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**RESEARCH ARTICLE**

# A cross sectional study of relationship of body mass index with blood pressure in obese & non-obese.

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## *Abstract*

Background: Obesity leads to morbidity as well as mortality. There is usually increased level of total cholesterol, LDL- cholesterol, VLDL- cholesterol, triglycerides and decreased level of HDL- cholesterol in obesity. These are the risk factors for cardiovascular disease, hypertension, diabetes mellitus, pulmonary disorder and gall stones. Method: In this cross sectional study conducted at out patients department & patients admitted in GGH General Hospital, Jamnagar between May 2012 and April 2013, a total of 105 patients were included. Obesity index BMI measured using standard protocol. Both systolic & diastolic Blood pressure measured using standard techniques. Result: significant raised in systolic & diastolic blood pressure noted in obese as compare to non obese. In conclusion, elevation in blood pressure is more in obese as compare to non obese. There is a significant correlation between various blood pressure parameters and body mass index.



## Introduction

Obesity is the condition of abnormal or excessive fat accumulation in adipose tissue, to the extent that health may be impaired.[1] Obesity can be seen as the first wave of defined cluster of noncommunicable disease called "New World Syndrome" creating an enormous socioeconomic and public health burdens in poorer countries. The WHO has described obesity as one of today's most neglected public health problem, affecting every region of the globe.[2].

BMI (weight in kilograms divided by the square of the height in meters) is promulgated by the WHO as the most useful epidemiological measure of obesity. It is nevertheless a crude index that does not take into account the distribution of body fat, resulting in variability in different individuals and populations.[3]

As India and many other countries in south-east Asia are currently going through the so called "nutrition transition" which is associated with a change in the structure of the diet, reduced physical activity and rapid increase in the prevalence of obesity. [4] Hypertension in youth is associated with obesity.[5] It is speculated that obesity may be the strongest modifiable risk factor for hypertension[6]

Because the prevalence of hypertension in normal weight is low, the question arises whether body mass index (BMI)-for-age can be used to identify youth at highest risk for hypertension. This information can be used to target a high-risk population for BP screening

In this study attempt has been made to correlate blood pressure with BMI among the overweight and obese subjects

## Material and Methods

This study was a hospital based cross sectional descriptive study conducted in G.G.H. Hospital, Jamnagar between May 2011 and May 2013.

Subjects were recruited according to simple random sampling method meeting the selection criteria.

**Inclusion criteria:**

A subject who have Body Mass Index (BMI) > 18.5 kg/m2, Age more than 20 years, both male and female,

No. of subjects to be included in study : Total 105.They were divided into 3 groups according to BMI Group I - Normal weight (18.5 to 24.9 kg/m2) ,Group II - Overweight (25 to 29.9 kg/m2) Group III - Obese (more than 30 kg/m2)

**Exclusion criteria:**

Subjects who were come in OPD & IPD for taking treatment and routine check up and were known case of obesity secondary to hypothyroidism, Cushing's syndrome, Hypothalamic disease, Pregnant women. weight gain due to fluid retention but not due to fat like in congestive cardiac failure, renal failure, cirrhosis with ascitis.

Subjects were explained the purpose and protocol of the study. After informed consent BMI & blood pressure measured.BMI is measured by formula =body weight in (kg)/height in meter2

**Statistics**

Mean & SD were calculated. Unpaired student's 't' test was applied to test difference between means. Pearson Correlation co-efficient (r) was calculated to test correlation between parameters. Statistical significance was accepted at P value of <0.05.

## Result

The study was carried out on 105 subjects, out of which 55 were male and 50 were female.

The subjects were divided into three groups according to their body mass index and each group contains 35 subjects.

