



## PREVALENCE AND RISK FACTORS WITH DIABETES MELLITUS AMONG THE PEOPLE IN DINAJPUR DISTRICT OF BANGLADESH

A. Hossain<sup>1</sup>, M. A. Sayed<sup>2\*</sup>, B. C. Sarker<sup>3</sup>, U. K. Majumder<sup>4</sup> and M. A. Hossain<sup>5</sup>

<sup>1,2</sup>Department of Biochemistry and Molecular Biology, Hajee Mohammad Danesh Science and Technology University, Dinajpur 5200, Bangladesh

<sup>3</sup>Department of Agricultural Chemistry, Hajee Mohammad Danesh Science and Technology University

<sup>4</sup>Department of Statistics, Hajee Mohammad Danesh Science and Technology University, Dinajpur-5200, Bangladesh

<sup>5</sup>Department of Biochemistry and Molecular Biology, Bangladesh Agricultural University, Mymensingh 2202, Bangladesh

Received 09 October 2012, revised 26 June 2013, accepted 27 June 2013

### ABSTRACT

A cross-sectional survey was conducted in Dinajpur district, the Northwest Bangladesh, in order to determine the risk factors associated with the development of diabetes from pre-diabetes condition. Among the various possible risk factors, hypertension status, level of walk, dietary and smoking behaviour were selected as significant risk factors associated with the development of diabetes from the pre-diabetes condition. Pre-diabetes subjects with hypertension were 1.54 fold more possibility of diabetes than those of no hypertension. Developing diabetes were tended 2.10 and 1.64 fold among the people practicing one or two days walking and four to five days walking per week, respectively, in compare to the subjects having regular walking habit. Taking up sweet taste diet during pre-diabetes condition was also marked as risk factor which pushed the patients toward the development of diabetes in 2.12 times higher than the people who did not take sweet taste diet during pre-diabetes condition. Smoking behaviour of the pre-diabetes patients was also identified as a significant risk factor of diabetes. The study indicated that the ex-smokers and current smokers were 1.53 times and 1.73 times, respectively, more possibility of migrating from pre-diabetes condition to diabetes one in compare to those who never took smoke. However, for checking the development of diabetes from pre-diabetes condition and establishing proper strategy as well, a deep and large scale research is highly recommended with these identified risk factors.

**Key words:** Diabetes, hypertension, prevalence, risk factor

### INTRODUCTION

Diabetes mellitus is a group of metabolic disorders that present the phenotype of hyperglycemia. The etiologies of diabetes mellitus are a complex interaction of genetics, environmental factors and life-style choices. The number of world people with diabetes is increasing due to increasing population, aging, urbanization and increasing prevalence of obesity and physical inactivity. Diabetes mellitus has a high prevalence in both developed and developing countries (Wild *et al.* 2004). An increased prevalence of diabetes in India, Pakistan and China was 12.1%, 11.1% and 6.1%, respectively (Ramachandran *et al.* 2001; Shera *et al.* 1999; Dong *et al.* 2005). This increase has also been observed among the people of Asian Americans, and was suggested to be due to ageing of the population, urbanization and increasing

prevalence of obesity and physical inactivity (Marguerite *et al.* 2004). Diabetes occurs in the world-wide and the incidence of both type 1 and type 2 diabetes are rising. It is estimated that the year 2000, 171 million people had diabetes and this is expected to double by 2030 (Wild *et al.* 2004). This global pandemic principally involves type 2 diabetes, to which several factors contribute including greater longevity, obesity, unsatisfactory diet, sedentary life style and increasing urbanization (Frier and Fisher 2006). In 2007, a United Nations (UN) resolution was adopted to mark diabetes mellitus as a significance global public health issue (Gulabani *et al.* 2008). Worldwide prevalence of diabetes in adults was estimated to be 4.0% in 1995 and expected to rise to 5.4% by the year 2025. The number of adults with diabetes in the world is expected to rise from 135 million in 1995 to 300 million in the year 2025. The major part of this

