Original Article

Prevalence of Prediabetes and Associated Risk Factors among Undergraduate Medical Students

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Abstract

Background: *Diabetes is a silent killer, which can take the lives of victims if undiagnosed at the earliest stage. Prediabetes is the preventable and curable stage of diabetes mellitus. The objectives of our study were to determine the prevalence of prediabetes and find out any association between the different risk factors with prediabetes among undergraduate medical students.* ***Materials and methods:*** *This cross sectional study was conducted in Chattagram Maa-O-Shishu Hospital Medical College from September 2019 to February 2020. A total 100 medical students of both sex, age ranges from 19 to 25 years participated voluntarily. Socio demographic profile, associated risk factors and biochemical parameters were recorded in the questionnaire to determine the prediabetic group of study. SPSS 22 version was used for data analysis.* ***Results:*** *In this study 35% student had raised their blood glucose level and recognized as prediabetes. 74% students reported a family history of diabetes with their parents or grandparents, 23% of students maintaining their sedentary lifestyle, 44% students were overweight or obese having central obesity and 41% smoke active or passively. Alarmingly our 96% students were in stress and 69% complained about their sleep disturbance. We found significant ($p<0.05$) influence of family history of diabetes, regular physical activities and sleep disturbance over prevalence of prediabetes. There was strong association between prediabetes and sleep disturbance (OR 1.84; $p<0.05$).* ***Conclusion:*** *From this study it may be concluded that prediabetes screening for medical students gives the opportunity to implement lifestyle interventions as early as possible, which could prevent the development of diabetes in future leading generation.*

Keywords: Prediabetes, Risk factors, Medical students

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Introduction

Diabetes is one of the most challenging health problems of the twenty-first century. It is one of the major causes of morbidity and early mortality worldwide.[1] It has become the seventh leading risk factor for burden of disease in South Asian countries.[2] Bangladesh has the second largest number of adults with diabetes (5.1 million adults, 6.31%).[3] Previously, diabetes was a middle-aged disease but currently it shifted to a much younger age.[4]

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The first stage is characterized by insulin resistance accompanied by a compensatory increase in insulin secretion; is called prediabetes. This stage is often referred to as the "grey area".[5] Patients with both impaired fasting glucose (IFG) and impaired glucose tolerance (IGT) have insulin resistance, but the site of their predominant insulin resistance differs.[6,7] Prediabetes is defined as a fasting blood glucose concentration of 100-124 mg/dl, or a two-hours post prandial blood glucose concentration of 140-199 mg/dl or a HbA1c value of between 5.7% and 6.4%. So, prediabetes includes subjects with elevated fasting plasma glucose concentrations and normal response to a glucose load called IFG or subjects with raised postprandial blood glucose with normal fasting glucose concentration called IGT or a combination of both IFG and IGT.[8] The subjects with IFG have predominantly hepatic insulin resistance, whereas IGT have predominantly muscle insulin resistance.[9]

Prevalence of IGT is 8.3% globally[10], is associated with physical inactivity, obesity (especially central

obesity), dyslipidemia with high triglycerides and/or low high density lipoprotein cholesterol, and hypertension.[11] It is thus a metabolic syndrome, usually involves no symptoms and only high blood sugar as the sign.[12]

There is evidence that prediabetes is a curable disease state.[13] Intensive weight loss and lifestyle intervention may improve glucose tolerance substantially and prevent progression from IGT to type2 diabetes. Prevention or delay in the onset of diabetes should not only recover the burden of the disease on the individual, but could also decrease the associated morbidity and mortality. Preventing type 2 diabetes may result in significant public health benefits, including lower rates of cardiovascular disease (CVD), renal failure, blindness and premature mortality.[14] The prevalence of pre-diabetes notably increased with increasing age and increasing weight.[15] The earlier onset of the disease is important because of the effect on the productive life years and the long term burden on the healthcare.[16] Prevalence of active and passive smoking among medical students also increasing and the nicotine deteriorate glucose metabolism, glycemic control and ultimately insulin resistance that leads to prediabetes.[17]

A high prevalence of stress is reported among medical students globally. Extensive curricula, numerous academic requirements, frequent, difficult and various types of examinations make their life stressfull.[18] It is well documented that high levels of stress has negative effects on the physical and mental health of medical students.[19] They reduce their sleep time for academic requirements that is extra time for study and workload especially before an examination. Sleep disturbance or voluntarily restricted sleep duration are associated with impairment of glucose homeostasis, beta cell dysfunction and increased risk of diabetes.[20,21] Studies have shown that people who reported sleeping fewer than five hours per night had a greatly increased risk of developing diabetes.[22]

Medical students have a stressful life, sedentary lifestyle and irregular food habits which could predispose them for pre diabetes or diabetes at a younger age. They are important part of the society and can be easily educated regarding the early identification of pre diabetes to prevent the complications that follow in the later life.[23]

Our study participants will be the future healthcare professionals and will play crucial role in health promotion. So, study has been designed to observe the prevalence of prediabetes among the medical students and to investigate any association between the different risk factors with prediabetes prevalence.

