Original Article

Prediabetes and Associated Risk Factors among Undergraduate Medical Students in Bangladesh

Md Azizul Hoque[1], Syed Muhammad Baqui Billah[2], Md Ahmedul Kabir[3], Md Jahangir Alam[4], Md Sayem Chowdhury[5], Kazi Shaila Rakhi[6], Ishrat Jahan[7]

Abstract

Background: *Early detection and timely intervention of prediabetes is an important first step in preventing the disease.*

Objectives: *To assess the prediabetes and associated risk factors in medical students of Bangladesh.*

Materials and Methods: *A cross-sectional study was done among 252 medical students of Shaheed Ziaur Rahman Medical College, Bogura. Data related to demography with some behavioral factors, anthropometry, blood pressure, fasting plasma glucose, family history of hypertension (HTN) and diabetes mellitus (DM) were collected. Prediabetes was assessed by the American Diabetes Association (ADA) and World Health Organization (WHO) criteria.*

Results: *The proportion of prediabetes was 13% according to ADA and 1.6% according to WHO respectively. Students with a positive family history of hypertension (HTN) had more prediabetes compared to those who didn't have. None of the demographic factors, family history of DM or HTN, exercise and obesity were related between prediabetic and normal students, though prediabetic students had more proportion of family history of HTN.*

Conclusion: *Prediabetes is proportionately high among students with positive family history of HTN. We recommend a regular checking of fasting plasma glucose of medical students with special attention to those who have a strong positive family history of DM and HTN.*

Keywords: *Prediabetes, Obesity, Hypertension, Young adults, Medical students.*

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Introduction

Diabetes, commonly known as Type 2 diabetes mellitus (DM) is a leading cause of worldwide morbidity and mortality.[1,2] International Diabetes Federation (IDF) estimated more than half a billion people (10.5% of total adult population of the world) living with diabetes[3] which has become rising two-thirds among the affected live in low and lower middle-income countries.[1-5] The prevalence of prediabetes is also increasing worldwide and it is projected that 470 million people will have prediabetes in 2030.[6] When we look at Bangladesh, we find around 13.1 million people are suffering from diabetes with a national prevalence of 10.7% among adults 4, which is increasing in all age groups .[7,8] Studies reveal that the prevalence of diabetes ranges from 7% to >20% in Bangladeshi population and that of prediabetes is around 10.1% in all age groups.[8,9] Bangladesh Demographic and Health Survey (BDHS) observed 12.8% prevalence of diabetes and 14% prediabetes in 2018.[10] Prediabetes an intermediate state of hyperglycemia not creeping up to overt diabetes has also increased and is a potential metabolic risk factor for future DM and cardiovascular events.[11-16] The consequences are accompanied with microvascular complications like retinopathy, nephropathy and diabetic peripheral neuropathy.[12] IDF estimates 14% adults of total population to be pre-diabetic, while 6.20% children and adolescents are pre-diabetic, which is predicted to be 6.9% in 2045.[4] As Bangladesh is passing through the epidemiologic transition from communicable diseases to non-communicable diseases (NCDs) like DM, HTN, dyslipidemia,[17] we need to focus on

1. Professor and HOD Endocrinology, Sher-e-Bangla Medical College and Hospital, Barishal, Bangladesh.
2. Associate HOD Department of Community Medicine, Sher-e-Bangla Medical College, Barishal, Bangladesh.
3. Assistant Professor, Department of Endocrinology, TMSS Medical College, Bogura, Bangladesh.
4. Assistant Professor, Department of Endocrinology, Shaheed Ziaur Rahman Medical College, Bogura, Bangladesh.
5. Intern Doctor, Shaheed Ziaur Rahman Medical College, Bogura, Bangladesh.
6. Intern Doctor, Shaheed Ziaur Rahman Medical College, Bogura, Bangladesh.
7. Intern Doctor, Shaheed Ziaur Rahman Medical College, Bogura, Bangladesh.