\*Corresponding author: M. A. Sayed, Department of Biochemistry and Molecular Biology, Hajee Mohammad Danesh Science and Technology University, Dinajpur 5200, Bangladesh, e-mail: sayed\_bmb@yahoo.com, Cell phone: +88 01715326270

numerical increase will occur in developing countries. There will be a 42% increase, from 51 to 72 million, in the developed countries and a 170% increase, from 84 to 228 million, in the developing countries. Thus, by the year 2025, 75% of people with diabetes will reside in developing countries, as compared with 62% in 1995 (King *et al.* 1998). Bangladesh is a developing country. International Diabetes Federation (IDF) estimated and forecasted that 3.8 million or 4.8% of people living in Bangladesh would be affected by diabetes mellitus by the year 2007 and the number is expected to be 7.4 million or 6.1% of the population by the year 2025 ([www.med.uio.no/disputaser/mo/muhammad-abdur-rahim.xml](http://www.med.uio.no/disputaser/mo/muhammad-abdur-rahim.xml). Accessed May 15, 2008). This explosion in diabetes prevalence will place Bangladesh among the top ten countries in terms of the number of people living with diabetes in 2025. At that time, 80% of all diabetes cases will be the burden in the low and middle socioeconomic countries than affluent society ([www.worlddiabetesday.org/node/2918](http://www.worlddiabetesday.org/node/2918) Accessed May 15 2009). As the disease has got increased incidence and prevalence globally and mostly in the under developed countries therefore increased economic burden will posed for the problem as well as for its complications. Since diabetes mellitus is a life-long problem; the quality of individual life can be improved if managed properly. The non communicable diseases like hypertension, diabetes and asthma are emerging as a major health problem in Bangladesh. Among these, the prevalence of hypertension and diabetes are increasing rapidly. In recent time, there is no study on prevalence of these diseases in our country. Some population-based studies conducted in Bangladesh in different time and have revealed the increasing trends of diabetes prevalence ranging from 1.5 to 3.8% in rural communities (West and Kalbfleisch 1966 and Sayeed *et al.* 1997). In Bangladesh, these non communicable diseases are emerging as a major health problems and the government has given them high research priority (Mitra *et al.* 2001). Quantifying the prevalence of diabetes and identifying the individuals affected by diabetes, now and in the future, are important to allow rational planning and allocation of resources for diabetic prevention and control. In addition, the identification of risk factors for diabetes would allow better identification of people at risk for diabetes, and more effective, efficient application of preventive measures. Therefore, the purpose of this study was to estimate the prevalence of socioeconomic, demographic and health attributes of diabetes people as well to identify the risk factors for diabetes people from pre-diabetes condition in Dinajpur District of Bangladesh.

## MATERIALS AND METHODS

**Study location:** A cross-sectional survey was conducted in Dinajpur district of Northwest

Bangladesh, named Dinajpur. Study was conducted on 359 diabetes people of study area with different age and sex groups. Objective oriented data was collected from January to June 2011 from diabetes and pre-diabetes patients who came to the hospital for getting service in Dinajpur Diabetes and Swastha Seba Hospital, Bangladesh. The ethical clearance and approval were respected in the surveys. The protocol was approved by the Dinajpur Diabetes and Swastha Seba Hospital, Bangladesh.

