



Original Article

Blood Pressure Variability in Type 2 Diabetes Mellitus Patients

Jaber Ahmed Chowdhury¹, Wajeunnesa², Ismoth Ara Jerin³, Syed Nadim Ahmed⁴, Rifath Nawrin Ovi⁵

^{1,3}Assistant Professor, Department of Physiology, Jalalabad Ragib-Rabeya Medical College.

²Associate Professor, Department of Physiology, Jalalabad Ragib-Rabeya Medical College.

⁴Assistant Professor, Department of Physiology, Sylhet Women's Medical College.

⁵Lecturer, Department of Physiology, Jalalabad Ragib-Rabeya Medical College.

ABSTRACT

The impact of type 2 diabetes mellitus on cardiovascular diseases has been identified in different studies around the world in a variety of sex. So the present comparative, cross-sectional and analytical study was carried out to observe blood pressure in type 2 diabetes mellitus patients in both sex groups in the department of Physiology with the collaboration of the department of Endocrinology, Mymensingh Medical College, Mymensingh, from January 2016 to December 2016. For this purpose, a total number of 200 subjects of both sexes with an age ranged from 30-60 years were selected; of whom 100 were type 2 diabetic patients and 100 were apparently healthy. The results showed that, blood pressure was significantly higher ($p < 0.0001$) in both males and females of the study group in comparison to the healthy control group. From this study, it may be concluded that type 2 diabetic patients are considered to have a significant positive relationship with the development of hypertension and metabolic abnormalities. So, prevention of type 2 diabetes mellitus by taking necessary measures like regular physical exercise, intake of a healthy diet, behaviour therapy and drugs may help in prevention of type 2 diabetes mellitus related complications.

Keywords: Diabetes, Blood pressure, Fasting serum glucose, Serum glucose 2 hours after meal.

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INTRODUCTION

Diabetes mellitus is a clinical syndrome characterized by hyperglycaemia caused by absolute or relative deficiency of insulin. The incidence of both type 1 and type 2 diabetes is rising. It is estimated that, in the year 2000, 171 million people had diabetes and this is expected to double by 2030. The global pandemic

principally involves type 2 diabetes and is associated with greater longevity, obesity, an unsatisfactory diet, sedentary lifestyle and increasing urbanization¹. The pandemic of diabetes has progressed in association with rapid cultural transformation, growing urbanization, dietary changes, decreased physical activity and other unhealthy lifestyles².

Excess weight is the single most important cause of type 2 diabetes. Being overweight increases the chances of developing type 2 diabetes seven fold. Being obese makes people 20 to 40 times more likely to develop diabetes than someone with a healthy weight. Losing

Address of Correspondence:

Dr. Jaber Ahmed Chowdhury, Assistant Professor, Department of Physiology, Jalalabad Ragib-Rabeya Medical College, Sylhet, Mobile: +8801716393159, E-mail: dr.jaberpath@gmail.com

weight can help if a person's weight is above the healthy-weight range. Losing 7 to 10 percent of current weight can cut a person's chances of developing type 2 diabetes mellitus in half³. The American Diabetes Association has recommended the fasting plasma glucose test for screening because it is easier and faster to perform, more convenient and acceptable for patients, and less expensive than other screening tests⁴. The fasting blood glucose level in the early morning is normally 80 to 90 mg/100 ml and 110 mg/100 ml is considered to be the upper limit of normal. A fasting blood glucose level above this value often indicates diabetes mellitus or at least marked insulin resistance⁵.

In recent years, non-communicable diseases like obesity, hypertension and type 2 diabetes mellitus have been increasing, especially in developing nations. In Bangladesh, the diagnosis of diabetes appears to be late or mostly diagnosed at an advanced stage of the disease. Also, it may be noted that small community surveys conducted at different periods revealed an increasing trend of hypertension and diabetes in Bangladesh⁶.

In patients with type 2 diabetes, the risk of diabetes complications was strongly associated with raised blood pressure. Any reduction in blood pressure is likely to reduce the risk of complications; with the lowest risk being in those with a systolic blood pressure of less than 120 mm Hg⁷. Cardiovascular diseases are the major cause of mortality in people with diabetes and are twice as frequent in patients with diabetes compared with patients without the disease. Conversely, recent data suggests that hypertensive people are more predisposed to the development of diabetes than normotensive people. Furthermore, up to 75% of cardiovascular disease in diabetes may be attributable to hypertension, leading to recommendations for more aggressive treatment in patients with co-existing diabetes and hypertension⁸. Raised blood pressure is more common in people with type 2 diabetes than in the general population, and in people without diabetes, it is a major risk factor for myocardial infarction and stroke. On average, each 10 mm Hg reduction in systolic blood pressure was associated with a 12% decrease in the risk of any end point related to diabetes and a 15% reduction in the risk of death related to diabetes⁷.

