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Prevalence and Risk Factors of Type 2 Diabetes Mellitus Among Secretariat Employees of Bangladesh

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Abstract:

Context*: The pandemic of diabetes is more explosive in developing countries and Bangladesh is one of the top 10 countries estimated to have the highest numbers of people with diabetes in 2000 and 2030.*

Aims: *The aim of this study was to quantify the prevalence and risk factors of diabetes among secretariat employees of Bangladesh.*

Settings and Design: *A random sample of 1000 employees of Bangladesh Secretariat was included in this cross sectional study.*

Methods and Material*: Blood glucose levels, both Fasting (FPG) and 2-hours after 75gm load, total cholesterol, triglycerides were measured in each case. Body mass index (BMI), blood pressure, was measured as well as collection of information regarding risk factors and socio-demographic variables.*

Statistical analysis used: *Univariate analysis of all variables was done. Cohen's Kappa was used to find agreement and odds ratios were calculated to assess risk factors.*

Results: *The prevalence of diabetes was 12.3% and 7.5% according to FBG and 2-hours after 75gm glucose, respectively. Age of study population was e"20 years and male, female ratio was 4.75:1. The prevalence was almost similar among men (12.35%) and women (12.05%) considering FBG. While a higher prevalence among women (9.8%) was noticed than men (7%) after 75gm glucose. Pre-diabetic employees were 13.7 %(impaired glucose tolerance) and 31.8% (impaired Fasting glucose). Moderate agreement was observed between FBG and 2-hours after 75gm glucose (kappa 0.6). Increasing age, sedentary lifestyle (OR 1.5), diabetes among first degree relatives (OR 1.7), BMI ≥30 (OR 1.5), systolic blood pressure ≥130 (OR 1.2), total cholesterol ≥200 (OR 1.6), triglycerides ≥150 (OR 1.4) were found significantly related to diabetes.*

Conclusion: *Increased prevalence of diabetes, IFG and IGT forecasts the upcoming diabetes explosion and calls for urgent steps towards the primary prevention in developing countries.*

Keyword: *Type 2 diabetes, prevalence, risk-factors, BMI, sedentary lifestyle*

Introduction:

Bangladesh, which is still fighting with communicable diseases, is already overburdened with non-communicable diseases. The total number of people with diabetes in Bangladesh is projected to raise from 3.2 million in 2000 to 11.1 million in 2030.[1] Diabetes is already the tenth most expensive disease here in terms of total healthcare cost allocated for an illness.[2]

The pandemic of diabetes has progressed in association with rapid cultural transforms, growing urbanization, dietary changes, decreased physical activity and other unhealthy lifestyles. Therefore, it may seem strange that the developing world, which is associated with hunger and malnutrition, is now experiencing an epidemic in Type 2 diabetes. Asian people are considered susceptible genetically. However, increased affluence may unmask it. That is why; the great

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concern is how to face this situation in the different segments of society. In Bangladesh several studies were done in rural areas, urbanizing rural community or comparing rural and urban communities.[3-6] There is no available statistic regarding the burden of diabetes among urban affluent people. This study intends to estimate prevalence and relevant risk factors of Diabetes among the secretariat employees as they are considered vulnerable due to their job nature, high social class and income.

Subjects and Methods:

This cross sectional study was carried out among 1000 randomly selected employees of Bangladesh Secretariat in December 2008. All classes of employees irrespective of age or sex were included. Information regarding risk factors as well as socio-demographic variables was collected in a preformed questionnaire and face-to-face interview was carried out. Written informed consent was obtained from each participant. Weight was taken to the nearest 0.1 kg with light clothing and without shoes by modern digital bathroom scales placed on a flat surface. The weighing machine was checked each day with a standard weight. Height was taken to the nearest centimeter without shoes, with the subjects standing fully erect and looking straight ahead on a flat surface. Body mass index (BMI) was calculated and evaluated as defined by World Health Organization (WHO).[7] Blood pressure (BP) was measured with standard technique after the subjects rested for at least 10 min in sitting position. Venous blood was collected with all aseptic precautions for fasting blood glucose (FBG) and fasting lipid profile with no caloric intake for at least eight hours. Then all the subjects were given a 75 gm glucose solution to drink for 2-hour post glucose challenge test. Laboratory investigations were conducted out by auto analyzer. Data entry was controlled both through programmed appliance and manually. Prevalence of diabetes was determined in accordance with American Diabetes Association criteria for both FBG and 2-hour post glucose load.[8] Analysis of data was performed using SPSS (Version12). Univariate analysis of all variables was done and a chi-square test was performed to compare categorical variables. P value less than 0.05 was considered statistically significant. Cohen's Kappa was used to find agreement between FBG and 2-hour post glucose load for diagnosis of diabetes mellitus. To assess risk factors of diabetes crude odds ratios with 95% CI were calculated.