**Survey and sampling:** During survey, there are 359 people of different ages and sex groups who are from different locations of Dinajpur District. Respondents were chosen who were more than 16 years old and who were able to understand clearly the instructions of the survey. All the subjects had answered voluntarily and confidently against the administered pre-tested questionnaires. All individuals were given an identification number. For study we were selected 359 out of 12,000 diabetes and pre-diabetes patients by systematic random sampling during. Pregnant women and disabled persons, who were unable to face simple questions, were avoided from the study. Initial contact was made with individuals and their families to provide information to them about the study and to obtain informed consent. Data relating to their socioeconomic, demographics and health status collected during interview and clinical examinations were performed at Dinajpur Diabetic and Swastha Seba Hospital. Each participant's was interviewed for the status of physical activities, family history of diabetes, hypertension, annual income etc. By following with proper aseptic precautions, 5 ml. of venous random blood was taken for blood glucose estimation. Fasting blood glucose was estimated by the glucose-oxidase method using the auto analyzer. After estimation of random blood sugar (RBS), the participants were classified into normal, impaired glucose tolerance (IGT) and diabetes based on the diagnostic criteria of WHO and American Diabetes Association ( $<7.8$  mmol/l = normal,  $7.8-11.0$  mmol/l = IGT,  $>11.1$  mmol/l = DM).

**Anthropometrical and Blood Pressure Measurement:** Anthropometrical measurement indicated height, weight and Body Mass Index (BMI) of patients. Height was measured by using stadiometer, interviewed standing upright on a flat surface without shoes and body weight was taken to the nearest 0.1 kg by a digital bathroom scale with light clothes. BMI was calculated as a ratio of weight in kg divided by height in meters squared. Blood pressure level was recorded in the procedure described by Akhter *et al.* (2011).

**Statistical Analysis:** Descriptive statistics on the prevalence of diabetes was computed. Diabetes prevalence at different levels of categorical independent variables (e.g., age, sex and locations) were calculated. Multiple logistic regressions was applied to identify diabetes risk factors, and to

compare their relative importance. Statistical significance was set at  $\alpha = 0.05$  (P-value < 0.05), in some cases  $\alpha = 0.10$  was considered. Statistical software SPSS (Ver. 16.0) was used for all statistical calculations.

## RESULTS AND DISCUSSION

Socio-demographic characteristics of the study subjects were presented in Table 1. The subjects were 34.3% and 65.7% in urban and rural area, respectively. Among the participants 52.9% was male, about 47% was female and most of them were married (97.2%). All patients were divided into 4 age groups; in which 6.4 % were between 16 to 29 years, 29.8 % participants were between 30 to 44 years, 46.5% were 45 to 59 years and 17.3 % were above 60 years of age. About 78.3% of the adult population was primary level, 13.9% was secondary level and 7.8 % was found to have Bachelor education. Occupationally, 14.8% were businessmen, 7.8% teachers, 40.9% housewives, 8.9% servicemen, 17.3% farmers, 7.0% day laborers and 3.3 % were students. In regard to socio-economic status, all participants were divided into 4 income groups (Taka/year); in which 11.1 % were between 150000-250000 and above, 65.5% were 100000 to 150000, 18.7% were 50000-100000 and 4.7% were below 50000 income groups. Those are having diabetic from his parents that means family history positive were 30.4% and those are negative family history were 69.6%. Among the participants 57.9% were habituated with physical activities and 42.1% were not. In respect to mental condition 85.5% was happy and 14.5% was unhappy in their family life. About 36% participants were hypertension patients and 63.8% was no hypertension status.

According to level of Physical walking all participants were divided into three categories such as every day, four to five days per week and one or two days per week, respectively. Out of all participants 68.8% were walked every day, 20.6% were 4-5 days per week and 10.6 % were walked at one or two days per week. Patient of diabetic type divided into type 1, type 2 and juvenile and gestational diabetes mellitus (GDM). About 4.5% were type 1 diabetic, 92.8% were type 2 diabetic and only 2.8% were juvenile and GDM patients. All subjects those are never sweet taken were 95.8%

and those are taken sweet were 4.2%. Among the all subjects 56.0% were never smoked, 25.6% were ex smoker and 18.4 were current smoker. In aspects of alcohol consumption by the patients 72.7% were never drank alcohol, 10.3 % were mildly drank, 17.0% were moderately drank alcohol in their living life. BMI was divided into three categories under weight, normal and over. The BMI of underweight, normal and over were 15.0 60.2 and 24.8%, respectively. Among the participants the pre-diabetes was 22.0% and diabetes was 78.0%.

