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A Suspected Poor Glycemic Control of Type2 Dm Patient in Bangladesh. A Study in Dhaka Medical College Hospital

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Abstract

Background: Poor Glycemic Control among Type 2 Diabetics in Dhaka, Bangladesh. Despite established glycemic control targets, many diagnosed diabetics worldwide fail to achieve them. This study assessed the glycemic control in Type 2 diabetics and the factors behind poor control in patients attending Dhaka Medical College Hospital.

Methods: Diagnosed diabetics on medication attending DMCH were included. Sociodemographic and lifestyle data were collected. Plasma Glucose (glucose oxidase-peroxidase) and HbA1c (ion-exchange resin) were measured. Data analysis used SPSS (version 22).

Results: Mean HbA1c was 8.9%, with only 21.53% reaching the national target ≤7.5%. HbA1c significantly increased with diabetes duration ($p<0.001$). The difference between the highest and lowest recorded plasma glucose in the past three months had a highly significant positive correlation with HBA_{1c}. (Pearson's correlation).

Conclusions: This study reveals low rates of target glycemic control among Type 2 diabetics in Bangladesh. Poor control may lead to complications with increasing diabetes duration.

Keywords: Diabetes Mellitus, Glycemic control, HbA1c, Plasma Glucose

Introduction

Diabetes mellitus is a highly prevalent non-communicable disease in Bangladesh. Its prevalence was 8% in 2011 and is predicted to rise by about 10% by 2030 [1]. Local and international diabetic associations and institutions have published targets for diabetes control, aiming for HbA1C levels between 6.5% to 7.5% to reduce chronic complications in the last few decades [2, 3]. Present HbA1c has been taken as an important indicator of overall and long-term glycemic control [4]. The glycemic targets, established based on recent and past evidence for achievability, appropriateness, cost-effectiveness, and practicality, are not always achieved in various populations. Reports from developed countries like the United States and many European nations reveal a discouraging trend: approximately 50% of diagnosed diabetic cases fail to reach the target glycemic control level [5-8]. In Bangladesh, healthcare providers are committed to improving health outcomes with available resources. However, a crucial gap exists in understanding the current glycemic control status of diagnosed diabetics. This study aims to assess glycemic control among diabetic patients attending Dhaka Medical College Hospital, a major healthcare facility serving a large population. By evaluating the glycemic control of this patient population, the study can provide valuable insights into the overall state of diabetes care in Bangladesh. Since Dhaka

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Medical College Hospital attracts patients from across the country, the findings can potentially reflect the national picture of glycemic control among Bangladeshi diabetics.

Materials and Methods

Study Design and Setting: This cross-sectional study was conducted at the Department of Endocrinology and Metabolism, Dhaka Medical College Hospital, Bangladesh, from November 2018 to October 2019. Ethical approval was obtained from the Dhaka Medical College Hospital Ethical Committee.

Subjects: A total of 209 consecutive type 2 diabetes mellitus (T2DM) patients attending the outpatient department were recruited. The group included 114 males and 95 females. Informed written consent was obtained from all participants.

Inclusion Criteria: Diagnosed with T2DM for at least 3 months before participation, confirmed by history, medical records, and laboratory examinations according to the 2017 American Diabetes Association (ADA) guidelines.

Data Collection: A structured data collection form was developed to capture demographics, lifestyle habits, clinical findings, and laboratory results. A pilot test ensured the form's effectiveness. Each participant's medical history was reviewed to confirm the T2DM diagnosis.

Laboratory Tests: Oral glucose tolerance test (OGTT) and HbA1c were performed at Dhaka Medical College Hospital (DMC), BIRDEM, or BSMMU laboratories. Blood samples were collected under aseptic conditions: Venous blood (10 ml) was drawn by venipuncture. One sample was collected in an EDTA vial for HbA1c measurement. Another sample was collected in a plain vial, allowed to clot, centrifuged to separate serum, and used for fasting blood glucose and serum creatinine tests. Blood glucose was measured using the glucose oxidase-peroxidase method. HbA1c was estimated by the ion-exchange resin method. Body mass index (BMI) was calculated (weight [kg] / height [m²]). BMI categories were defined as: Overweight: 23.0-24.9 kg/m², Preobese: 25.0-29.9 kg/m², Obese: ≥ 30 kg/m², morbidly obese: ≥ 40 kg/m². Blood pressure was measured twice after a 5-minute rest, and the average was recorded.

Glycemic Variability: Glycemic variability was defined as the difference between the highest and lowest blood sugar levels recorded in the past three months.

Data Management and Analysis: All data from interviews, clinical examinations, and laboratory investigations were recorded in the data collection forms. Data was entered into SPSS version 22 after ensuring the completeness of each form. Descriptive statistics were used: Mean ± standard deviation (SD) for continuous variables. Absolute numbers and percentages for categorical variables. Student's t-test was used for significance testing, with $p < 0.05$ considered statistically significant.