Results:

Among 1000 employees, male, female ratio was 4.75:1. Age group I (18 - 30), group II (31 - 40), group III (41 - 50) and group IV (>50) had 17.9%, 34.8%, 30.6% and 16.7% employees respectively. All the employees were literate. 46.8% employees had secondary and higher secondary education and 44.4% were graduate and postgraduate. Majority (76.1%) had a monthly basic income above 5100 taka (900 US $ yearly) and 94.4%.were married. Table-I shows the selected characteristics of the study population.

Table-I

Socio-demographic characteristics of sample population.

Variable	Mean value	Standard deviation
Age(in years)	40.58	9.22
Monthly income(Tk)	11246. 38	9933.42
Fasting Plasma glucose (mmol/L)	5.78	1.36
2-h postload glucose (mmol/L)	7.42	2.39
BMI (kg/m^2)	24.38	3.15
Systolic blood Pressure (mmHg)	122.28	17.63
Diastolic blood pressure (mmHg)	82.21	10.04
Total Cholesterols (mg/dl)	170.72	39.35
Triglyceride (mg/dl)	170	97.69

The prevalence of diabetes was 12.3% according to FBG level and 7.5% after 2-h 75gm glucose. Prevalence was 12.35% among men and 12.05% among women considering FBG. But the prevalence was 9.8% among women and 7% among men after 75gm glucose load. Diabetes prevalence was found to increase with increasing age. Among the persons who had a provisional diagnosis of diabetes according to FBG (n=123), 62 employees (50.41%) had also glucose intolerance. Similarly 61(49.59%) participants having diabetes according to FBG did not show glucose intolerance 2-h after 75gm glucose. Moderate agreement (kappa 0.6) was observed between FBG and 2-h after 75gm glucose (Table-II).

Table-II

Agreement between fasting plasma glucose values (FPG) and the 2-h post load glucose (OGTT) in diagnosis of diabetes.

FPG (mmol/L)	OGTT(mmol/L)		Total
	<11.1	≥11.1	
<7	864	13	877
≥7	61	62	123
Total	925	75	1000

Cohen's Kappa: 0.588, Agreement: 0.926, 95% Confidence Interval: 0.50-.67

A good number of participants (31.8%) had impaired Fasting glucose (IFG). Among them (n=318), 11(3.5%) were found diabetic 2-h after 75gm glucose. Prevalence of impaired glucose tolerance (IGT) was 13.7%.

Twenty percent diabetes was previously undiagnosed. Figure 1 shows the distribution of risk factors among diabetic patients. Mean BMI (±SD) of diabetic subjects was 24.45 ± 3.28. Increasing age, sedentary lifestyle, diabetes among first degree relatives, BMI ≥ 30, systolic blood pressure ≥130, serum triglyceride≥150 and total cholesterol ≥ 200 were found significantly related to diabetes (Table-III).

