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GLYCEMIC STATUS OF A MEDICAL CAMP ATTENDEES: A REAL-WORLD ASSESSMENT FROM BANGLADESH

MASHFIQUL HASAN[1], MOHAMMAD ATIQUR-RAHMAN[2], KISHORE KUMAR SHIL[3], RIFAT HOSSAIN RATUL[4], NUSRAT SULTANA[5], MUHAMMAD ABUL HASANAT[6]

Abstract

Background: *The prevalence of diabetes mellitus (DM) is rising in both rural and urban Bangladesh. Community engagement and motivation in a real-world setting are essential for accurately assessing the true glycemic situation. The aim of the study is* ***t****o assess the frequency of dysglycemia in people attending medical camps arranged in community level of Bangladesh in a real-world setting.* ***Methods****: This survey encompassed 2209 participants(median age 45, interquartile range 36-55 years; female 53.4%; known diabetes 33%)attending medical camps arranged as part of community health awareness programs in urban and ruralareas between2012 and 2024. Capillary blood glucose (CBG) was measured by a calibrated glucometer regardless of feeding or glycemic status. Non-diabetic participants were categorized according to their fasting/ random CBG values using oral glucose tolerance test cut-offs, while glycemic control of people with diabetes was considered good add irrespective of affecting factors if fasting CBG<7 or random <10 mmol/ L.* ***Results:*** *Among the 1482 participants with unknown glycemic status, 33.4% had capillary blood glucose (CBG) levels indicative of dysglycemia, including DM at 8.4% and prediabetes at 25.0%. The prevalence of dysglycemia, based on fasting CBG (n=1176), was 34.6%, with DM in 8.2% and impaired fasting glycemia (IFG) in 26.4%. Using random CBG (n=306), dysglycemia was found in 18.3%, with DM in 5.6% and impaired glucose tolerance (IGT) in 12.7%. Dysglycemia rates did not differ significantly between genders (p=0.260)but were higher in those aged over 30 years (p=0.012) and those with a family history of DM (p=0.040). Among participants with known diabetes (n=727), only 40% had good glycemic control.* ***Conclusion:*** *One in three newly tested individuals had dysglycemia, while three out of five individuals with known diabetes had poor glycemic control.*

Keywords: *Dysglycemia, Glycemic control, Real-world scenario, Bangladesh.*

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1. PhD researcher, Department of Endocrinology, Bangladesh Medical University, Shahbag, Dhaka-1000, Bangladesh
2. Assistant Professor, Department of Endocrinology, National Institute of Neurosciences and Hospital, Dhaka-1207, Bangladesh
3. Resident, Department of Endocrinology, Bangladesh Medical University, Shahbag, Dhaka-1000, Bangladesh
4. Research Assistant, Study on Diabetes in Young (SODY) group, Department of Endocrinology, Bangladesh Medical University, Shahbag, Dhaka-1000, Bangladesh
5. Associate Professor, Department of Endocrinology, Bangladesh Medical University, Shahbag, Dhaka-1000, Bangladesh
6. Professor, Department of Endocrinology, Bangladesh Medical University, Shahbag, Dhaka-1000, Bangladesh

*__Correspondence:__ Dr. Mashfiqul Hasan, Associate Professor, Dept. of Endocrinology (OSD, DGHS), PhD Researcher, Department of Endocrinology, Bangladesh Medical University, Shahbag, Dhaka-1000, Bangladesh. Email: mashfiqul.phd.m22@bsmmu.edu.bd

Introduction

Diabetes and its complications are among the leading causes of morbidity and mortality worldwide, including in Bangladesh.[1] About **589 million adults** (11.1%) now live with diabetes, and another **635 million** (12.0%) have impaired glucose tolerance globally, with **81%** of diabetic individuals residing in low- and middle-income countries—over **60%** of whom are in Asia.[2,3] In South Asia, the prevalence of diabetes and prediabetes has been steadily rising in both urban and rural areas. This trend is primarily driven by shifting lifestyles, influenced by urbanization and industrialization.[4-6] In a developing country like Bangladesh, the prevalence of diabetes continues to rise. Published data suggest that 7.8%of the Bangladeshi population are affected by diabetes.[7]