Results

A total of 220 subjects were enrolled in the study, with 209 completing it. The mean age of the participants was 49.03 years (SD ± 10.68), ranging from 22 to 76 years. The largest age group (37.3%) fell between 41 and 50 years old. Males comprised a majority of the participants (114, 54.5%) compared to females (95, 45.5%). Residence distribution was nearly equal, with 51.7% living in urban areas and 48.3% in rural areas. Regarding occupation, 30.3% were categorized as informal workers, and 28.4% were service holders. Educational attainment varied, with 16.6% having no formal education and 33.4% having higher secondary education or above. The average body mass index (BMI) was 26.1 kg/m2 (SD ± 4.2) in table 1.

Table 1: Sample characteristics

Total	209
Male/Female	114/95
Age	49.03±10.68
Living areas (%)	
Urban	51.7
Rural	48.3
Occupation (n,%)	
House wife	64(30.3)
Service	60(28.4)
Teacher	22(10.4)
Farmer	11(5.2)
Business	24(11.4)
Police	9(4.3)
Doctor	19(9)
Education (n,%)	
Illiterate	35(16.6)
Primary	43(20.4)
Secondary	60(28.4)
Higher secondary above	71(33.4)
Economic status (n, %)	
Poor	58(27.8)
Middle class	110(52)
Upper class	41(19.6)
Clinical parameter (mean±SD)	
BMI(Kg/m^2)	26.1±4.2
BP Systolic	133.4±23.2
BP Diastolic	79.4±13.5
RBS	15.7±4.1
Highest plasma glucose	21.08±4.81
Lowest plasma glucose	6.44±2.09
HbA_{1C}	8.9±1.8
Duration of Diabetes (yrs)	5.6±4.9

The mean duration of diabetes in the study group was 5.6 years (SD ± 4.9), with a range of 0.5 to 28 years. Based on diabetes duration, the participants were divided into five subgroups: (1) up to 5 years, (2) 6–10 years, (3) 11–15 years, (4) 16–20 years, and (5) greater than 20 years. Figure 1 demonstrates a statistically significant increase ($p < 0.001$) in mean HbA1c (%) with increasing duration of diabetes mellitus (DM) as determined by the ANOVA test.

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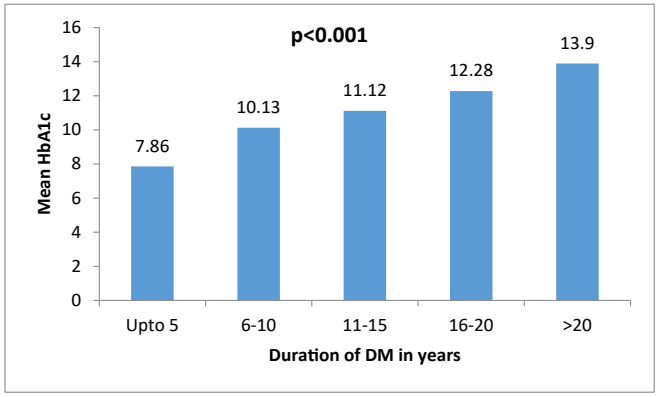

Figure 1: The above bar diagram shows that mean HbA1c is increasing with the duration of DM (p<0.001).

HbA1c levels were categorized into four groups for analysis (Table II): (1) Good control (≤7.5), (2) Adequate control (7.5-9), (3) Inadequate control (9-11), and (4) Poor control (>11).

Table II: Distribution of Type 2 Diabetic Subjects on the basis of HbA1C values (n=209)

HbA1c	Frequency	Percentage
<7.5	45	21.53
7.6-9	75	35.88
9.1-11	64	30.62
>11	25	11.96

Distribution of Type 2 Diabetic Subjects based on HbA1C values (n=209) With respect to the overall glycemic control, 21.53% reached the target of ≤7.5% HbA1c.

Overall glycemic control was achieved by correlation between glycemic variation (defined as the difference between the highest and lowest blood glucose levels in the past three months) and HbA1c. This correlation was nearly linear, suggesting that higher blood glucose variability in the last three months predicts poorer glycemic control, as shown in Figure II.

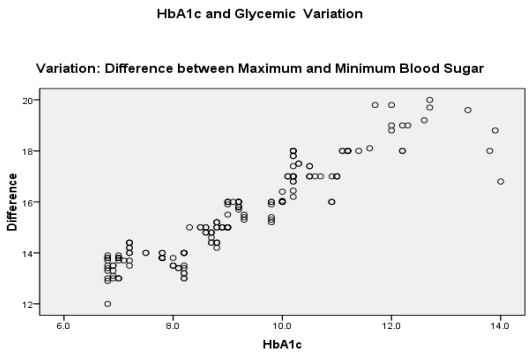

Figure 2: Correlation between HbA1c and Glycemic Variability.