Some selected socio-economic and demographic factors were investigated to determine their effect on diabetes among the selected people in Dinajpur district. The study was considered sixteen (16) probable risk factors (Table 1) to identify possible determinants of diabetes patients from prediabetes. To identify the determinants of diabetes from prediabetic people, multiple logistic regression analysis was performed and the result is presented in Table 2.

In this study, an important relationship between hypertension status and diabetes was observed. The people with pre-diabetes condition have 1.54 fold more possibility of diabetes if they have hypertension than those having no hypertension. It indicated that the hypertension status is an important risk factor associated with the development of diabetes from pre-diabetes condition. The hypertension was also mentioned as one of the risk factors of diabetes (Sayeed *et al.*, 1997 and Grossman and Messerli., 2008). Another risk factor evident in the study was level of walk. People have one or two days walk practice per week have 2.10 fold more possibility of development of diabetes from pre-diabetes condition than those having regular walking habit. This possibility is 1.64 fold more for peoples practicing 4 to 5 days walking per week. This finding is similar and very common for the studies related to diabetes (Jayasinghe *et al.* 2007; Hu *et al.* 1999; Andersson *et al.* 2002). Dietary behavior was also observed as an important risk factor of developing diabetes from pre-diabetes condition. The close association between the dietary behavior and diabetes was also mentioned in several studies (Primanda *et al.* 2011; Sumiyoshi *et al.* 2009; Omondi *et al.* 2012). In this study, people who take sweet taste diet during pre-diabetes condition have 2.12 times more possibility than the

**Table 1.** Demographic characteristics and biochemical parameter of the study population

	Variables	Frequency	Percentage
Location	Urban	123	34.3
	Rural	236	65.7
Sex	Male	190	52.9
	Female	169	47.1
Marital status	Married	349	97.2
	Unmarried	10	2.8
Age	<30	23	6.4
	30-44	107	29.8
	45-59	167	46.5
	60+	62	17.3
Education	Primary	281	78.3
	Secondary	50	13.9
	Bachelor	28	7.8
	Business men	53	14.8
Profession	Teacher	28	7.8
	House wife	147	40.9
	Service men	32	8.9
	Farmer	62	17.3
	labourer and others	25	7.0
	Students	12	3.3
	150000-250000 and above	40	11.1
Yearly income in Tk.	100000-150000	235	65.5
	50000-100000	67	18.7
	<50000	17	4.7
Family History	Negative	250	69.6
	Positive	109	30.4
Physical activities	Yes	208	57.9
	No	151	42.1
Mental condition	Happy	307	85.5
	Unhappy	52	14.5
Hypertension	Yes	130	36.2
	No	229	63.8
Level of walk	Every days	247	68.8
	4-5 days/week	74	20.6
	1 or 2 days/week	38	10.6
Patient of diabetic type	Type 1	16	4.5
	Type 2	333	92.8
	Juvenile and GDM	10	2.8
Dietary behavior	No sweet taste	344	95.8
	Sweet taste	15	4.2
Smoking behavior	Never	201	56.0
	Ex smoker	92	25.6
	Current smoker	66	18.4
Alcohol consumption	Never	261	72.7
	Mild	37	10.3
	Moderate to severe	61	17.0
BMI	Under weight <18.5	54	15.0
	Normal (18.5-24.9)	216	60.2
	Over (25.0+)	89	24.8
Fasting blood sugar	Prediabetis	79	22.0
	Diabetes	280	78.0

**Table 2.** Multiple logistic regression analysis for significant studied variables in determining risk factors for diabetic patients from pre-diabetic patients

