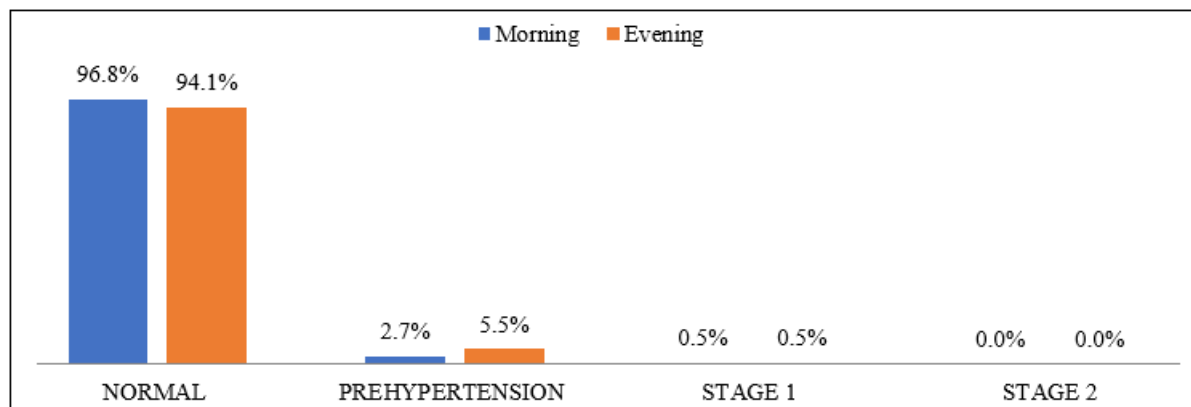


Figure 2: Shows diurnal variation of blood pressure

Variation with gender:

Table 2: Shows variation of blood pressure with gender

| | Male | Male | Female | Female |
|-----------------|---------|-----------|---------|-----------|
| | Morning | Afternoon | Morning | Afternoon |
| Normal | 125 | 120 | 88 | 87 |
| Prehypertension | 4 | 9 | 2 | 3 |
| Stage 1 | 1 | 1 | - | - |
| Stage 2 | - | - | - | - |

Relation to stress

Table 3: Shows variation of blood pressure due to stress.

| Classification | Before Examination | After Examination |
|-----------------|--------------------|-------------------|
| Normal | 207 | 209 |
| Prehypertension | 12 | 10 |
| Hypertension | 1 | 1 |

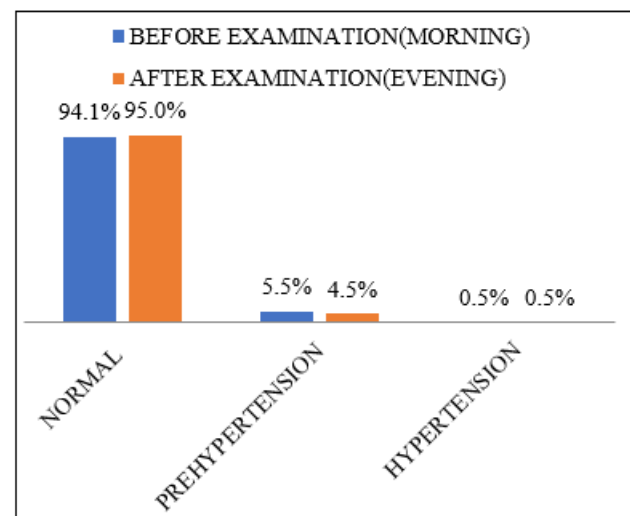


Figure 3: Shows variation of blood pressure due to stress

Relation to substance abuse

Table 4: Shows variation of blood pressure due to substance abuse

| Classification | Substance Abuse | Substance Not Abuse |
|-----------------|-----------------|---------------------|
| Normal | 62 | 151 |
| Prehypertension | 3 | 4 |
| Hypertension | - | - |

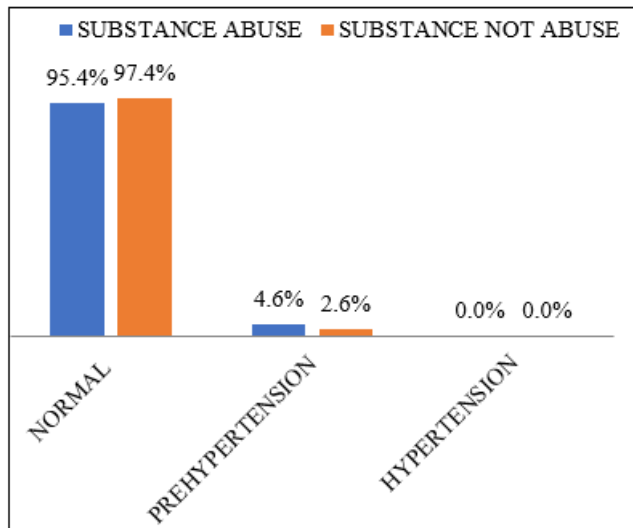


Figure 4: Shows variation of blood pressure due to substance abuse

4. Discussion

In our study it is found that 2.72 % are in the prehypertensive state in the morning where it increases to 5.45% in the evening. The study showed clear **diurnal variation** in blood pressure. In the overall group, normal BP declined slightly from morning (96.8%) to evening (94.1%), while **prehypertension nearly doubled** (2.7% → 5.5%). This reflects the natural rise in BP later in the day due to activity and sympathetic drive.

Gender variation indicated that males had a greater evening rise (prehypertension 3.1% → 6.9%) compared to females (2.2% → 3.3%). This suggests that young men may be more vulnerable to stress-related or behavioral BP increases.

Charts relating to **stress** revealed that before examinations, more students were prehypertensive (5.45%) compared to after (4.55%), showing that **anticipatory stress** temporarily elevates BP even in healthy youth. Mental stress elevates BP during the day time and may cause daytime hypertension

With **substance abuse**, users had a higher proportion of prehypertension (4.6%) compared to non-users (2.6%). Although the difference is small, it highlights how smoking, alcohol, or stimulants can worsen diurnal BP variation. Smoking habit is also associated with an increase in the morning - evening BP difference.

The prevalence of hypertension in male youth was 1.6% in a study conducted in Singapore Pyle et al (8). observed that

13.4% had elevated blood pressure showing an association with male gender ⁽⁹⁾.

5. Conclusion

This study demonstrates that even in apparently healthy young adults, blood pressure shows a clear **diurnal variation**, with a higher prevalence of prehypertension in the evening compared to the morning. The variation was more pronounced in males, indicating a possible gender predisposition to early blood pressure elevation. Additionally, **academic stress** and **substance use** were associated with unfavorable shifts in blood pressure, underscoring the role of modifiable behavioral factors.

Although the overall prevalence of hypertension was low, the presence of prehypertension in a significant proportion of students highlights the importance of **early detection, stress management, and lifestyle interventions** in this age group. Regular monitoring of blood pressure in young adults, especially during high-stress periods and among those with substance use, may help prevent the progression to sustained hypertension later in life

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