Corresponding author: Md. Azizul Hoque, Professor and Head, Department of Endocrinology, Sher-e-Bangla Medical College and Hospital, Barishal, Bangladesh. **Cell**: +8801712622707, **E-mail:** azizulendo@gmail.com

prediabetes in addition to DM (NCDs).[2]

Obesity is a major public health issue and risk factor for developing early onset DM in youth.[18] Now childhood and adolescents overweight or obesity has increased both in developed and developing countries due to rapid urbanization, changes in food habits (nutrition transition), physical inactivity, family history of obesity and industrialization.[15,19-21] The pursuant health hazards among obese adolescents include DM, HTN, dyslipidemia, cardiovascular disease, asthma, depression, some forms of cancers leading to morbidity and mortality in young adults.[15,21] Narayanappa D et al found a 3.7% prevalence of prediabetes in school going children where they argued that an increase in the incidence of DM in young adults is correlated with childhood obesity.[22] Bangladesh Institute of Research and Rehabilitation in Diabetes, Endocrine and Metabolic disorders (BIRDEM) revealed 2.1% and 20% of adolescents are suffering from DM and prediabetes from 2006 to 2008,[23] with a two-fold increased risk of developing DM in obese or overweight children and adolescents.[24]

As we learn that prediabetes in young adults are being investigated because of apprehended risk of being obese and DM with other comorbidities, we need to investigate the relationship of these factors with prediabetes in young population.[2,19,21,25] Medical students are the future health care providers who would aware people about the healthy behavior to control body weight hence be risk free of DM, HTN and other health conditions. If they are aware about their own health in terms of obesity and risk of prediabetes or HTN, they would grow conscious health personnel for a healthy nation. So, we want to conduct this study to assess the risk of prediabetes in medical students with some selected metabolic risk factors.

Materials and Method

This cross sectional study was conducted at Shaheed Ziaur Rahman Medical College (SZMC) in November 2019 among 252 (response rate 33.02%) of 763 willingly enrolled undergraduate medical students, excluding foreigners. We took ethical permission from the Institutional Review Board (IRB) of SZMC before commencing the study. After receiving informed written consent from each enrolling participant, we collected data on age, gender, height, weight, blood pressure, fasting blood sugar (FBS), exercise and work out activities of the students. We also collected data on family history of DM and HTN as we considered these two variables as risk factors related to prediabetes. After necessary cleaning of the data, we could finally analyze 192 datasheets because of incompleteness in other data.

We operationalized impaired fasting glucose as prediabetes" by WHO and "ADA" criteria. According to WHO, impaired fasting or prediabetes is considered when the FBS is ≥6.1 - 6.9 mmol/L.[26] The ADA criteria considers FBS ≥5.6 - 6.9 mmol/L to be regarded as impaired fasting.[11] We computed body mass index (BMI) from height and weight by taking the reference of WHO defining BMI for Asians.[27] We transformed SBP to normal (SBP≤119 mm Hg), Pre-HTN (120-139 mm Hg), and HTN (≥140 mm Hg). Similarly, we transformed DBP to normal (<80 mm Hg) and pre-HTN (80-89 mm Hg) and HTN (≥90 mm Hg).[28] Afterwards we computed a common HTN variable by keeping any one or both normal SBP and DBP to normal, both pre-HTN to common pre- HTN, and any or both of HTN to common HTN.

Results

Our study revealed a 13% (95% CI: 8.6-18.6%) and 1.6% (95% CI: 0.3-4.5%) prediabetes according to ADA and WHO criteria respectively (Figure 1 and 2 respectively).

