



**A COMPARATIVE STUDY OF BMI AND BLOOD PRESSURE DIFFERENCES BETWEEN DIABETICS AND NON DIABETICS**

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**ABSTRACT**

Hypertension and diabetes mellitus are independent risk factors for various vascular diseases. It is seen that diabetes mellitus affects the blood vessels and their function. Result of similar studies in our region is not available. So this study was taken up to study the effect of type 2 diabetes mellitus on arterial blood pressure. The study was conducted on 150 study subjects, 75 were previously diagnosed type 2 diabetes mellitus and 75 were controls (non diabetics). Height and weight was recorded and BMI calculated. Non invasive test like measuring blood pressure in supine posture was conducted and values recorded from both the groups. Statistical analysis was done using SPSS 21. 48% of non diabetics were males and 52% were females. Again 61% of the diabetic patients were males and 39% were females. In this study, both the systolic and diastolic blood pressure are found to be significantly higher in diabetics as compared to non diabetics. The BMI is also found to be significantly higher in diabetics than the non diabetics.

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**INTRODUCTION**

Presently, non communicable diseases like cardiovascular disease, diabetes, cancer, and chronic lung disease have overtaken various infectious diseases as world's leading cause of death. Up to 80% of the people with diabetes will die of cardiovascular disease and stroke as most of the diabetics will develop hypertension in due course of time. 1 Diabetes mellitus is defined as a cluster of metabolic disorders which presents with hyperglycemia high enough to significantly increase the incidence of retinopathy, nephropathy and neuropathy. 3 Hypertension or high blood pressure is defined as blood pressure higher than 140/90 millimeters of mercury. 3

Hypertension and type 2 diabetes are closely related disease. Together they increase the risk of atherosclerotic cardiovascular disease. Worldwide the number of people having diabetes are increasing. Most of them live in low and middle income countries. 3

WHO revealed 13% of all deaths globally are related to hypertension, making it an area of prime importance for public health in both developed and developing countries. 1

Diabetes is associated with an increased prevalence of hypertension. Type 2 diabetes mellitus is known to compromise the autonomic system which is an important regulative mechanism for blood pressure.

1 Hypertension is an important and controllable risk factor for many diseases. But as increased blood pressure is mostly symptomless, people are unaware of their raised blood pressure status.

An increase in body fat is associated with an increase in risk of metabolic diseases such as type 2 diabetes mellitus, hypertension and dyslipidemia. Defining the relationship between body weight and metabolic disease is critical toward a better understanding of the underlying pathophysiological process leading to excessive fat related metabolic disease. 7

BMI (body mass index) or Quetelet index is defined as the body weight divided by the square root of the body height and is expressed in units of kg /m<sup>2</sup>. (8) BMI is currently the primary focus in obesity treatment recommendations, with different treatment cut off points based upon the presence or absence of obesity related co morbid disease. 7

It is also seen that most of the patients with metabolic disease are either overweight or obese. 7 Therefore this study helps us to identify the body mass index (BMI) and blood pressure status of study subjects, both diabetics and non diabetics and further find if raised blood sugar has any effect on blood pressure levels. 2

**MATERIALS AND METHODS**

This study titled "a comparative study of BMI and blood pressure differences between diabetics and non diabetics" was conducted in Department of Physiology, Silchar Medical College and Hospital. The period of study was one year. The study was done after obtaining approval from the Institutional

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Ethical committee. A total of 150 individuals, both males and females were selected for the study. Among them 75(study group) were previously diagnosed cases of type 2 diabetes mellitus from Medicine OPD, students, teaching and non teaching staff, and 75(control group) were age matched non diabetic healthy individuals. It was a case control study. Equipments used were Weighing machine (Crown, ISO:9001), stadiometer, Sphygmomanometer (PIONEER deluxe IS:3390) , and Stethoscope (PIONEER). The subject was asked to report to Department of Physiology, Silchar Medical College, by 10 AM in the morning. The tests that were performed are simple and non-invasive. The subject was asked to have light breakfast on that day. He was advised not to take caffeine beverages at least two hours prior to the tests. On reaching the Department, he was made to rest for some time in our silent research lab in order to alleviate any anxiety. The subject was explained the purpose and procedures of the study and written informed consent for the study was taken. History was taken and general and systemic examination of the subjects was done. A standard proforma was used to record the subject particulars. Body height and weight was measured before recording the blood pressure and their BMI was calculated. BMI was calculated using Quelet's index (weight(kg)/ height(m)<sup>2</sup>).