Chronic hyperglycemia is associated with several long-term diabetes-related complications, such as kidney disease, heart disease, neuropathy, and retinopathy. These complications place an additional burden on the healthcare system. Good glycemic control is essential to prevent or delay the progression of complications.[8] However, most individuals with type 2 diabetes mellitus(T2DM) in Asia have poor glycemic control, and only around 50% of the global diabetes population achieves good glycemic control.[9] The Bangladesh Demographic and Health Survey 2017–2018 found only 31% of Bangladeshi adults with diabetes are aware of their diagnosis, 28% receive treatment, and just 26% have glycemia under control.[10] A facility-based study reported a high prevalence of uncontrolled T2DM among participants, with most diabetic patients experiencing one or more complications.[11] The prevalence of uncontrolled diabetes remains a major concern in Bangladesh, despite the availability of diabetes care.[12,13]

General populations are not always inclined to participate in facility-based studies, which may limit their ability to reflect real-world conditions due to stringent selection criteria and trends to recruit older, more comorbid patients. Community mobilization and engagement are essential for accurately determining the true glycemic scenario of a region. Therefore, the current study aimed to assess the real-world glycemic situation among participants attending various health camps and awareness campaigns across different regions of Bangladesh by retrospectively analyzing the capillary blood glucose (CBG) measurements, irrespective of meal timing.

Methods:

This cross-sectional study was conducted by retrospectively analyzing data collected from community health camps across various regions of Bangladesh between 2012 and 2024. These camps were organized by visiting physicians as part of community awareness programs, providing basic screening and treatment services in areas with poor access to healthcare facilities. The study included data from 2209 enrolled participants, regardless of age, gender, comorbidities, medication history, or endocrinopathies. Participants were recruited through consecutive non-probability sampling as they voluntarily attended health awareness and screening programs organized in both urban and rural locations. The sites of health camps were selected conveniently. Most participants were recruited from camps organized in the following districts: Mymensingh (Haluaghat) with 512 participants, Kishoreganj (Bhairab) 385, Satkhira (Tala) 359, Khulna (Paikgacha) 410, Jamalpur (Islampur) 203, and Dhaka (Kamrangirchar) 110. An additional 230 participants were enrolled from smaller-scale screening camps conducted in Barguna, Cumilla, Naogaon, Netrokona, Thakurgaon, Moulvibazar, and Tangail.

A brief medical history was obtained, including history of diabetes, family history of diabetes, and smoking history. Participants were categorized as fasting if at least 8 hours had elapsed since their last meal; otherwise, they were considered non-fasting. This status was self-reported at the time of testing. Capillary blood glucose (CBG) was measured on-site using a glucometer, irrespective of glycemic status (whether previously diagnosed with diabetes or not). Glucometers were calibrated regularly according to manufacturer instructions, and any anomalous readings were confirmed using a secondary device to ensure accuracy. All outcomes were recorded in a standardized questionnaire.

For categorizing glycemic status, the cut-off values used during an oral glucose tolerance test (as recommended by the World Health Organization) were applied to individuals with unknown glycemic status. For fasting tests, the categories were: normal (≤6.0 mmol/L), impaired fasting glycemia (IFG: 6.1–6.9 mmol/L), or diabetes mellitus (DM: e”7.0 mmol/L). For non-fasting (random) tests, the categories were: normal (≤7.8 mmol/L), impaired glucose tolerance (IGT: 7.8–11.0 mmol/L), or DM (≥11.1 mmol/L). For individuals with known diabetes, glycemic control was classified according to the National Guidelines on Diabetes Mellitus, Bangladesh, with good control defined irrespective of affecting factorsas fasting blood glucose <7.0 mmol/L or random blood glucose <10.0 mmol/L. Only a single glucose value was measured for each participant.

Normality of continuous variables was assessed visually and using the Shapiro–Wilk test before using non-parametric summaries (median, IQR).Qualitative data were expressed as frequency distribution and percentages. Statistical analyses were performed using IBM SPSS Statistics for Windows, version 25.0. The association between categorical variables was assessed using the ÷² test. A p-value of less than 0.05 was considered statistically significant for all analyses. Ethical clearance was obtained from the ethical committee of the Study on Obesity and Diabetes in Young (SODY) group.