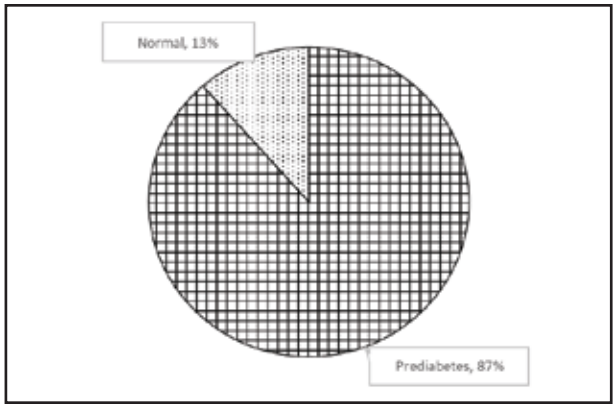

Figure 1: Prevalence of prediabetes according to ADA criteria

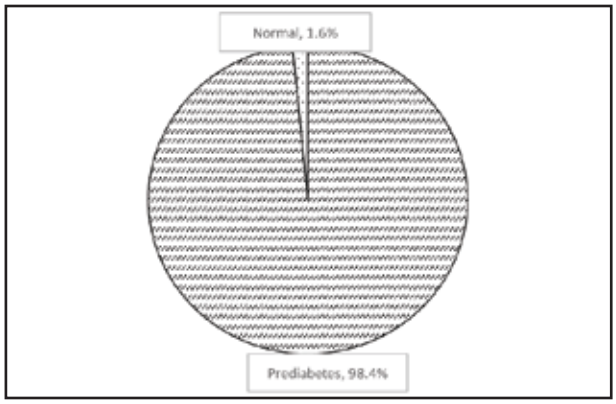

Figure 2: Prevalence of prediabetes according to WHO criteria

Table I is showing the baseline characteristics of the respondents. The age was 21.09 ±1.19 years on average, the height averaged around 165 cm, weight 60.5 kg, BMI 22.5, SBP 107 mm Hg, DBP 70 mm Hg and FBS around 4.7/mmol/L. Females were higher in proportion (n=120, 62.5%) among 192 respondents in our study.

Table I: Frequency distribution of demographic characteristics of study population (n=192)

Demography	mean± SD / n (%)
Age in years (mean±SD)	21.09 ±1.19
Height in cm (mean±SD)	164.99 ±10.32
Weight in kg (mean±SD)	60.27 ±9.80
BMI (mean±SD)	22.36 ± 4.36
SBP (mean±SD)	106.85 ± 11.87
DBP (mean±SD)	69.64 ± 7.08
FBS	4.69 ± 0.71
Female	120 (62.5)
Positive family history of diabetes	62 (32.3)
Positive family history of hypertension	82 (42.7)

A number of 62 (32.3%) students gave positive family history of DM and while 43% gave positive family history of HTN as depicted in Table II. More than a quarter of them (30%) were underweight, 28% were normal, 22% were overweight and another 20% were obese. When we looked at the HTN, 88.5% were normal, nearly 10% were in pre-HTN stage and only 1.6% were suffering from HTN.

Table II: Clinical characteristics of study population (n=192)

Clinical parameters	mean± SD / n (%)
Positive family history of diabetes	62 (32.3)
Positive family history of hypertension	82 (42.7)
BMI	
Underweight	58 (30.2)
Normal	53 (27.6)
Overweight	43 (22.4)
Obese	38 (19.8)
HTN	
Normal	170 (88.5)
Pre -HTN	19 (9.9)
HTN	3 (1.6)

We analyzed the relationship of prediabetes with different factors in our study (Table III). But none of gender, family history of DM or HTN, exercise and work out habit, BMI or HTN had any relation with impaired fasting rather they were homogeneously distributed along the outcome variables. The prediabetic had a little higher proportion of family history of HTN, slightly higher proportion of family history of DM compared to those with no family history. Around a quantile (21.6%) were overweight and obese altogether compared to 15% normal BMI and nearly 14% underweight. Only one student had fallen into the category of HTN with prediabetes.