Type 2 diabetes is frequently associated with other cardiovascular risk factors, such as dyslipidaemia and hypertension. Cardiovascular disease is the leading cause of death among individuals with type 2 diabetes mellitus, accounting for 40 to 50% of all deaths. In these patients, the mortality risk for coronary, cerebrovascular and peripheral vascular disease is 2 to 10-fold higher than in the non diabetic population. The worldwide explosive increase in type 2 diabetes mellitus and its cardiovascular morbidity are becoming a major health concern⁹.

Very few studies have been done to find out the blood pressure variability in type 2 diabetic patients with sex differences in Bangladesh. So the present study was carried out to observe the variation in blood pressure in type 2 diabetes mellitus patients of both sexes.

MATERIALS AND METHODS

This comparative, cross-sectional and analytical study was carried out in the department of Physiology, Mymensingh Medical College, Mymensingh, from January 2016 to December 2016. In this study, a total number of 200 subjects with an age range of 30 to 60 years of both sexes were included, of whom 100 were apparently healthy and 100 were type 2 diabetic person. All the subjects were obtained from the department of Endocrinology, Mymensingh Medical College and Hospital. The study population was divided according to body mass index (BMI) category into control group male (IA), control group female (IB), study group male (IIA), and study group female (IIB). The subjects with a history of smoking and alcohol consumption, type 1 diabetes mellitus, any history of kidney disease, cardiac disease, liver disease, malignancy, pregnancy, diagnosed case of hypothyroidism, Cushing's syndrome, polycystic ovary, antipsychotic drug users, regular steroid users, and any type of systemic illness were excluded from the study. Fasting serum glucose and serum glucose 2 hours after meal were assessed by the enzymatic, colorimetric, GOD-PAP method. During the visit, blood pressure of the individuals was measured at least after 15 minutes of rest. An aneroid sphygmomanometer and an appropriate size cuff encircling 80% of the arm were used in the seated

posture, with feet on the floor. Three measurements about 5-10 minutes apart were taken. The statistical analysis was done by using the statistical package for social science (SPSS) programme, version 11.5 and p value <0.05 was considered as significant. The comparison between the groups was calculated by an unpaired Student's 't' test.

RESULTS

The mean (\pm SE) fasting serum glucose and serum blood glucose 2 hours after meals of different groups are presented in Table-I. The mean fasting serum glucose was significantly higher ($p=0.0001$) in study groups (IIA and IIB) in comparison to healthy control groups (IA and IB). But, no statistically significant difference was observed between groups IIA and IIB. The mean serum glucose 2 hours after meal was

significantly higher ($p=0.0001$) in study groups (IIA and IIB) in comparison to healthy control groups (IA and IB). But no statistically significant difference was observed between groups IIA and IIB (Table-II and Table-III). The mean (\pm SE) systolic blood pressures of different groups were presented in Figure-1 and the mean (\pm SE) diastolic blood pressures of different groups were presented in Figure-2. The mean systolic and diastolic blood pressure were significantly higher ($p=0.0001$) in study groups (IIA and IIB) in comparison to healthy control groups (IA and IB). But no statistically significant difference was observed between groups IIA and IIB.

Table-I: Fasting serum glucose and serum glucose 2 hours after meal of control and study groups ($n=200$).

Biochemical Parameters	Group IA	Group IB	Group IIA	Group IIB
Fasting serum glucose	5.13 \pm 1.02	5.39 \pm 1.08	8.68 \pm 2.02	9.03 \pm 2.34
Serum glucose 2 hours after meal	9.41 \pm 1.72	8.74 \pm 2.16	16.82 \pm 4.65	18.30 \pm 4.56

Table-II: Statistical analysis of fasting serum glucose in different sub groups ($n=200$).

Groups	df	t value	p-value
IA versus IIA	98	11.094**	0.0001
IB versus IIB	98	10.006**	0.0001
IIA versus IIB	98	0.801 ^{NS}	0.425

** Indicate Significant at $p < 0.05$. NS= not significant

Table-III: Statistical analysis of serum glucose 2 hours after meal in different sub group ($n=200$).