Materials and Methods

This cross sectional study was conducted in the Physiology, Bio chemistry and Endocrinology department of Chattagram Maa-O-Shishu Hospital Medical College from September 2019 to February 2020 after receiving ethical approval from institutional Ethical Review Committee and research grant from Chittagong Medical University. A total 100 medical students of both male and female (first year to fifth year) age range from 19 to 25 years voluntarily participated and included in this study. The students having history of diabetes mellitus, asthma, heart disease, pancreatic disorder, any endocrine disorder, malignancy or habit of alcohol consumption were excluded from this study. All respondents were briefed about purpose of the study and painful procedure of sample collection.

Waist-hip circumference, weight, and height were measured. BMI of ≥25kg/m² considered as overweight and ≥30kg/m² as obese. The waist circumference (cutoff for Asians) of ≥90 cm for males and ≥80 cm for females marked as central obesity.
Their blood sample was collected after 8 hours of fasting at around 9.00 am for FBS with HbA1c and then two hours after taking 75gm glucose for 2HPPBS. The students having FBS ≥100-126 mg/dl

or 2HPPBS 140-199 mg/dl or a HbA1c 5.7% - 6.4% were diagnosed as prediabetes.

All the information regarding their identity, anthropometric measurements, associated risk factors and laboratory findings were recorded in pre-designed, validated questionnaire and statistical analysis was done by using SPSS 22 version. The frequency distribution, mean, standard deviation, and cross-tabulations were used in this descriptive analysis. Chi square analysis was performed to test the association between the prevalence and associated risk factors. The analysis was performed at a 95% confidence interval and P <0.05 was considered to be statistically significant. The risk factors were further analyzed by multiple logistic regressions.

Results

All the information of 100 medical students was collected for statistical analysis. The prevalence of prediabetes, baseline characteristics of study participants and association between risk factors and prediabetes are presented in following table

Table I shows 25% students had raised fasting blood sugar (FBS) >100 mg/dl, 16% had 2 hours post prandial blood sugar (2HPPBS) >140mg/dl and only 2% had HbA1c >5.7%. Among them 1% had raised all FBS, 2HPPBS and HbA1c. 6% had raised both FBS and 2HPPBS and 1% had raised FBS and HbA1c. A total 65 students had normal blood glucose level and 35 (23 female and 12 male) had raised blood glucose level and recognized as prediabetes.

Table II shows the baseline characteristics of the students, presenting frequency distributions of the participants as per their different risk factors.74% students reported a family history of diabetes with their parents or grandparents. 23% of students maintaining their sedentary lifestyle and 77% perform light or moderate exercise. 29% students were overweight, 15% were obese and majority of them (53%) having central obesity. 41% of our study participants smoke active or passively. Alarmingly our 96% students were in stress and 69% complained about their sleep disturbance.

Table: I : Prevalence of prediabetes among study participants (n = 100)

	Male	Female	Total (n = 100)	*p* value
Fasting blood glucose				
>100mg/dl	10%	15%	25%	
<100mg/dl	33%	42%	75%	0.456
2 hours post prandial blood glucose				
>140mg/dl	4%	12%	16%	
< 140mg/dl	39%	45%	84%	0.093
HbA1c				
>5.7%	1%	1%	2%	
<5.	42%	56%	98%	0.927
n = number of study sample, *p* value by using Chi square test.				

Table II: Baseline characteristics of study participants (n = 100)

Risk factors		Male	Female	Total (n=100)	*P* value
Family history of DM	Present	29%	45%	74%	0.017**
	Absent	14%	12%	26%	
Physical activity	Moderate	10%	4%	14%	0.91
	Light	26 %	37%	63%	
	Sedentary	7%	16%	23%	
BMI (kg/m²)	<25	14%	42%	56%	0.000***
	25-30	21%	8%	29%	
	>30	8%	7%	15%	
Waist circumference in cm	<80	2%	35%	37%	0.000***
	>80	10%	11%	21%	
	<90	0%	2%	2%	
	>90	31%	9%	40%	
Central obesity	Present	31%	22%	53%	0.000***
	Absent	12%	35%	47%	
H/O Smoking	Present	23%	18%	41%	0.000***
	Absent	20%	39%	59%	
Sleep disturbance	Present	23%	46%	69%	0.011**
	Absent	20%	11%	31%	
Stress	Present	39%	57%	96%	0.003**
	Absent	4%	0%	4%	

n = number of study sample. Significant * p <0.05, ** p <0.01, *** p<0.001

Table III shows the summary of the risk factors and prevalence of prediabetes in study participants. The prediabetes was cross tabulated with associated risk factors. The risk factors of family history of diabetes mellitus, regular physical activity and sleep disturbances were found to be significantly ($p<0.05$) influencing the prediabetes but BMI, central obesity stress, and smoking habit was not significant statistically ($p>0.05$).

Table IV Shows multiple logistic regressions for association of risk factors for prediabetes in study participants. We found significant association of sleep disturbance with prediabetes (OR 1.84; $p<0.050$).