Table III: Factors related to prediabetes

Factors	Impaired fasting	Normal	p - value
Gender			
Male	9 (12.5)	63 (87.5)	0.87
Female	16 (13.3)	104 (86.7)	
Family history of diabetes			
Yes	18 (13.8)	112 (86.2)	0.62
No	7 (11.3)	55 (88.7)	
Family History of Hypertension			
Yes	14 (17.1)	68 (82.9)	0.15
No	11 (10.0)	99 (90.0)	
Used to work out and exercise			
Yes	4 (12.1)	29 (87.9)	0.87
No	21 (13.2)	138 (86.8)	
BMI			
Underweight	8 (13.8)	50 (86.2)	0.45
Normal	8 (15.1)	45 (84.9)	
Overweight	7 (16.3)	36 (83.7)	
Obese	2 (5.3)	36 (94.7)	
HTN			
Normal	24 (14.1)	146 (85.9)	0.21
Pre - HTN + HTN	1 (4.5)	21 (95.5)	

Discussion

The proportion of 13% (n=33) of them prediabetes in our study by ADA criteria is relatively higher than that of conducted at Mymensingh Medical College (7.14%). Though our study didn't detect any diabetes, it was pretty less (1.92%) in another study done in Mymensingh Medical College.[25] The BDHS 2017-18 survey showed the prevalence of prediabetes around 11.5% between 18-34 years.[10] A recent systemic review and meta-analysis assess the data from 1995-2019 pulled at 10% prevalence of prediabetes in Bangladeshi adults homogenously distributed in both genders.[8] The female preponderance of prediabetes in our study is similar to the study done in Romanian children and adolescents by Temneau et al.[26-29]

One study showed similar prevalence on DM (2.36%) and prediabetes (17.57%) in medical students in India 2. Another study revealed a higher prevalence of 8.9% prediabetes at another medical school in India.[30] In contrast, a study among medical students in Pakistan could not explore any prediabetes ,[31] another study in the same country discovered very high prevalence (23.1%) in medical students, equally distributed in both genders.[32] And their study gets support from a high 20% prevalence of prediabetes among US adolescents between 12 and 18 of age.[33] Researchers from US predict that the prevalence of DM in childhood and adolescents will almost quadruple by the year 2050.[34]

As 5%-10% of prediabetes turn into DM every year,[6] DM in children and adolescents has the potential to become a global public health issue with substantial unfavorable health outcomes due to rising levels of obesity and physical inactivity in many countries.[35] Lifestyle intervention through dietary modification and increase physical activity for prediabetic individuals can bring up to 40-70% relative risk reduction of developing DM in future.[36] We recorded a 42.2% overweight or obese students found to be which is almost similar to different studies[21,25] Though Duncan G didn't find any relation between obesity and prediabetes,[16] Izzo A et al. excavated that prediabetes in underweight, normal and overweight is more compared to obese.[37]

We observed a relatively lower frequency of pre-HTN (9.9%) and HTN (1.6%) compared to other studies done in Bangladesh, ranging from 11.5% to 20% .[17,25] Though our study could not establish the relationship of positive family history of DM and HTN with prediabetes because of probably small sample size, the relationship is well established in current literature .[2, 25, 30, 38-40]

Our study had some limitations that need to be mentioned. It was small-scale single center study with a low response rate, so we cannot generalize the. We didn't do oral glucose tolerance test (OGTT), the gold standard test for the diagnosis of DM and prediabetes. We didn't record serum lipid profile nor we measured waist circumference to assess obesity, which are known predictors for DM and prediabetes. Nevertheless, the findings of this study will act as the cornerstone for a larger study that will evaluate the metabolic risks in this group of young participants in the future.

Conclusion

Our study revealed a considerable proportion of prediabetes among medical students. Regular checking of fasting plasma glucose of medical students is recommended to assess this problem so that appropriate control measure can be initiated.

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References

1. Akter S, Rahman MM, Abe SK, Sultana P. Prevalence of diabetes and prediabetes and their risk factors among Bangladeshi adults: a nationwide survey. Bull World Health Organ. 2014;92:204-213, 13A.