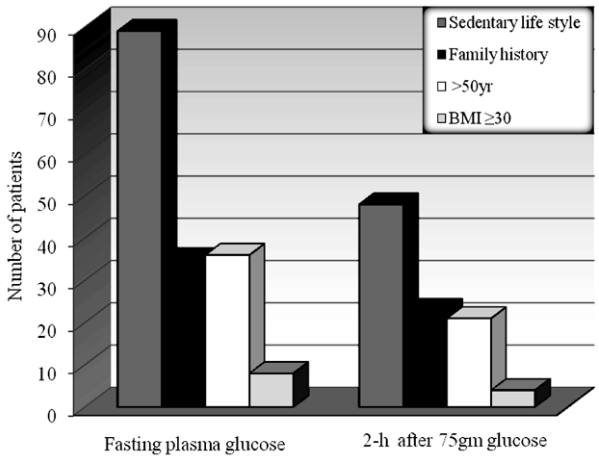

Fig.-1: *Distribution of risk factors among diabetic patients (n_1=123, n_2= 75).*

Table-III

Odds ratio(OR) with 95% confidence interval (CI) of diabetes following fasting blood glucose and 2-h postload glucose values by following risk factors among secretariat employees.

Variables	n	Fasting plasma glucose		2-h postload glucose	
		OR	95% CI	OR	95% CI
Age					
41-50	306	1.16	0.8-1.7	1.3	0.8-2.1
>50	167	2.36	1.5-3.6	2.08	1.2-3.5
BMI					
<18.5	32	1.02	0.4-3	1.80	0.6-5.3
18.5-24.9	495	1.08	0.7-1.6	0.94	0.6-1.5
25-29.9	425	0.99	0.7-1.5	0.95	0.6-1.5
≥ 30	47	1.46	0.7-3.2	1.13	0.4-3.2
Physical activity					
Sedentary	650	1.48	1-2.2	0.95	0.6-1.6
Moderate to Vigorous	350	0.67	0.5-1.0	1.05	0.6-1.7
Regular exercise	309	0.59	0.4-0.9	0.64	0.4-1.1
Smoking	206	0.98	0.6-1.6	0.72	0.4-1.4
1st degree relatives	199	1.73	1.1-2.7	1.88	1.1-3.2
Systolic blood pressure ≥ 130	371	1.23	0.8-1.8	1.63	1.0-2.6
Diastolic blood pressure ≥ 85	355	1.01	0.7-1.5	1.23	0.8-2
Total Cholesterol ≥ 200	217	1.59	1.0-2.4	1.06	0.6-1.9
Triglycerides ≥ 150	485	1.36	0.9-2	1.31	0.8-2.

Annex

Numerical data of Figure

Variable	Fasting plasma glucose(n_1)	2-h after 75gm glucose(n_2)
Sedentary life style	89	48
Diabetes among 1st degree relatives	35	23
Age>50yr	36	21
BMI $\geq$ 30	8	4

Discussion:

The prevalence of diabetes for all age-groups worldwide was estimated to be 2.8% in 2000 and 4.4% in 2030.[1] Urban studies in Bangladesh have shown increasing prevalence of diabetes in 1996 (7.9%) and in 2006 (11.2%).[4,5] Pre-diabetic conditions like impaired glucose tolerance and impaired fasting glucose are also on the rise .This trend is in agreement with the studies conducted in India, showing that the prevalence of diabetes in adults in urban areas had shot up from 5.0% to 13.9% within 16 years(1984-2000).[9] This study also shows a high prevalence of Type 2 Diabetes Mellitus (DM) and an unusually high prevalence of pre-diabetes. Although the prevalence is lower than the urban prevalence of India (13.9%), it is much higher than that of Pakistan (6%, 3.5%), China (7.8%) and Japan (10.5%, 12.9%).[9-12] In fact, the prevalence in the present report is not likely to represent the prevalence of diabetes in whole urban population of Bangladesh. The study place was selected purposively as a vulnerable group and the sample size was not so large as to represent the entire country. Moreover rural community shows less burden of DM in Bangladesh (2.8%), which is lower than that of Pakistan (6.9%, 2.5%) and China (5.1%).[13,10,11] This striking difference can be attributed to lifestyle habits and the lower socioeconomic status of the rural population.