Results:

The real-world study enrolled 2209 participants as they attended health camps, irrespective of their glycemic status. Participants' ages ranged from 9 to 95 years (median 45, IQR 36-55 years), with 53.4% being female and 55.2% having never previously tested their blood glucose levels. The demographic characteristics of the study participants are presented in Table I. Among participants who were not known to have DM (67% of all participants, n=1482), 1176 measured CBG in a fasting state and 306 in a post-prandial (random) state. Dysglycemia was identified in 33.4% of these individuals, including 8.4% DM and 25.0% prediabetes.The fasting group showed 8% DM and 26% impaired fasting glycemia (IFG), and the random group showed 6% DM and 13% impaired glucose tolerance (IGT) (Figure 1 and 2).Among those with a known diagnosis of DM (33% of all participants, n=727), 609 measured CBG in a fasting state and 118 in a post-prandial (random) state. Blood glucose levels were above the target range (fasting >7.0 mmol/L or random >10 mmol/L) in 60.1% of these individuals, with 61% in the fasting group and 58% in the random group (Figure 1 and 2).

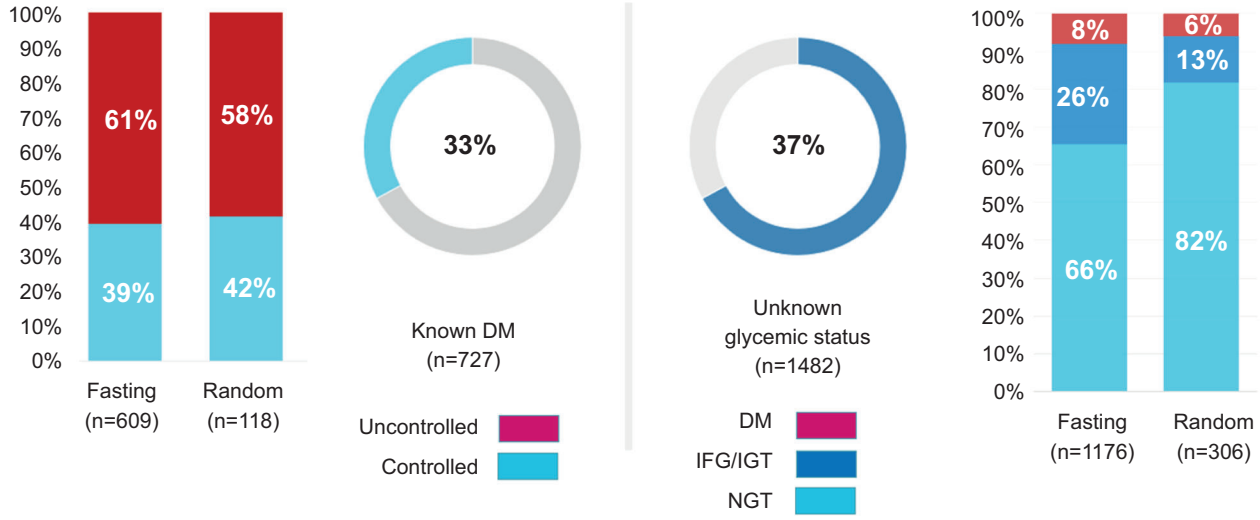

Figure 1: Glycemic status of the participants (n=2209)
DM: Diabetes mellitus; IFG: Impaired fasting glucose; IGT: Impaired glucose tolerance; NGT: Normal glucose tolerance
Uncontrolled DM: Fasting >7.0, Random >10
Controlled DM: Fasting ≤7.0, Random ≤10
IFG: 6.1-6.9 mmol/l, IGT: 7.8-11.0 mmol/l, DM: Fasting≥7 mmol/l or Random ≥11.1 mmol/l