Table III: Association between risk factors and prevalence (n =100)

Risk factors		Normal	Prediabetes	Total (n = 100)	*p* value
Gender	Male Female	31% 34%	12% 23%	43% 57%	0.140
Family history of DM	Present Absent	46% 19%	30% 5%	76% 24%	0.027*
Physical activity	Moderate Light Sedentary	11% 45% 9%	3% 18% 14%	14% 63% 23%	0.020*
BMI (kg/m^2)	< 25 25-30 >30	39% 18% 8%	17% 11% 7%	56% 29% 15%	0.464
Waist circumference in cm	<80 >80 <90 >90	26% 13% 1% 25%	11% 8% 1% 15%	37% 21% 2% 40%	0.838
Central obesity	Present Absent	39% 26%	24% 11%	63% 37%	0.838
H/O Smoking	Present Absent	27% 38%	14% 21%	41% 59%	0.524
Sleep disturbance	Present Absent	42% 23%	27% 8%	69% 31%	0.015
Stress	Present Absent	61% 4%	35% 0%	96% 4%	0.260
n = number of study sample. Significant * p < 0.05, ** p < 0.01, *** p< 0.001					

Table IV: Multivariate logistic regression analysis of risk factors for Prediabetes.

Variable	B	SE	t	OR (95% CI)	*p* Value
Gender	0.099	0.142	0.698	0.572 (0.183-0.380)	0.487
Family history of DM	0.002	0.004	0.568	0.403(0.010-0.006)	0.572
Physical activity	0.059	0.030	1.973	0.307(0.000-0.118)	0.052
Smoker	0.001	0.104	0.012	0.504 (0.206-0.208)	0.990
Central obesity	0.038	0.061	0.612	0.915 (0.084-0.159)	0.542
Sleep disturbance	0.171	0.090	1.904	1.84(0.350-0.007)	0.050
SE; standard error, OR; odd ratio, 95% CI; 95% confidence interval					

Discussion

A total 100 students participated in our study. 57% of them were female and 43% were male with mean age of 21.82 ± 1.80 years ranges from 19 to 25 years. A total 65 students having normal blood glucose level and 35 (23 female and 12 male) had raised blood glucose level and recognized as prediabetes. Rao T have found 17.57% prediabetes and other studies having female predominance.[24–26]

In the present study 74% students reported a family history of diabetes with their parents or

grandparents. Chowdhury found higher prevalence of prediabetes with no family history of diabetes but other researchers provides evidence of significant association between family history of diabetes and the prevalence of prediabetes.[26–29]

In this study 29% students were overweight, 15% were obese and majority of them (53%) had central obesity. Obesity and prediabetes are associated with insulin resistance and accumulation of inflammatory mediators in plasma. Other researchers have found similar result with us.[24,30,31]

In our study, the total number of 41 smokers were found as prediabetic. Nicotine causes inflammation throughout the body, superimposed on genetic predisposition and ultimately increases insulin resistance, Abdulbari Bener found smoking and family history are important contributors to Diabetes.[25,27,33] We found alarming prevalence of stress (96%) and sleep disturbance (69%). Medical students of United States and Lithuania reported poor sleep quality 51% and 59% respectively.[34,35] Abdullah I found 53% students having stress and 76% with poor sleep quality.[36] The prevalence of stress in medical students of Pakistan, Thailand, and United States and Malaysia was 60%, 61%, 57% and 42% respectively.36 Poor sleep and depression are associated with the metabolic syndrome, insulin resistance , and diabetes.[37]

In our research work, the family history of diabetes mellitus , regular physical activity and sleep disturbance were found to be significantly ($p<0.05$) influencing the prediabetes but BMI, central obesity , stress and smoking habit was not significant statistically ($p>0.05$). Amaranth et all found that the students having obesity, family history, and physical inactivity are at high risk of prediabetes.[32] Small sample size and the study population from a medical college limits the extrapolation of the data to the general population. Another limitation is the use of self-reported data about smoking, sleep disturbance and stress; and the assumption that participants responded honestly and accurately.

In the present study, family history, physical inactivity and sleep disturbances are significantly acting as risk factors for development of prediabetes. Moreover sleep disturbance is strongly associated with prediabetes.

Conclusion

The result from this study concluded that early diagnosis and appropriate measures can delay the natural progression of the Prediabetes. So, Prediabetes and other high-risk individuals should be advised regular monitoring at least once yearly through educational program on lifestyle modifications to delay the onset of diabetes mellitus.

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Contribution of the Authors

The study was a substantial team work of the principal author and co-authors. Dr. Monira Khatun was largely involved in initiation, designing and developing case record form, Dr. Muhammed Abu Bakar coordinating the data collection procedure, Dr. Nihad Rownak contributed in literature

review, Dr. Farhena Ahmed in writing the manuscript of the study, Professor Jesmin Abedin and Professor Shaheda Khanam contributed in reviewing data analysis and writing result.

Disclosure

All the authors declare no competing interest

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