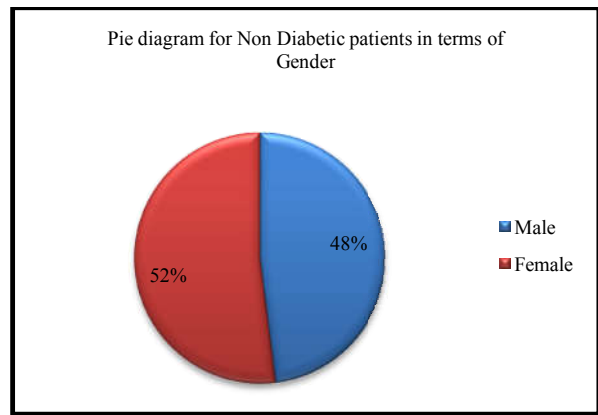
Then the subject was asked to lie down on a bed and his resting blood pressure was recorded. BP cuff of appropriate size was placed in the left arm at heart level in supine position. Blood pressure was recorded by the auscultatory method .The cuff was inflated to about 20 mmHg above the pressure at which the radial pulse disappeared. It was deflated at a rate approximately 3 mmHg/ second and the point at which Korotkoff sounds could first be heard was recorded as the systolic blood pressure. The point at which Korotkoff sounds disappeared (Phase V) was recorded as the diastolic blood pressure.<sup>6</sup>

**RESULTS AND OBSERVATIONS**

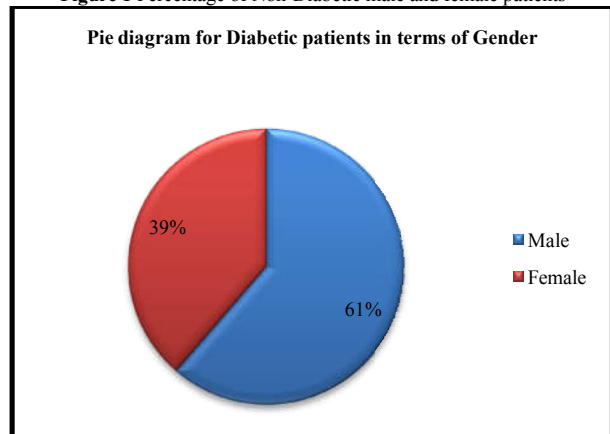
statistical analysis is done using SPSS 21. In our study, 48% of the non diabetic population were males and 52% females. In diabetic population 61% were males and 39% were females. It is represented in respective pie diagrams. Also the BMI in diabetics is 25.39±1.97 and non diabetics is 22.10±3.86 which shows a rise in diabetics.

**Table 1** Percentage of males and females patients in terms of Non-Diabetic and Diabetic

Gender	Non-Diabetic	Diabetic
Male	48%	61%
Female	52%	39%



**Figure 1** Percentage of Non-Diabetic male and female patients



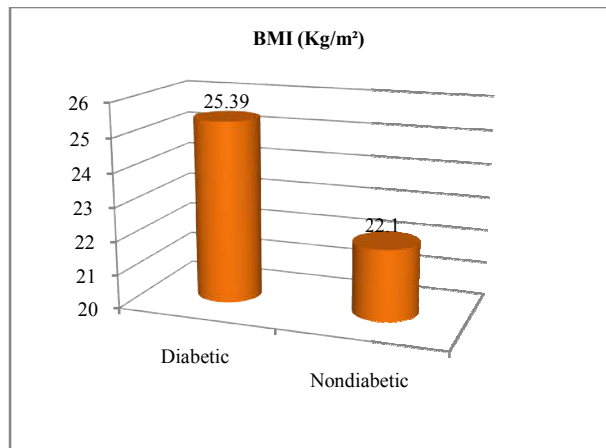
**Figure 2** Percentage of Diabetic male and female patients

**Table 2** Comparison of BMI in terms of Non-Diabetic and Diabetic

Types of patients	BMI	P value
Non-Diabetic	22.10±3.86	0.000
Diabetic	25.39±1.97	

**CONCLUSION**

From the above table we may conclude that there is a significant difference between diabetic and non-diabetic patients in terms of BMI, as p values is less than 0.05 (p value = 0.000).



**Fig 3** Bar diagram showing comparison of mean values of BMI between diabetics and non diabetics

Comment: from the above bar diagram we find that the mean value of BMI in diabetics is higher than mean value of BMI in non diabetics.

On comparison of systolic blood pressure and diastolic blood pressure between diabetic and non diabetic subjects we find that the both the systolic and diastolic blood pressure is higher in diabetics as compared to non diabetics. This is shown in line diagram below.

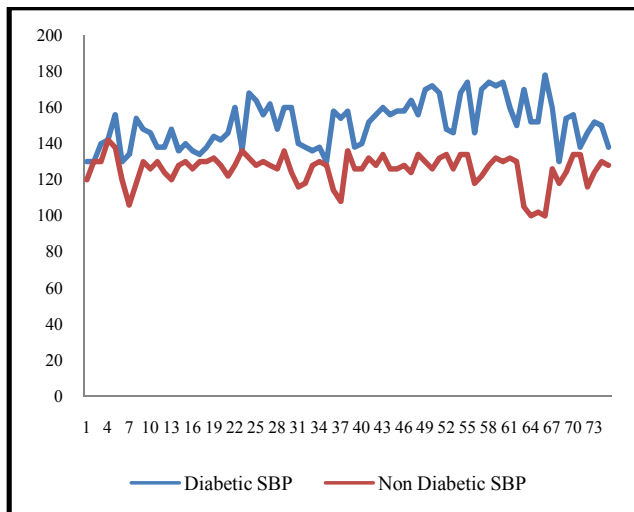


Figure 4 Comparison of SBP between Diabetic and Non-Diabetic patients

**CONCLUSION**

From the above graph we may conclude that SBP is higher in diabetic subjects as compared to non-diabetic patients.