Category	Level	B	S.E.	P-value	Exp(B)	95% C.I. for EXP(B)	
						Lower	Upper
Hypertensi on status	Yes	0.432	0.285	0.079	1.54 <sup>†</sup>	.882	2.693
	No (RC)				1.00		
Level of walk	Every day (RC)				1.00		
	4 or 5 days per week	0.493	0.363	0.026	1.63 <sup>*</sup>	.803	3.334
	1 or 2 days per week	0.740	0.480	0.048	2.10 <sup>*</sup>	.818	5.368
Dietary behaviour	No sweet taste diet (RC)				1.00		
	Sweet taste diet	0.751	0.459	0.087	2.11 <sup>†</sup>	.861	5.210
Smoking behaviour	Never (RC)				1.00		
	Ex-smoker	0.426	0.308	0.046	1.53 <sup>*</sup>	.837	2.799
	Current smoker	0.546	0.336	0.024	1.72 <sup>*</sup>	.893	3.335
Constant	1.126	1.126	0.224	0.000	3.08 <sup>**</sup>		

RC means reference category. <sup>†</sup>, \* and \*\* indicates significant at 10, 5 and 1% of level of probability respectively. Variable(s) entered as independent: Location, Sex, Merital status, Age group, Education, Income, Body mass index, Family history, Physical activities, Mental condition, Hypertension status, Level of walk, Dietary behaviour, Smoking behaviour, Alcohol behavior and Fasting blood sugar of patients.

people who do not take so. Another risk factor associated with development of diabetes from pre-diabetes condition was smoking behavior. The ex-smokers and current smokers have such possibility of 1.53 folds and 1.73 folds, respectively, more of migrating from pre-diabetes condition to diabetes one in compare to those have never taken smoke. Various research works indicated the smoking behavior as very important risk factor (Hsin-Chieh *et al.* 2010; Ko and Cockram 2005; Rimm *et al.* 1995; Radzeviciene and Ostrauskas 2009).

### CONCLUSIONS

It concluded that hypertension, level of work, dietary behavior and smoking behavior were marked as contributing risk factors associated with the development of diabetes from pre-diabetes condition in Dinajpur district of Bangladesh. For developing proper strategy to control diabetes, further large scale but in intensive studies are highly deserved.

### ACKNOWLEDGEMENTS

The authors thank to the authority of Dinajpur Diabetic and Swastha Seba Hospital for necessary supports during this study.

### REFERENCES

- Akhter A, Fatema K, Afroz A, Bhowmik B, Ali L and Hussain A. 2011. Prevalence of Diabetes Mellitus and its Associated Risk Indicators in a Rural Bangladeshi Population. *The Open Diabetes Journal*. 4: 6-13.
- Andersson C, Bjara G and Ostenson C. 2002. A stage model for assessing a community-based diabetes prevention program in Sweden. *Health Promotion International*, 17(4): 317- 27.
- Diabetes, 2006. Retrieved from [www.worlddiabetesday.org/node/2918](http://www.worlddiabetesday.org/node/2918) Accessed May 15 2009.
- Dong Y, Gao W, Nan H, Yu H, Li F, Duan, W, et al. 2005. Prevalence of type 2 diabetes in urban and rural chinese population in Qingdao, China, *Diab. Med.*, 22: 1427-1433.
- Epidemiology of Diabetes Mellitus in Bangladesh. 2008. Retrieved from [www.med.uio.no/disputaser/mo/muhammad-abdur-rahim.xml](http://www.med.uio.no/disputaser/mo/muhammad-abdur-rahim.xml). Accessed May 15
- Frier BM and Fisher M. 2006. 'Diabetes mellitus', in NA Boon, NR Colledge, BR Walker and JAA Hunter (eds.), *Davidson's Principles and Practice of Medicine*, (20th ed.), Churchill Livingstone, London, P. 808.