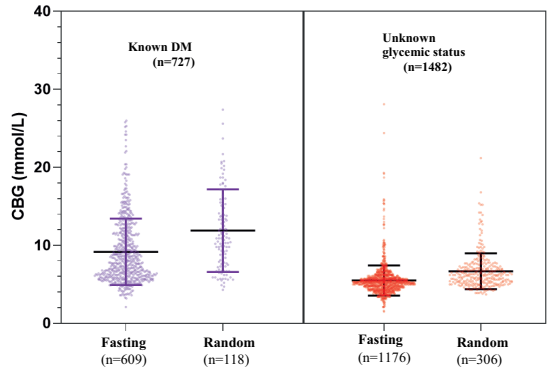

Figure 2: Blood glucose values of the participants (n=2209)
DM: Diabetes mellitus; CBG: Capillary blood glucose

Among participants with unknown glycemic status, a significantly higher proportion of individuals aged e"30 years (p=0.012) and those with a positive family history of DM (p=0.040) were found in the dysglycemia group compared to the normoglycemic participants (Table II). Similarly, among participants with known DM, a significantly higher proportion of individuals aged e"30 years (p=0.005) were observed in the uncontrolled DM group compared to those with controlled diabetes (Table III).

Table I

Characteristics of the study participants (n=2209)

Characteristics	Median and IQR or n (%)
Age (years)	45 (36-55)
Gender	
Male	1030 (46.5)
Female	1179 (53.4)
Glycemic status	
Known DM	727 (32.9)
Not known DM	1482 (67.1)
Previously Glucose tested or not	
Tested	989 (44.8)
Never tested	1220 (55.2)
†**Family History of DM**	
Present	686 (31.1)
Absent	1523 (68.9)
Smoking History	
Smoker	356 (16.1)
Non-smoker	1853 (83.9)

Median and IQR for skewed data; Percentages are over column total

† Family history of DM in 1^0relatives

IQR: Interquartile range, DM: Diabetes mellitus

Table II

Comparison of characteristics of participants with normoglycemia and dysglycemia among those who did not know their glycemic status (n=1482)

Variable	Normoglycemia (n=987)	Dysglycemia (n=495)	p
Age group			
<30 years	139 (14.1)	47 (9.5)	**0.012**
≥30 years	848 (85.9)	448 (90.5)	
Gender			
Male	446 (45.2)	239 (48.3)	0.260
Female	541 (54.8)	256 (51.7)	
Family history of DM			
Absent	773 (78.3)	364 (73.5)	**0.040**
Present	214 (21.7)	131 (26.5)	
Smoking			
Non-smoker	814 (82.5)	437 (88.3)	**0.004**
Smoker	173 (17.5)	58 (11.7)	

Significance level was measured by c2

Within parentheses are percentages over the column total

Dysglycemia: IFG: 6.1-6.9 mmol/l, IGT: 7.8-11.0 mmol/l, DM: Fasting ≥7 mmol/l or Random ≥11.1 mmol/l

Normoglycemia: fasting: <6.1 mmol/l, Random: <7.8 mmol/l.

TableIII

Comparison of characteristics ofknown DM subjects with controlled and uncontrolled glycemic status (n=727)

Variable	Controlled DM (n=289)	Uncontrolled DM (n=438)	p
Age group			0.005
<30 years	14 (4.8)	6 (1.4)	
e”30 years	275 (95.2)	432 (98.6)	
Gender			
Male	140 (48.4)	205 (46.8)	0.665
Female	149 (51.6)	233 (53.2)	
Family history of DM			
Absent	149 (51.6)	237 (54.1)	0.500
Present	140 (48.4)	201 (46.9)	
Smoking			
Non-smoker	240 (83.0)	362 (82.6)	0.890
Smoker	49 (17.0)	76 (17.4)	

Significance level was measured by c2 test

Within parentheses are percentages over the column total

Uncontrolled DM: Fasting >7.2, Random >10

Controlled DM: Fasting ≤7.2, Random ≤10

Discussion:

The prevalence of DM is escalating globally, particularly in Asia, including Bangladesh. This rising burden is especially challenging for developing countries due to the chronic nature of the disease, its associated comorbidities, and complications. The burden of complications is further exacerbated when glycemic control is suboptimal. The primary aim of this study was to assess the real-world glycemic status among individuals with unknown glycemic status and to evaluate the level of glycemic control in those with known diabetes during various diabetes awareness campaigns. Our findings revealed that two-thirds of the participants were unaware of their glycemic status, and more than half had never tested their blood glucose levels. Additionally, one in three participants with unknown glycemic status had capillary blood glucose levels indicative of dysglycemia, while three out of five individuals with known diabetes did not meet glycemic targets.