Groups	df	t value	p-value
IA versus IIA	98	10.575**	0.0001
IB versus IIB	98	13.40**	0.0001
IIA versus IIB	98	1.607 ^{NS}	0.111

** Indicate Significant at $p < 0.05$. NS= not significant

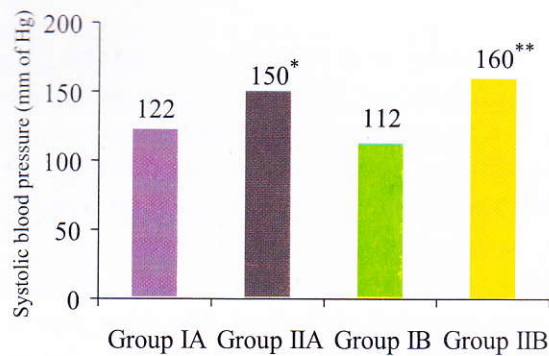


Figure-1: Bar diagram showing mean values of systolic blood pressure in different groups (n=200).

*p=0.001

**p=0.001

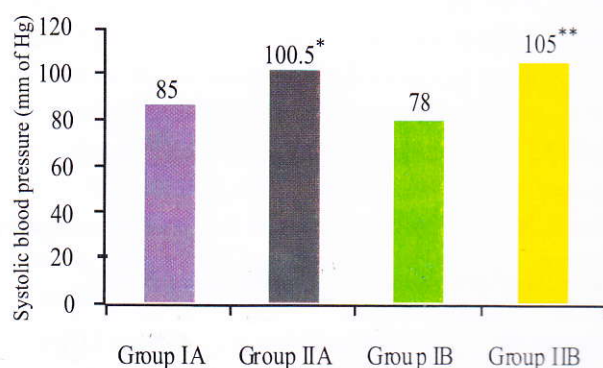


Figure-2: Bar diagram showing mean values of diastolic blood pressure in different groups (n=200).

*p=0.001

**p=0.001

DISCUSSION

In the present study, there was a significant change in fasting serum glucose and serum glucose 2 hours after meals in the study groups than in the control group. Fasting serum glucose, serum glucose 2 hours after meals were significantly higher ($p=0.0001$) and both systolic and diastolic blood pressure were significantly higher ($p=0.0001$) in both sexes of type 2 diabetes patients in comparison to their respective healthy controls. Similar observations were reported by Sayeed et al., Alder et al., Rahim et al., Bhowmik et al., and Vijan et al.^{6,7,10-12}. Those researchers used fasting serum glucose 7 mmol/l as the diagnostic criterion. It was consistent with our study. This finding was also consistent with an Indian study¹³ but inconsistent with an Australian study¹⁴. A recent study from Copenhagen involving 20,000 women and 17,000 men aged 30-80 years found that, for each 10% increase in BMI, the systolic blood pressure was 2-6 mm of Hg higher along with an increase in diastolic pressure of 1-3 mm of Hg¹⁵.

It was reported by Alder et al. in 2000⁷ that raised blood pressure was more common in people with type 2 diabetes than in the general population, and in people without diabetes, it was a major risk factor for myocardial infarction and stroke. On average, each 10 mm of Hg reduction in systolic blood pressure was associated with a 12% decrease in the risk of any end point related to diabetes and a 15% reduction in the risk of death related to diabetes⁷. The basic mechanism involved in the development of type 2 diabetes mellitus is a deficiency of insulin at the cellular level. Cellular insulin resistance, rather than hyperinsulinaemia, may lead to hypertension. Recent observations suggest that, impaired cellular response to insulin predisposed to increasing vascular smooth muscle tone⁸. Hypertension is extremely common in patients with type 2 diabetes, affecting up to 60%. Hypertension in patients with type 2 diabetes mellitus is a prevalent condition that leads to substantial morbidity and mortality¹². Osher and Stren¹⁶ in 2008 found that, diastolic not systolic blood pressure showed a significant relation to type 2 diabetes mellitus. But in our study, both systolic and diastolic blood pressure showed significant relation to type 2 diabetes mellitus.

CONCLUSION

It may be concluded that type 2 diabetic patients were considered to have a significant positive relationship with the development of hypertension and metabolic abnormalities that lead to high morbidity and mortality. So, prevention of type 2 diabetes mellitus by taking necessary measures like regular physical exercise, intake of a healthy diet, and behaviour therapy may help in prevention of type 2 diabetes mellitus related complications.

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