Group – I : Normal weight (18.5 - 24.9)

Group – II : Overweight (25.0 - 29.9)

Group – III : Obese (> 30.0)

**TABLE -1 mean value of age & BMI..**

| GROUP | No. of Subjects | Age (years) | | BMI (kg/m2) | |
|---|---|---|---|---|---|
| | | Mean | ± SD | Mean | ± SD |
| I | 35 | 39.37 | 10.76 | 22.40 | 2.10 |
| II | 35 | 42.63 | 10.57 | 27.70 | 1.34 |
| III | 35 | 49.05 | 8.57 | 33.62 | 1.81 |

**TABLE NO.2 Systolic blood pressure (SBP)**

| Systolic Blood Pressure (mmhg) | Group-I | | Group-II | | Group-III | |
|---|---|---|---|---|---|---|
| | No. | % | No. | % | No. | % |
| **< 120** | 15 | 42.86 | 3 | 8.57 | 2 | 5.71 |
| **120- 139** | 20 | 57.14 | 27 | 77.14 | 19 | 54.29 |
| **140 – 159** | 0 | 0 | 5 | 14.29 | 12 | 34.29 |
| **≥ 160** | 0 | 0 | 0 | 0 | 2 | 5.71 |
| **Total** | 35 | 100 | 35 | 100 | 35 | 100 |

**TABLE NO.3 Diastolic blood pressure (DBP)**

| Diastolic Blood Pressure (mmhg) | Group-I | | Group-II | | Group-III | |
|---|---|---|---|---|---|---|
| | No. | % | No. | % | No. | % |
| **< 80** | 15 | 42.86 | 5 | 14.29 | 1 | 2.86 |
| **80- 89** | 20 | 57.14 | 27 | 77.14 | 23 | 65.72 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **90 – 99** | 0 | 0 | 3 | 8.57 | 9 | 25.71 |
| **≥ 100** | 0 | 0 | 0 | 0 | 2 | 5.71 |
| **Total** | 35 | 100 | 35 | 100 | 35 | 100 |

**TABLE NO.4 MEAN VALUE OF BLOOD PRESSURE PARAMETERS**

| **Parameters** | **GROUP I** | | **GROUP II** | | **GROUP III** | |
|---|---|---|---|---|---|---|
| | **Mean** | **± SD** | **Mean** | **± SD** | **Mean** | **± SD** |
| **SBP** | 119.37 | 6.65 | 126.40 | 8.94 | 134.68 | 13.95 |
| **DBP** | 78.34 | 3.74 | 81.88 | 4.57 | 85.94 | 7.18 |
| **PP** | 41.03 | 3.58 | 44.51 | 5.75 | 48.74 | 7.93 |
| **MAP** | 92.02 | 4.60 | 96.72 | 5.77 | 102.19 | 9.24 |

According to above table, mean value of all blood pressure parameters like systolic, diastolic, pulse and mean arterial pressure are higher in overweight and obese subjects as compared to normal weight subjects

**TABLE NO. 5 CORRELATION COEFFICIENT BETWEEN BLOOD PRESSURE AND BODY MASS INDEX**

| | **Correlation Coefficient r** | **p** | **95% CI for r** |
|---|---|---|---|
| **SBP** | 0.6002 | < 0.0001 | 0.46 – 0.71 |
| **DBP** | 0.5656 | < 0.0001 | 0.42 – 0.68 |
| **PP** | 0.5494 | < 0.0001 | 0.40 – 0.67 |
| **MAP** | 0.5945 | < 0.0001 | 0.45 – 0.70 |

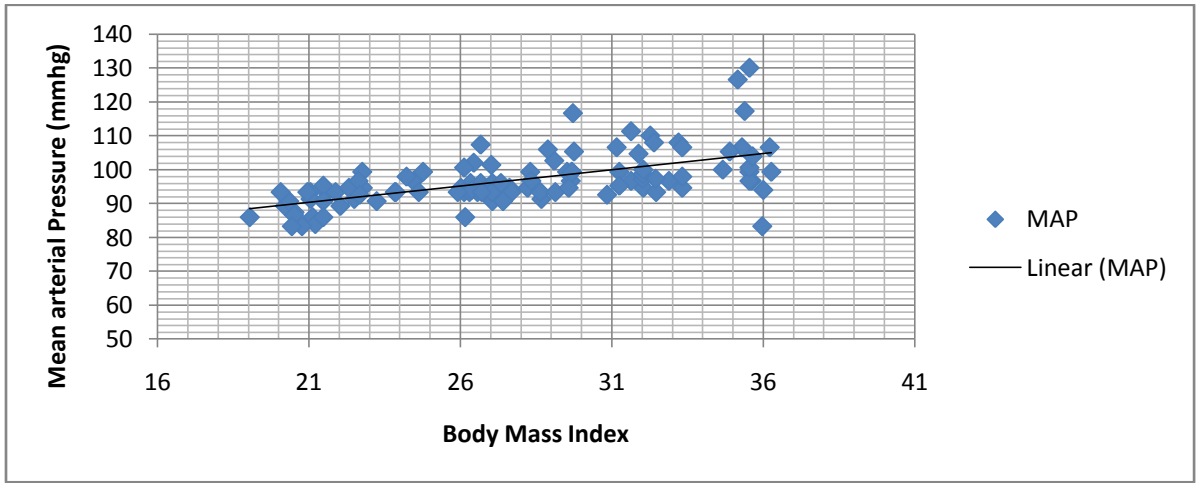
Above table shows correlation between body mass index and blood pressure parameters and p value is < 0.05, so there is highly significant correlation between body mass index and blood pressure parameters