Globally, 48.5% (ranging from 24% to 74%) of individuals with DM remain undiagnosed.[14] In developing countries, a huge number of populations are unaware of the regular screening of diabetes and thus remain undiagnosed. Common challenges in the screening and management of diabetes in these regions include limited public awareness, inadequate

healthcare systems for diabetes management, and insufficient political and social commitment to community health engagement.[15] Among participants who were unaware of their glycemic status, 8.4% had CBG levels in the range indicative of DM, while 25.0% had CBG levels within the ranges of prediabetes. This frequency is consistent with the findings of a systematic review and meta-analysis, but lower compared to the 12.5% prevalence reported in the IDF Atlas 2021.[7] The lower prevalence in our study compared to IDF data can be attributed to the fact that the participants with already known diabetes were analyzed separately. In addition, we measured either fasting or random blood glucose, which cannot be considered a substitute for the oral glucose tolerance test (OGTT). However, well-designed studies utilizing methodical OGTT may struggle to engage the general population, as many individuals are unwilling to participate in time-consuming surveys. Real-world studies, therefore, may offer a practical solution to overcome this barrier.

The frequency of prediabetes observed in this study was higher than in other developing countries such as Cameroon (7.1%), Pakistan (11.4%), and Nepal (10.3%).[16,18] A potential reason for the increased frequency of dysglycemia may be linked to the shift in the Bangladeshi labor force from agriculture to manufacturing, services, and industry, resulting in a significant decline in physical activity and energy expenditure. Additionally, IFG was more prevalent than IGT, which is characteristic of Asian populations.[19]

The prevalence of poor or suboptimal glycemic control is notably high among patients with T2DM in low- and middle-income countries. For example, two studies by Temma et al. and Matsumura et al. in Japan reported poor glycemic control in 59.3% and 46.8% of patients with T2DM, respectively.[20,21] Similar studies conducted in Croatia, Colombia, and Thailand also reported relatively high prevalence rates of poor glycemic control, at 58.8%, 52.7%, and 54.8%, respectively.[22,23] In our study, even with CBG measurements, three out of five participants had uncontrolled glucose levels, a situation that could be even worse if HbA1c were used to assess the degree of diabetes control. In Bangladesh, other studies measuring glycemic control by HbA1c have found a higher proportion of uncontrolled blood glucose.[24,25]

The findings of this study should be interpreted with caution, as the sampling sites were not uniformly distributed across the country and a non-probability sampling method was used. Therefore, the results may not be fully representative of the entire population of Bangladesh. Nevertheless, the results of this study demonstrate that poor glycemic control among DM patients in Bangladesh continues to be a significant health issue. Addressing this challenge requires a comprehensive strategy and coordinated efforts from all stakeholders to mitigate its negative impacts.

Conclusion:

One in three newly tested individuals had dysglycemia, while three out of five individuals with known diabetes had poor glycemic control. The prevalence of diabetes and the proportion of individuals with uncontrolled glycemic levels are notably high in Bangladesh, potentially leading to an increased incidence of diabetes-related complications and placing an additional burden on healthcare costs. To address this growing concern, further community-based studies are essential to identify common risk factors for poor glycemic control and the barriers to effective diabetes management.

Ethics approval and consent to participate:

Ethical clearance was obtained from the ethical committee of the Study on Obesity and Diabetes in Young (SODY) group. Informed written consent was waived due to the retrospective nature of the study.

Availability of data and materials:

Available to the corresponding author upon reasonable request.

Competing interests:

There are no conflicts of interest.

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Authors' contributions:

MAH developed the concept, designed methodology, supervised project implementation, MAR,,NS and MH contributed to developing methodology and interpretations of findings, NS edited the manuscript, MH Conducted data analysis and edited the manuscript, KKS and RHR wrote the first draft manuscript .All authors reviewed the manuscript

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Declaration of generative AI and AI-assisted technologies in the writing process

During the preparation of this work the authors used ChatGPTin order toimprove the readability and language of the manuscript. After using this tool, the authors reviewed and edited the content as needed and take full responsibility for the content of the published article.

Declaration of interests:

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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