



**DIABETES MELLITUS AND HYPERTENSION: A PROSPECTIVE COMMUNITY-BASED STUDY**

\*<sup>1</sup>Maharaj Biswas and <sup>2</sup>Chanchal Kumar Manna

<sup>1,2</sup>Endocrinology Laboratory, Department of Zoology, Faculty of Science, University of Kalyani, Kalyani-741235, Nadia, West Bengal, India.

\*Corresponding Author: Dr. Maharaj Biswas

Endocrinology Laboratory, Department of Zoology, Faculty of Science, University of Kalyani, Kalyani-741235, Nadia, West Bengal, India.

Article Received on 27/04/2016

Article Revised on 17/05/2016

Article Accepted on 07/06/2016

**ABSTRACT**

**Objective:** To evaluate the current prevalence and distribution of diabetes and hypertension and their relationship within the Studied people. **Methods:** Door-to-door population based survey work was conducted to collect data regarding diabetes and hypertension and their associated risk factors (sociodemographic and biochemical) from 2,453 members of households of studied people. Blood samples were collected from 114 willing participants for the biochemical analysis. Data were analyzed using chi-square test at both 2.5% and 5% level of significance. **Results:** Overall crude prevalence of hypertension was 15.85% in studied people. Male (17.43%) showed a higher hypertensive rate than female (14.35%). The rate of hypertension in diabetic (47.37%) patients was very high in comparison to non-diabetic (22.10%) group of people. Mean BP (SBP/DBP) in diabetic and non-diabetic subjects were 139.52/92.36 mmHg and 118.34/81.26 mmHg respectively. Significant increase of both SBP ( $p < 0.01$ ) and DBP ( $p < 0.05$ ) were observed in diabetic subjects in contrast to non diabetic group of people. Chi-square test revealed that there was a significant ( $p < 0.025$ ) increase of hypertension in diabetic group of people. **Conclusions:** The results indicate that the hypertension as well as blood pressure was significantly associated with diabetes.

**KEYWORDS:** Hypertension, Diabetes, Scheduled Caste community, Blood pressure, Normotensive, Cardiovascular diseases.

**1. INTRODUCTION**

Hypertension means abnormally high blood pressure (i.e., SBP/DBP  $\geq 140/90$  mmHg)<sup>[1]</sup> exerted by blood on the vessel walls while flowing through it, whereas diabetes mellitus is a metabolic disorder characterized by any of the following three criteria: i) a fasting plasma glucose  $\geq 7.0$  mmol/l or 126 mg/dl ii) a 2-hour plasma glucose level  $\geq 11.1$  mmol/l or 200 mg/dl<sup>[2]</sup> iii) the symptoms of diabetes (polyuria, polydipsia and unexplained weight loss) plus casual (any time of day without regard to meals) plasma glucose concentration  $\geq 200$  mg/dl.<sup>[3]</sup>

In people with diabetes, higher glucose levels predict a higher risk of macrovascular and microvascular disease.<sup>[4-7]</sup>

Diabetes is an strong, independent risk factor for future cardiovascular (CV) events in general population,<sup>[8-9]</sup> - a problem that accounts for approximately 70% of all mortality in people with diabetes.<sup>[10]</sup>

Plasma glucose level is continuous risk factor for CV events in people with type-1 and type-2 diabetes.<sup>[11-14]</sup>

Now a days, Diabetes and hypertension are most common but life threatening diseases throughout the

world. There is no doubt that both the diseases are intimately associated with each other and it is largely due to present form of our life styles. In this study, a population based study was conducted to estimate the current prevalence and distribution of diabetes and hypertension and their relationship within the SC community of the district Nadia, West Bengal, India. As both diabetes and HTN are mostly associated with life styles, this information will help to recommend specific life style interventions and to assess their impact on the control of these life threatening diseases in the studied people.