2. Rao T, Chaudhary R, Jain J. Prevalence and risk factors of diabetes among young students of a Medical College in Central India. International Journal of Biomedical and Advance Research. 2017;8:416-420.

3. Federation ID. The IDF consensus worldwide definition of the METABOLIC SYNDROME. Belgium: International Diabetes Federation; 2006.

4. Federation ID. IDF Diabetes Atlas. 10 ed2021.

5. Wu Y, Ding Y, Tanaka Y, Zhang W. Risk factors contributing to type 2 diabetes and recent advances in the treatment and prevention. Int J Med Sci. 2014;11:1185-1200.

6. Tabak AG, Herder C, Rathmann W, Brunner EJ, Kivimaki M. Prediabetes: a high-risk state for diabetes development. Lancet. 2012;379:2279-2290.

7. collaboration NNaWj. Bangladesh NCD Risk Factor Survey 2018. 2018.

8. Akhtar S, Nasir JA, Sarwar A, Nasr N, Javed A, Majeed R, et al. Prevalence of diabetes and pre-diabetes in Bangladesh: a systematic review and meta-analysis. BMJ Open. 2020;10:e036086.

9. Billah SMB, Jahan MS, Jesmine S, Keobouahome B, Watanabe Y, Kinoue T, et al. Metabolic Syndrome in Bangladesh using NCEP Adult Treatment Panel III Criteria. Jpn J Clin Ecol. 2011;20:61-70.

10. Islam RM, Khan MN, Oldroyd JC, Rana J, Magliago DJ, Chowdhury EK, et al. Prevalence of diabetes and prediabetes among Bangladeshi adults and associated factors: Evidence from the Demographic and Health Survey, 2017-18. medRxiv Preprint. 2021.

11. Serwood Z. Prediabetes: Definition, diagnostic criteria and management. Journal of Diabetes Nursing. 2018;22:1-4.

12. Hostalek U. Global epidemiology of prediabetes - present and future perspectives. Clin Diabetes Endocrinol. 2019;5:5.

13. Ahmed M. Non-Communicable Diseases and theirprevention: A global, regional and Bangladesh perspective. National Bulletin of Public Health. 2018;1:2-4.

14. Group DPPR. REDUCTION IN THE INCIDENCE OF TYPE 2 DIABETES WITH LIFESTYLE INTERVENTION OR METFORMIN. N Engl J Med. 2002;346:393-403.

15. Shafique S, Akhter N, Stallkamp G, de Pee S, Panagides D, Bloem MW. Trends of under- and overweight among rural and urban poor women indicate the double burden of malnutrition in Bangladesh. Int J Epidemiol. 2007;36:449-457.

16. Duncan G. Prevalence of Diabetes and Impaired Fasting Glucose Levels Among US Adolescents. Arch Pediatr Adolesc Med. 2006;160:523-528.

17. Chowdhury MA, Uddin MJ, Haque MR, Ibrahimou B. Hypertension among adults in Bangladesh: evidence from a national cross-sectional survey. BMC Cardiovasc Disord. 2016;16:22.

18. Dunstan D, Zimmet P, Welborn T, deCourten M, Cameron A, Sicree R, et al. The Rising Prevalence of Diabetes and Impaired Glucose Tolerance- The Australian Diabetes, Obesity and Lifestyle Study. Diabetes Care. 2002;25:829-834.

19. Biswas T, Islam A, Islam MS, Pervin S, Rawal LB. Overweight and obesity among children and adolescents in Bangladesh: a systematic review and meta-analysis. Public Health. 2017;142:94-101.

20. Bulbul T, Hoque M. Prevalence of childhood obesity and overweight in Bangladesh: findings from a countrywide epidemiological study. BMC Pediatr. 2014;14:86.

21. Goon S. Fast Food Consumption and Obesity Risk among University Students of Bangladesh. European Journal of Preventive Medicine. 2014;2.

