A RELATIONSHIP BETWEEN BMI AND BLOOD PRESSURE AMONG FIRST YEAR MBBS STUDENTS OF MYSORE MEDICAL COLLEGE AND RESEARCH INSTITUTE
Lohith Rao Jadav¹, K. S. Tejaswini², Revathi Devi M. L³

HOW TO CITE THIS ARTICLE:

ABSTRACT: AIMS & OBJECTIVE: To evaluate relationship between BMI and Blood Pressure among 1ST Year M.B.B.S. students of Mysore medical college. METHODOLOGY: A total of 126 students, 79 males and 47 females participated in the study conducted between June and July 2014 at Mysore Medical College. All students were divided into underweight, normal, over weight according to Western Pacific Regional Organization 2000 (WPRO) BMI classification. Hypertension was determined from the measurement of Blood pressure (BP). Comparison of blood pressure among different groups was made by ANOVA. RESULTS: Their mean age was calculated to be 18.6 years. Among students 23.8% were overweight and 22.2% were underweight while rest had normal BMI. A consistent increase was seen in the prevalence of hypertension in Underweight, Normal, Overweight Mean values of systolic BP (110.9, 114.3, 124.0 mmHg) and diastolic BP (76.2, 74.0, 78.4 mmhg) also increased with increasing BMI. CONCLUSION: The present study tested the hypothesis that there is a significant correlation between BMI with SBP, MBP & RRP.

KEYWORDS: Blood Pressure, BMI.

INTRODUCTION: Hypertension is a medical condition in which the blood pressure is chronically elevated.(¹) It is usually found incidentally by health care professionals measuring blood pressure during routine checkup. In isolation, it usually produces no symptoms although some people do report symptoms during onset or before HTN is diagnosed.(²) Although no specific medical cause can be determined in essential HTN, it often has several contributing factors which include obesity, salt sensitivity, renin homeostasis, insulin resistance, genetics and age. It is also strongly correlated with BMI.(³)

As per the World Health Organization report 2013 on Hypertension. The largest proportion of Non communicable disease deaths is caused by cardiovascular disease. In terms of attributable deaths, raised blood pressure is one of the leading behavioural and physiological risk factor. Hypertension is reported to be the fourth contributor to premature death in developed countries.(⁴) The increasing prevalence of hypertension Is attributed to population growth, ageing and behavioural risk factors, such as unhealthy diet, harmful use of alcohol, lack of physical activity, excess weight and exposure to persistent stress.

Body Mass Index (BMI) is a simple index of weight-for-height that is commonly used to classify underweight, overweight and obesity in adults. It is defined as the weight in kilograms divided by the square of the height in metres (kg/m²).(¹) BMI values are age-independent and the same for both sexes. However, BMI may not correspond to the same degree of fatness in different populations due, in part, to different body proportions. The health risks associated with
increasing BMI are continuous and the interpretation of BMI gradings in relation to risk may differ for different populations.\(^5\)

Obesity has been shown to be an independent risk factor for cardiovascular mortality and an indirect risk factor because of its effect on hypertension, diabetes, and dyslipidaemia.\(^6\)\(^,\)\(^7\)

The knowledge of the effect of obesity on hypertension is very important as it is a modifiable risk factor. Associations between body mass index (BMI) and blood pressure (BP) have been consistently observed, but remain poorly understood.\(^8\)

Despite the consistency with which this correlation is observed, mechanistic explanations for the phenomenon are still being debated, and no biological model of the process has been established.\(^9\)

The recognition of obesity (As assessed by BMI) in the present study as important factors associated with increased risk of developing elevated BP among subjects may help target prevention towards high-risk individuals in this age group. In the present study, we tested the Hypothesis that there is a correlation between BMI and BP indices viz Systolic pressure (SBP), Diastolic pressure (DBP), Mean pressure (MBP), Heart rate (HR), Rate pressure product (RPP) in apparently healthy adolescents.\(^10\)

**MATERIALS AND METHODS:** The study sample consists of 126 subjects in the age group of 18-19 yrs. from first year MBBS. MMC & RI. Informed consent was taken. Ethical committee approval was also taken. The measurements of height and Weight were taken. BMI calculated by Weight (Kg)\(^/\)\{Height (m)\}\(^1\) Blood pressure readings were taken at sitting position at left arm using digital sphygmomanometer.

Based on BMI subjects were classified as underweight, Normal weight and Overweight.

None of the subjects were taking any medication and none had a significant medical history. All of them had a normal Physical examination. Subjects with History and or clinical evidence of acute medical illnesses were excluded.\(^2\)

Descriptive Statistics, Product Moment Correlation, 1Way Annova, 2 Way ANOVAs were used as statistical analysis.

**RESULTS:** The study population consisted of 126 1\(^{st}\) year M.B.B.S students of Mysore medical college and Research Institute. We Included 79 males and 47 females. The mean age of the subjects were 18.6yrs. Among them 28 were Under Weight, 68 were Normal Weight and 30 were Over Weight as per the Western Pacific Regional Organization (WPRO) BMI classification.

Comparison of parameters between males and females, showed that MBP, SBP, RPP, were significantly higher in Males. Mean values of systolic (110.9, 114.3, 124.0mmHg) and diastolic BP (76.2, 74.01, 78.4 mmHg) were found to be higher as the BMI increased In Underweight, Normal weight and Overweight respectively.

When bivariate correlation analysis was done systolic BP, Mean BP, RRP had positive correlation with BMI. No significant association of DBP with BMI was seen.