**2. MATERIALS AND METHODS**

A door-to-door community based survey work was conducted to investigate the prevalence of hypertension within the SC community of three selected villages (viz. Chowgachha, Bagula and Priyanagar) of the district Nadia, West Bengal, India. About 2,453 members of households of study areas were interviewed and detailed information regarding diabetes and hypertension like age, sex, weight and height for BMI, waist and hip for WHR, HR, blood pressure, physical activity, oil intake, salt intake, blood pressure, heart rate, lipid profile, blood sugar, serum and urine electrolytes etc. were recorded. Average age of the studied individuals was

approximately  $41.58 \pm 14.25$  (range, 20-79 yrs). Data were collected from 10.00 am to 4.00 pm. The blood pressure was measured by both mercury and digital (HEM-7111 and HEM-4030, Omron healthcare, Kyoto, Japan) sphygmomanometer in supine position after at least 10 minutes rest.

Here, hypertension and diabetes mellitus were diagnosed according to the American Joint National Committee VII<sup>th</sup> report, 2003<sup>[1]</sup> and American Diabetes Association criteria, 2006<sup>[3]</sup> respectively.

The biochemical analysis was done by a semi-automatic biochemistry analyzer (Prietest-easy lab, Robonik India Pvt. Ltd., Mumbai, India). The biochemical analysis of serum and urine was done in 114 people of the study areas. Out of 114 people, thirty (30) subjects were hypertensive and eighty four (84) were normotensive people.

In this study, the association between diabetes and hypertension was reported. Data were analyzed using Chi-square test at both 5% and 2.5% level of significance.

### 3. RESULTS

The overall and sex and diabetes mellitus wise prevalence and distribution of hypertension in studied people were depicted in the Table-1 and in Figure-1.

**Table-1: Overall crude prevalence of hypertension and hypertension rate in relation to sex and diabetes in studied people.**

Groups		Number	Normotensive (%)	Hypertensive (%)
Total population surveyed (N=2,453)		2,453	84.15	15.85
Sex (N=2,453)	Males	1,199	82.57	17.43
	Females	1,254	85.65	14.35
Total blood sample taken (N=114)		114	73.69	26.31
Fasting blood glucose level	Diabetic ( $\geq 126$ mg/dl)	19	52.63	47.37
	Non-diabetic (<126 mg/dl)	95	77.90	22.10

**Table-2: Prevalence of hypertension in relation to diabetes mellitus within the studied people.**

Groups	Diabetic	Non-diabetic	Total
Hypertensive	9	21	30
Non-hypertensive	10	74	84
Total	19	95	N=114
$\chi^2 = 5.211$ , d.f.=1, $p < 0.025$			

Overall crude prevalence of hypertension in 2,453 studied people was 15.85%, whereas 26.31% of 114 participants (those who willingly gave their blood for biochemical analysis) were known to be hypertensive. Male (17.43%) showed a higher hypertensive rate than female (14.35%).

From the analyzed data it was found that hypertension was common in those who were suffering from diabetes mellitus (diabetes mellitus was diagnosed by measuring fasting blood glucose level  $\geq 7.0$  mmol/l or 126 mg/dl). The rate of hypertension in diabetic patients was 47.37% which was very high in comparison to non-diabetic (22.10%) group of people.

Chi-square test showed that there was a significant ( $\chi^2 = 5.211$ , d.f.=1,  $p < 0.025$ ) increase of hypertension in diabetic group of people (Table-2).

The mean BP (SBP / DBP) in diabetic and non-diabetic group were 139.52 / 92.36 mmHg and 118.34 / 81.26 mmHg. From z-test it was observed that both SBP ( $z = 3.07$ ,  $p < 0.01$ ,) and DBP ( $z = 2.52$ ,  $p < 0.05$ ) were significantly increased in diabetic patients in relation to non-diabetic group (Table-3, Figure-2).