22. Narayanappa D, Rajani HS, Mahendrappa KB, Prabhakar AK. Prevalence of prediabetes in school-going children. Indian Pediatr. 2011;48:295-299.

23. Mohsin F, Mahbuba S, Begum T, Azad K, Nahar N. Prevalence of impaired glucose tolerance among children and adolescents with obesity. Mymensingh Med J. 2012;21:684-690.

24. Talukder A, Hossain MZ. Prevalence of Diabetes Mellitus and Its Associated Factors in Bangladesh: Application of Two-level Logistic Regression Model. Sci Rep. 2020;10:10237.

25. Kamrul-Hasan A, Chanda P, Ahsan A, Fatima M, Mahboob R, Islam M, et al. Frequency of Dysglycemia and Obesity among Undergraduate Stuents of a Medical College of Bangladesh. Mymensingh Med J. 2020;29:539-544.

26. Bansal N. Prediabetes diagnosis and treatment: A review. World Journal of Diabetes. 2015;6.

27. Misra A. Ethnic-Specific Criteria for Classification of Body Mass Index: A Perspective for Asian Indians and American Diabetes Association Position Statement. Diabetes Technology & Therapeutics. 2015;17:667-671.

28. Jones DW, Hall JE. The National High Blood Pressure Education Program Thirty Years and Counting. Hypertension. 2002;39:941-942.

29. Temneanu O, Trandafir L, Purcarea M. Type 2 diabetes mellitus in children and adolescents: a relatively new clinical problem within pediatric practice. Journal of Medicine and Life. 2016;9:235-239.

30. Amarnath M, Prasad VVD, Reddy NSS. Pre-diabetes among Medical students in a Medical College, Andhra Pradesh. Indian Journal of Public Health Research & Development. 2014;5.

31. Waseem M, Bokhari FA, Jalal MA, Zahra Z, Khalid M, Aman M. PRE DIABETES IN YOUNG MEDICAL STUDENTS. ANNALS. 2015;21:39-43.

32. Shahzad F, Ishaque A, Saleem F. Prediabetes in adolescents - an emerging epidemic - a cross-sectional survey of medical students at a public university, Quetta, Pakistan. J Pak Med Assoc. 2021;71:1438-1441.

33. Andes LJ, Cheng YJ, Rolka DB, Gregg EW, Imperatore G. Prevalence of Prediabetes Among Adolescents and Young Adults in the United States, 2005-2016. JAMA Pediatrics. 2020;174.

34. Esquivel Zuniga R, DeBoer MD. Prediabetes in Adolescents: Prevalence, Management and Diabetes Prevention Strategies. Diabetes Metab Syndr Obes. 2021;14:4609-4619.

35. Federation ID. IDF Diabetes Altas2019.

36. Group DPPR. REDUCTION IN THE INCIDENCE OF TYPE 2 DIABETES WITH LIFESTYLE INTERVENTION OR METFORMIN. The New England Journal of Medicine. 2002;346:393-403.

37. Izzo A, Massimino E, Riccardi G, Della Pepa G. A Narrative Review on Sarcopenia in Type 2 Diabetes Mellitus: Prevalence and Associated Factors. Nutrients. 2021;13.

38. Salameh AB, Hyassat D, Suhail A, Makahleh Z, Khader Y, El-Khateeb M, et al. The prevalence of hypertension and its progression among patients with type 2 diabetes in Jordan. Annals of Medicine & Surgery. 2022;73.

39. Akhtar S, Nasir JA, Abbas T, Sarwar A. Diabetes in Pakistan: A systematic review and meta-analysis. Pak J Med Sci. 2019;35:1173-1178.

40. Belew MA, Abate TW, Berhie AY, Abeje ED, Ayele DA, Abate MD, et al. Determinants of hypertension among diabetes patients attending selected comprehensive specialized hospitals of the Amhara Region, Ethiopia: An unmatched case-control study. PLoS One. 2022;17:e0279245.