**TABLE NO. 6 COMPARISION BETWEEN NON-OBESE SUBJECTS AND OBESE SUBJECTS**

| **Parameters** | **Non obese (Group I+II)** | **Obese (Group III)** | **t-test** | **p value** |
|---|---|---|---|---|
| **SBP** | 122.88 | 134.68 | 5.349 | < 0.0001*** |
| **DBP** | 80.11 | 85.94 | 5.087 | < 0.0001*** |
| **PP** | 42.77 | 48.74 | 4.687 | < 0.0001*** |
| **MAP** | 94.37 | 102.19 | 5.348 | < 0.0001*** |

***** p < 0.01 = Significant**

**SCATTERED DIAGRAM SHOWS RELATION BETWEEN BODY MASS INDEX AND MEAN ARTERIAL PRESSURE**




This scattered chart suggests that there is linear relationship between body mass index and mean arterial pressure. So as the BMI increased this is associated with increased in mean arterial pressure**.**

**Table -7 CORRELATION COEFFICIENT BETWEEN BLOOD PRESSURE AND BODY MASS INDEX**

| STUDY | SBP | DBP | P value |
|---|---|---|---|
| Roberta SL Cassani et al.[9] | 0.33 | 0.39 | < 0.001 |
| Nanaware NL et al.[10] | 0.81 | 0.72 | < 0.001 |
| Dyer AR et al.[11] | 0.77 | 0.58 | < 0.001 |
| Present Study | 0.60 | 0.56 | < 0.001 |

## DISCUSSION

Obesity may increase the risk of many diseases such as diabetes, atherosclerosis, hypertension, hyperlipidemia, gall bladder diseases and cardiovascular diseases. The metabolic defects that ensue in obesity include increased levels of free fatty acids resulting from insulin resistance, increased LDL-cholesterol, VLDL and triglycerides and decrease in HDL-cholesterol.

In this study, total 105 subjects of different age group are taken. The value of each parameter was discussed between three groups and also with other studies.

In the present study, the mean value of systolic and diastolic blood pressure is significantly higher in overweight and obese subjects than in normal weight subjects.

Similar study conducted by Renu Lohitashwa et al. [8]on first year medical and dental students of 17 – 20 years age group enrolled in the academic years 2008– 09 and 2009 – 10 to J. N. Medical College, Belgaum found significantly higher mean value of systolic and diastolic blood pressure in overweight and obese subjects as compared to normal weight subjects and that is comparable with present study.

However study conducted by Huber AR et al. [9]also found significantly higher mean value of systolic and diastolic blood pressure in overweight and obese subjects as compared to normal weight subjects.

Above table shows correlation coefficient between blood pressure and body mass index, which is highly significant in present study. Similar studies conducted by Roberta SL Cassani et al.[9], Nanaware NL et al.[10] and Dyer AR et al. [11]also found highly significant correlation between body mass index and blood pressure.

## CONCLUSION

The mean values of systolic blood pressure, diastolic blood pressure, pulse pressure and mean arterial pressure are more in obese subjects as compared to non-obese subjects. There is a significant correlation between various blood pressure parameters and body mass index in this study. From the present study, it is concluded that overweight and obese subjects are at greater risk of development of hypertension. Large sample size would be more conclusive & needed for better correlation

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