We have observed higher prevalence of diabetes among the females (9.8%) compared to males (7.0%) after 75gm glucose load but the difference was not statistically significant (p=0.14). It is consistent with the finding of some other studies in Bangladesh.[4, 14] Sayeed MA et, al found a higher prevalence among males ((5.2 vs. 3.2%) and Hussain A et, al observed female predominance.[3,15] Globally, diabetes prevalence is similar in men and women but it is slightly higher in men <60 years of age and in women at older ages.[1]

In developing countries, the majority of people with diabetes are in the 45 to 64 year age range. In contrast, the majority of people with diabetes in developed countries are >64 years of age.[1] In the present study, diabetes prevalence increased with increasing age reaching a peak at >50 year age group. The finding correlates with other studies in Bangladesh and India.[3,5,15-17] As the survey was performed on government employees, data are not available on younger and older ages.

Both IGT (13.7%) and IFG (31.8%) were higher than diabetes here. Most of the studies in Bangladesh, India, Pakistan and Japan found a higher prevalence of IGT than diabetes.[4,5,10,12] People with IGT have a 25% to 50% risk of developing diabetes in the subsequent ten years forecasting a heavier burden.[18] So, IFG should also be evaluated carefully. We found moderate agreement (kappa 0.6) between FBG and 2-h after 75gm glucose in concordance with the previous findings of poor to moderate agreements.[14,15]

The important risk factors associated with diabetes are mostly similar in all countries but their expression and intensities vary widely between races, regions and countries. Surrogates for socioeconomic status, such as level of education and income are inversely associated with diabetes in high-income countries.[19] In contrary, the highly educated subjects of the current study, having a high monthly income were found at risk of diabetes. Other studies in Bangladesh show the same.[3,5,6,14] It might be due to the fact that high-income groups get less physical activities and more Western food. In fact, sedentary lifestyle was found significantly related to diabetes in this study as well as other surveys in Bangladesh.[3,6]

Regarding the adoption of habits harmful to health, the use of tobacco was more frequent than alcohol. 20.6% employees were smoker and only 0.05% had a history of taking alcohol regularly. Both failed to show any significant relation with DM. The values presented in the present study probably due to high religious value or omission of this information at the moment of the interview.

The strongest and most consistent risk factor for diabetes and insulin resistance among different populations is obesity and weight gain. For each unit increase in body mass index, the risk of diabetes increases by 12%.[20,21] On the other hand Asians have a high risk of developing glucose intolerance with small increments in their BMI. Actually, the association with BMI and type 2 diabetes appeared to differ in different ethnic groups. [22] Most of the diabetics in our study showed BMI within normal range but obesity is found to be related to diabetes. Data from previous studies have shown a marginal or no risk for Type 2 diabetes with higher BMI for both sexes in Bangladesh.[13,15] However, an Indian study found high prevalence of diabetes even though the rates of obesity were low among the rural and urban population.[23] This so-called 'lean diabetes' may be explained by higher genetic risk factor in this population. But increased

risk of diabetes and IGT were reported with increasing BMI, specially >25.[3,4,6] Observing this disparity, WHO convened the Expert Consultation on BMI in Asian populations which addressed the debate about interpretation of recommended body-mass index (BMI) cut-off points for determining overweight and obesity in Asian populations.[24] They added the cut-off points of 23, 27.5, 32.5 and 37.5 kg/m^2 as points for public health action.[24]

The risk for type 2 diabetes is higher in monozygotic twins and people with a family history of diabetes.[25] We found important relationship between DM and history of DM among 1st degree relatives like all previous studies.[3,6,10]

Systolic hypertension (SBP > 130 mm Hg) was associated with the occurrence of diabetes in our population which is in agreement with other studies in Bangladesh, southern Taiwan, China and Australia.[17,20,26-28] We observed that high serum triglyceride and cholesterol were significantly related to diabetes, whereas Sayeed MA et al. found no significant correlation was found with total cholesterol, TG, and HDL cholesterol.[5]

In view of the high prevalence of diabetes in this study, we can comment that increased affluence and westernization have been associated with an increase in the prevalence of diabetes in Bangladesh. Higher prevalence of IFG and IGT forecast the worrying potential for a further diabetes explosion and calls for urgent steps towards the primary prevention. The present cut-off values for BMI may call for readjustment in different population to indicate the population at risk. So, screening of healthy people with increased age and family history of diabetes should be done to start early intervention with adoption of healthy life style and reduction of body weight.

Conflict of interest : None

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