Correlation Coefficient of MNBP (0.240), SBP (0.360), RRP (0.207) p (<0.05)

These variables also showed a positive correlation among themselves also.
<table>
<thead>
<tr>
<th>GROUP</th>
<th>MEAN BMI</th>
<th>NO. OF PATIENTS</th>
<th>MALE</th>
<th>FEMALE</th>
</tr>
</thead>
<tbody>
<tr>
<td>I UNDER WEIGHT</td>
<td>18.5</td>
<td>28</td>
<td>23</td>
<td>5</td>
</tr>
<tr>
<td>II NORMAL WEIGHT</td>
<td>18.5-22.9</td>
<td>68</td>
<td>36</td>
<td>32</td>
</tr>
<tr>
<td>III OVER WEIGHT</td>
<td>&gt;23</td>
<td>30</td>
<td>20</td>
<td>10</td>
</tr>
</tbody>
</table>

**TABLE 1: DEMOGRAPHIC PROFILE OF STUDY SUBJECTS**

<table>
<thead>
<tr>
<th></th>
<th>MALES</th>
<th>FEMALES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MEAN</td>
<td>SD</td>
</tr>
<tr>
<td>UNDERWEIGHT</td>
<td>111.3043</td>
<td>14.172</td>
</tr>
<tr>
<td>NORMALWEIGHT</td>
<td>119.0278</td>
<td>8.1853</td>
</tr>
<tr>
<td>OVERWEIGHT</td>
<td>129.05</td>
<td>13.547</td>
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</table>

**TABLE 2: SYSTOLIC BLOOD PRESSURE**

<table>
<thead>
<tr>
<th></th>
<th>MALES</th>
<th>FEMALES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MEAN</td>
<td>SD</td>
</tr>
<tr>
<td>UNDERWEIGHT</td>
<td>76.21</td>
<td>10.15</td>
</tr>
<tr>
<td>NORMALWEIGHT</td>
<td>75.19</td>
<td>7.35</td>
</tr>
<tr>
<td>OVERWEIGHT</td>
<td>80.6</td>
<td>12</td>
</tr>
</tbody>
</table>

**TABLE 3: DIASTOLIC BLOOD PRESSURE**

![Fig. 1: MEAN OF SBP AT DIFFERENT BMI](image-url)
MALES | FEMALES
---|---
UNDERWEIGHT | 86.26 | 12.359 | 87.8 | 8.78
NORMALWEIGHT | 90.08 | 6.69 | 84.31 | 8.197
OVERWEIGHT | 95.5 | 11.803 | 87.3 | 8.084

TABLE 4: MEAN BLOOD PRESSURE
MALES | FEMALES
---|---
**MEAN** | **MEAN** | **SD** | **SD**
UNDERWEIGHT | 10051.09 | 2320.153 | 10617.6 | 2262.099
NORMALWEIGHT | 10435.31 | 1426.949 | 10249.72 | 2047.703
OVERWEIGHT | 11403.55 | 2604.926 | 10414.5 | 2777.927

**TABLE 5: RATE PRESSURE PRODUCT**

**DISCUSSION:** In this study, we examined the relationship between BMI and BP among the first year MBBS students of Mysore Medical College and Research Institute. There was a Significant Positive co-relation of BMI with SBP,$^{(11)}$ MBP,$^{(12)}$ and RPP.$^{(12)}$ Even though there was a slight increase in values of DBP, it didn't show significant co-relation. In both males and females, we found that SBP and DBP were highest in overweight subjects, intermediate in normal weight subjects and least in underweight subjects.$^{(10)}$ This is possibly due to differences in sympathetic tone between underweight and overweight subjects.$^{(13)}$ and also due to factors like Socio Economic Factors, Cultural Factors, Genetic factors, Physical activity, Salt Consumption, Alcohol consumption and Smoking.$^{(14)}$ Obesity is associated with Insulin resistance and Hyper Insulinemia is associated with excessive sympathetic activity.$^{(15)}$ The observed differences between the males and females of Under Weight, Normal Weight, and Over Weight possibly may be due to differences in Cardiovascular Autonomic control and Energy Metabolism.$^{(10)}$ Our results support that the higher BP in overweight subjects is due to heightened sympathetic vascular tone.$^{(10)}$
Interpreting the blood pressure–BMI relationship is further complicated by the suggestion from some studies of a threshold effect below which there appears to be no correlation between the variables.\(^{(16)}\)

Some of these studies have relatively small samples and therefore limited power to detect a true relationship.\(^{(17)}\)

In addition to greater fat stores and its associated direct metabolic consequences, persons with higher BMI values consume more sodium\(^{(18}, (19)}\) and engage in less physical activity.\(^{(20)}\)

Assuming that arterial compliance was not different between the groups, this suggests that stroke volume is also similar. Also, HR was similar. Thus, we have indirect evidence that cardiac output is not significantly different between the three groups. Thus, differences in BP could be largely due to differences in total peripheral resistance, which in turn is greatly influenced by tonic sympathetic control of resistance vessels. Our results indirectly suggest that the higher BP in overweight subjects is due to heightened sympathetic vascular tone.\(^{(8)}\)

REFERENCES:

5. WHO BMI DATABASE.
10. Dr. Ravishankar P, Dr. Madan Mohan, Dr. Kaviraja udupa, Dr. Sankaranarayanan Correlation between body mass index and blood pressure indices, handgrip Strength and Handgrip Endurance in Underweight, Normal Weight and Overweight adolescents. Indian journal Physiol Pharmacol 2005 ;49(4):455-461.