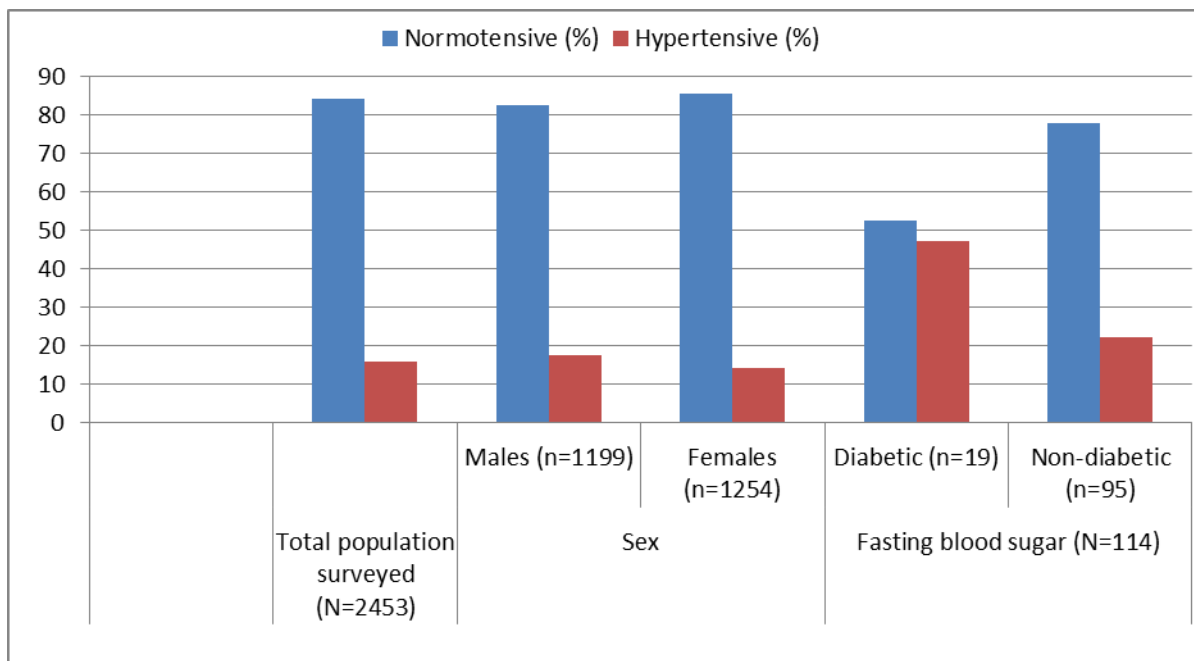


Figure-1: Prevalence of hypertension in relation to diabetes mellitus and sex in studied people.

Table-3: Range of SBP and DBP in diabetic and non-diabetic group of people. Data were expressed as average ± SEM.

Groups	Non-diabetic	Diabetic	z-value
SBP ± SEM	118.34 ± 2.64	139.52 ± 6.88**	z = 3.07, p<0.01
DBP ± SEM	81.26 ± 1.94	92.36 ± 4.39*	z = 2.52, p<0.05

\*= Significant at 5% level and \*\*= Significant at 1% level

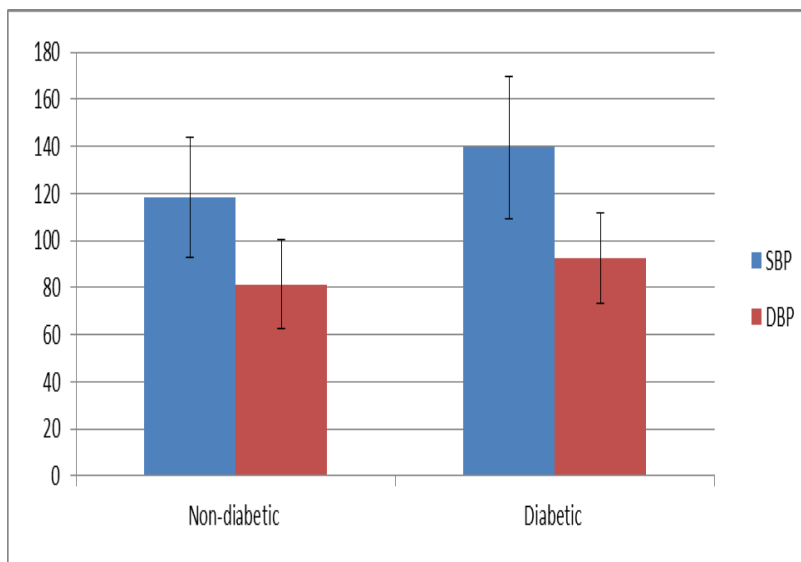


Figure-2: Range of SBP and DBP in diabetic and non-diabetic group of people. Data were represented as average ± SD.