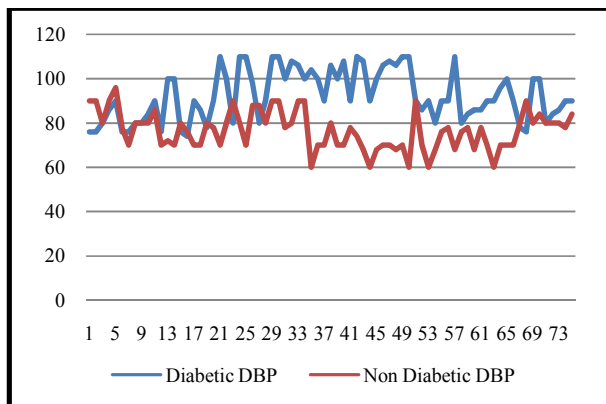


Figure 5 Comparison of DBP between Diabetic and Non-Diabetic patients

**CONCLUSION**

From the above graph we have obtained that DBP is also higher in diabetic subjects as compared to non-diabetic patients.

To compare SBP and DBP for diabetic and non-diabetic subjects separately we have applied paired t test as it can be used for testing the significant difference between two sets of

observations appearing in pairs. These statistical tests are analyzed in SPSS, version 21.

**Table 3** Comparison of SBP and DBP in terms of Non-Diabetic and Diabetic

Types of patients	Non-Diabetic	Diabetic	P value
SBP (mmHg)	125.85 ± 8.596	150.96 ± 8.596	0.000
DBP(mmHg)	76.56 ± 8.628	92.59 ± 11.469	0.000

**CONCLUSION**

From the above table we may conclude that there is a significant difference between SBP and DBP for both diabetic and non-diabetic subjects as p values is less than 0.05 (p value = 0.000). hence both the systolic and diastolic blood pressure are found to be significantly higher in diabetics.

**DISCUSSION**

It is mentioned that increased blood sugar levels change the behavior of blood vessels making them contract more strongly than normal hence increase blood pressure.4 The high blood sugar levels associated with diabetes damage capillaries including those in glomeruli. The capillary walls are thickened and the glomeruli are tricked into thinking that they are not receiving enough blood. As a result the kidneys try to raise the blood pressure hence trying to bring back a normal blood flow through their capillaries and therefore maintaining normal filtration rates. This long standing and complex mechanisms lead to increased resting blood pressure in diabetics.10 Hypertension in insulin resistance states is generally attributed to hyperinsulinemia, causing increased sodium retention by kidneys and increased sympathetic activity. Insulin attenuates vascular smooth muscle contractile responses to vasoactive factor. Therefore insulin resistant states will have enhanced vascular reactivity. Abnormal calcium homeostasis in vascular smooth muscle cell links insulin resistance and vascular smooth muscle tone rise.5 It was seen in a cohort study conducted in Tel Aviv, Israel in 2005 on 2227 type 2 diabetes mellitus patients that the prevalence of hypertension among the entire diabetic patients was 60.2%.2. Again the prevalence rate of hypertension in a cohort study in Iraq on 5578 diabetics showed that 89.6% of the patients with diabetes mellitus had hypertension.2 Wei TM et al, in 2009, in his study found that the prevalence of raised blood pressure is higher in people having diabetes mellitus.1

Again, prior data from both SHIELD (Study to Help Improve Early evaluation and management of risk factors leading to Diabetes) and NHANES (National Health And Nutrition Examination Survey) survey show that the patients with higher BMI are at higher risk for having diabetes mellitus, hypertension and dyslipidemia. Adiposopathy is a term used to describe pathogenic adipose tissue whose adverse clinical consequences may be promoted and exacerbated by adipose hypertrophy, visceral adipose tissue accumulation, and sedentary lifestyle ,all of which point to the root cause of physiological process that leads to various metabolic disease like Type 2 diabetes mellitus, hypertension and dyslipidemia.7 Since weight is an important predictor of Type 2 Diabetes mellitus, the term “diabesity” was proposed by Astrup and Finner in 2000. Previous studies show that excess weight is not only associated with an increased risk of type 2 DM, a

relationship well documented in existing literature , but leads to greater risk of a variety of DM complications .9

## CONCLUSION

It can be concluded that treating diabetes alone cannot address its complication unless the problem of raised blood pressure mostly present along with it is also focused together. Also overall weight gain is to be well monitored to prevent development of obesity and thereafter overt diabetes This will lead to an overall improvement in the survival benefit of the diabetic patient.

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