- Grossman E, Franz H and Messerli. 2008. Hypertension and Diabetes. *Cardiovascular Diabetology: Clinical, Metabolic and Inflammatory Facets*. Adv Cardiol. Basel, Karger, 45: 82–106.
- Gulabani M, John M and Isaac R. 2008. Knowledge of diabetes, its treatment and complications amongst diabetic patients in a tertiary care hospital. *Indian Journal of Community Medicine*, 33: 204-206.
- Hsin-Chieh Y, Bruce D, Schmidt MA. 2010. Smoking, smoking cessation and risk for type 2 diabetes mellitus. *Annals of Internal Medicine*. 152(1): 10-17.
- Hu F, Sigal R, Rich-Edward W and Solomon C. 1999. Walking compared with vigorous physical activity and risk of type 2 diabetes in women. *Journal of the American Medical Association*, 282(5): 1433-1447.
- Jayasinghe SA, Atukorala I, Gunethilleke B, Siriwardena, V, Herath, SC and De Abrew K. 2007. Is walking barefoot a risk factor for diabetic foot disease in developing countries? *Rural and Remote Health*, 7: 692.
- King H, Aubert RE and Herman WH. 1998. Global Burden of Diabetes, 1995–2025 Prevalence, Numerical Estimates, and Projections. *Diabetes Care*, 21: 1414–1431.
- Ko G and Cockram C. (2005). Cause as well as effect: smoking and diabetes. *Diabetes Voice*:. Smoking and diabetes special issue. 50: 19-22.
- Marguerrite J, Neely MC and Edward J. 2004. Type 2 diabetes prevalence in Asian Americans, *Diab. Care* 27: 66-69.
- National Institute of Population Research and Training, Mitra and Associates (MA), & ORC Macro (ORCM). 2001. *Bangladesh Demographic and Health Survey 1999-2000*. Dhaka, Bangladesh.
- Omondi DO, Walingo MK, Mbagaya GM and Othuon LOA. 2012. Predicting Dietary Practice Behavior among Type 2 Diabetics Using the Theory of Planned Behavior and Mixed Methods Design. *International Journal of Biological and Life Sciences* 8:2.
- Primanda Y, Kep S, Kritpracha C and Thaniwattananon P. 2011. Dietary Behaviors among Patients with Type 2 Diabetes Mellitus in Yogyakarta, Indonesia. *Nurse Media Journal of Nursing*, 1(2): 211-223.
- Radzeviciene L, Ostrauskas R. 2009. Smoking habits and the risk of type 2 diabetes: a case control study. *Diabetes and Metabolism*. 35(3): 192-197.
- Ramachandran C, Snehalatha A, Vijay V, Mohan V and Das AK. 2001. High prevalence of diabetes and impaired glucose tolerance in India: national urban diabetes survey, *Diabetologia*, 44: 1094-1101.
- Rimm E, Chan J and Stampfer M. 1995. Prospective study of cigarette smoking, alcohol use, and the risk of diabetes in men, *Br. Med. Journal*, 310: 555–559.
- Sayed MA, Hussain MZ, Banu A, Ali L, Rumi, MAK and Khan AKA. 1997. Effect of socioeconomic risk factor on difference between rural and urban in the prevalence of diabetes in Bangladesh, *Diabetes Care*, 20: 551–555.
- Shera AS, Rafique G, Khwaja IA, Baqai S, Khan IA, King H. 1999. Pakistan National Diabetes Survey prevalence of glucose intolerance and associated factors in North West at Frontier Province (NWFP) of Pakistan, *J. Pak. Med. Assoc.*, 49: 206-211.
- Sumiyoshi K, Kawata C, Shikata K, and Makino, H. 2009. Influencing factors for dietary behaviors of patients with diabetic nephropathy. *Acta Med. Okayama*. 64(1): 39-47.
- West, KM and Kalbfleisch, JM. 1966. Glucose tolerance, nutrition and diabetes in Uruguay, Venezuela, Malaya and East Pakistan, *Diabetes*, 15: 9-18.
- Wild S, Roglic G, Green A, Sicree R and King H. 2004. Global prevalence of diabetes. Estimates for the year 2000 and projections for 2030, *Diab. Care*, 27: 1047-1053.