4. DISCUSSION

Diabetes and hypertension may be regarded as life style disease as because both the diseases were greatly associated with our daily life. Although various factors (sociodemographic and biochemical) were responsible for the development of diabetes and hypertension, we have tried to show the prevalence and distribution of

diabetes and hypertension and their association in this study.

The overall crude prevalence of hypertension in total studied people was 15.85%. Hypertension was higher in males (17.43%) than females (14.35%) one. This kind of work was also done by some other workers.<sup>[15-17]</sup>

The prevalence of hypertension diabetic patients (47.37%) was very high compared to non-diabetic group (22.10%) people. From Chi-square test it was found that hypertension was significantly ( $p < 0.025$ ) increased with diabetes mellitus in the studied people. Comparable finding were also reported in other studies where rate of hypertension was found to be increased with the fasting blood glucose level.<sup>[18-21]</sup>

From this study, it is observed that mean BP in diabetic people is higher than non-diabetic group. Both SBP ( $p < 0.01$ ) and DBP ( $p < 0.05$ ) were significantly elevated in diabetic patients compared to non-diabetic one.

Suitable examples were also reported by some other workers. Their reports revealed that elevated blood pressure is a continuous risk factors for cardiovascular events in people with diabetes.<sup>[22-30]</sup>

## 5. CONCLUSIONS

From the present study it is clear that the prevalence and distribution of hypertension is found higher in those people who are suffering from diabetes mellitus and it is significantly associated with each other. The blood pressure is also found to be higher in diabetic group. As both the diseases are greatly dependent on our life styles, we should take care about them to control hypertension as well as diabetes.

## 6. ACKNOWLEDGEMENT

The authors are grateful to the people of the Scheduled Caste Community of the District Nadia, West Bengal, India, those who provided whole-hearted support for the collection of data regarding diabetes and hypertension during field study.

## 7. REFERENCES

- Chobanian AV, Bakris GL, Black HR, et al. The seventh report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure: The JNC 7 report. *JAMA*, 2003; 289: 2560-72.
- Expert Committee on the Diagnosis and Classification of Diabetes Mellitus. Report of the Expert Committee on the Diagnosis and Classification of Diabetes Mellitus. *Diabetes Care*, 1997; 20: 1183-97.
- American Diabetes Association. Clinical practice recommendations 2006. *Diabetes Care*, 2006; 29(suppl 1): S1-S85.
- Diabetes Control and Complications Trial Research Group. The effect of intensive treatment of diabetes on the development and progression of long-term complications in insulin-dependent diabetes mellitus. *N Eng J Med*, 1993; 329: 977-86.
- Moss SE, Klein R, Klein BEK, Meuer SM. The association of glycemia and cause-specific mortality in a diabetic population. *Arch Intern Med*, 1994; 154: 2473-9.
- Kuusisto J, Mykkanen L, Pyorala K, Laakso M. NIDDM and its metabolic control predict coronary heart disease in elderly subjects. *Diabetes*, 1994; 43: 960-7.
- Andersson DKG, Svardsudd K. Long-term glyceemic control relates to mortality in type 2 diabetes. *Diabetes Care*, 1995; 18: 1534-43.
- Kannel WB, McGee DL. Diabetes and cardiovascular disease. The Framingham Study. *JAMA*, 1979; 241: 2035-8.
- Chen YT, Vaccarino V, Williams CS et al. Risk factors for heart failure in the elderly: a prospective community-based study. *Am J Med*, 1999; 106: 605-12.
- Laakso M. Hyperglycemia and cardiovascular disease in type 2 diabetes. *Diabetes*. 1999; 48: 937-42.
- Fu CC, Chang CJ, Tseng CH et al. Development of macrovascular diseases in NIDDM patients in northern Taiwan. A four year follow-up study. *Diabetes Care*, 1993; 16: 137-43.
- Gall M-A, Borch-Johnsen K, Hougaard P et al. Albuminuria and poor glyceemic control predict mortality in NIDDM. *Diabetes*, 1995; 44: 1303-9.
- Agewall S, Wikstrand J, Ljungman S, Fagerberg B. Risk factor Intervention Study Group. Usefulness of microalbuminuria in predicting cardiovascular mortality in treated hypertensive men with and without diabetes mellitus. *Am J Cardiol*, 1997; 80: 164-9.
- Stratton IM, Alder AL, Neil HA et al. Association of glycaemia with macrovascular and microvascular complications of type 2 diabetes (UKPDS-35): prospective observational study. *BMJ*, 2000; 321: 405-12.
- Jajoo N, Kalantri P, Gupta P, et al. Prevalence of hypertension in rural population around Sevagram, MGM, Wardha. *J Assoc Physicians India*, 1993; 41: 422-4.
- Joshi SV, Patel JC, Dhar HL. Prevalence of hypertension in Mumbai. *Indian J Med Sci*, 2000; 54: 380-383.
- Biswas M, Manna CK. Prevalence of hypertension and sociodemographic factors within the Scheduled Caste community of the district Nadia, West Bengal, India. *High Blood Press Cardiovasc Prev*, 2011; 18(4): 179-185.
- Haffner SM, Lehto S, Rönömaa T, Pyörälä K, Lakso M. Mortality from coronary heart disease in subjects with type 2 diabetes and in nondiabetic subjects with and without prior myocardial infarction. *N Eng J Med*, 1998; 339: 229-34.
- Bakris GL, Williams M, Dworkin L et al. Preserving renal function in adults with hypertension and diabetes: a consensus approach. National kidney foundation hypertension and diabetes executive committee working group. *Am J kid disease*, 2000; 36: 646-661.
- Sower JR, Williams M, Epstein M, Bakris GL. Hypertension in patients with diabetes. Strategies for

- drug therapy to reduce complications. *Postgrad Med*, 2000; 107: 47-54, 60.
21. Biswas M, Manna CK. Biochemical parameters-wise hypertension in an Indian community. *Asian Pac J Health Sci*, 2015; 2(3): 86-93.
  22. Stamler J, Vaccaro O, Neaton JD, Wentworth D. Diabetes, other risk factors, and 12-yr cardiovascular mortality for men screened in the Multiple Risk Factor Intervention Trial. *Diabetes Care*, 1993; 16: 434-44.
  23. Lehto S, Ronnemaa T, Pyorala K, Laakso M. Predictors of stroke in middle-aged patients with non-insulin-dependent diabetes. *Stroke*, 1996; 27: 63-3.
  24. Hadden DR, Patterson CC, Atkinson AB et al. Macrovascular disease and hyperglycaemia: 10-year survival analysis in type 2 diabetes mellitus: the Belfast Diet Study. *Diabetes Med*, 1997; 14: 663-72.
  25. Mehler PS, Jeffers BW, Estacio R, Schrier RW. Association of hypertension and complications in non-insulin-dependent diabetes mellitus. *Am J Hypertens*, 1997; 10: 152-61.
  26. Lehto S, Ronnemaa T, Haffner SM et al. Dyslipidemia and hyperglycemia predict coronary heart disease events in middle-aged patients with NIDDM. *Diabetes*, 1997; 46: 1354-9.
  27. Wei M, Gaskill SP, Haffner SM, Stern MP. Effects of diabetes and level of glycemia on all-cause and cardiovascular mortality. The San Antonio Heart study. *Diabetes Care*, 1998; 21: 1167-72.
  28. Lehto S, Ronnemaa T, Pyorala K, Laakso M. Poor glycaemic control predicts coronary heart disease events in patients with type 1 diabetes without nephropathy. *Arterioscler Thromb Vasc Biol*, 1999; 19: 1014-9.
  29. Turner RC, Millns H, Neil HAW et al. Risk factors for coronary artery disease in non-insulin dependent diabetes mellitus: United Kingdom prospective diabetes study (UKPDS: 23). *BMJ*, 1998; 316: 823-8.
  30. Adler AL, Stratton IM, Neil HA et al. Association of systolic blood pressure with macrovascular and microvascular complications of type 2 diabetes (UKPDS 36): prospective observational study. *BMJ*, 2000; 321: 412-9.