The above figure shows that HbA1c is positively correlated with Glycemic Variability (r=0.58, p<0.01) and the association is statistically significant by Pearson's correlation t-test.

Similarly, a strong positive correlation was observed between HbA1c and both the highest and lowest plasma glucose levels from the previous three months (Figure III &IV).

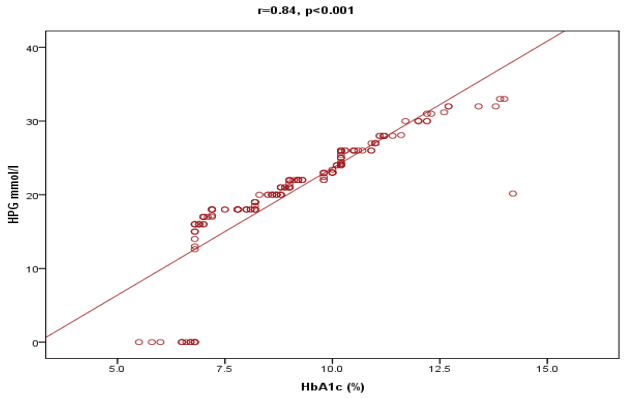

Figure 3: Correlation between HbA1c and HPG.

The above table shows that HbA1c is positively correlated with HPG (r=0.84, p<0.001) and the association is statistically significant by Pearson's correlation t-test.

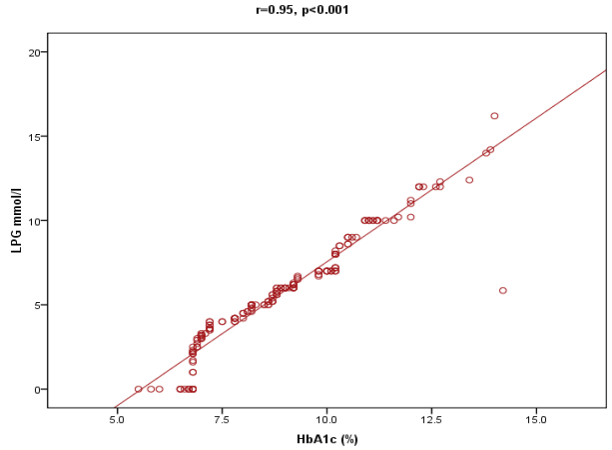

Figure 4: Correlation between HbA1c and LPG.

The above table shows that HbA1c is positively correlated with LPG (r=0.95, p<0.001) and the association is statistically significant by Pearson's correlation t-test.

Discussion

High Rates of Poor Glycemic Control in Bangladeshi Diabetics:

This study investigated glycemic control among Type 2 diabetics attending Dhaka Medical College Hospital. Our findings revealed alarmingly high prevalence of poor glycemic control (78.47%). The proportion of poor glycemic control among the study subjects was 78.47% but the study conducted in Jordon showed the proportion of poor glycemic control among patients with type-2 diabetes was 65.1% (HbA1c >7%) [9]. In Pakistan one study shows, the proportion of poor glycemic control was 46.7% (HbA1c >7.5%) and in Kuwait, the proportion of poor glycemic

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control was 66.7% of diabetes mellitus patients had HbA1c ≥ 8% [10, 11]. However, the above studies show that in the Eastern Mediterranean Region, a similar picture with a high proportion of poor glycemic control exists. A study in Saudi Arabia reported the proportion of poor glycemic control among type-2 diabetes was 73% [12]. Although clinical studies have shown that glycemic control correlates with a reduction in complications of diabetes [13]. These results highlight a widespread issue of poor glycemic control in the Eastern Mediterranean Region.

Patient Characteristics and Glycemic Control:

The study identified potential associations between patient characteristics and glycemic control. While a higher percentage of males exhibited poor control compared to females, the same pattern held true for those aged 60 years and above (82.8%) [14]. This finding requires further investigation in larger studies. Our data suggests a link between education level and glycemic control, aligning with previous research indicating better control among those with higher education [15, 16]. Socioeconomic factors like income may also play a role. While our study didn't show a statistically significant association, other studies suggest a connection between lower income and poorer glycemic control [17]. Abnormal dietary intake was prevalent among participants, with 73% having poor control. This aligns with the established role of diet in managing diabetes. Interestingly, no significant association emerged between physical activity and glycemic control in our study, which contradicts some existing research. Meanwhile, physical activity improves glycemic control results, reduces blood pressure, and positively affects other coronary heart disease risk factors for individuals who already living with type two diabetes [18]. So further investigation is warranted.

Comorbidities and Glycemic Control:

A significant proportion of participants (41.6%) had diabetic complications like hypertension and chronic kidney disease. These comorbidities were linked to higher HbA1c levels, suggesting a complex interplay between factors affecting glycemic control. Previous research also supports the notion that diabetic complications negatively impact quality of life [19].

Duration of Diabetes and Glycemic Variability:

As expected, the duration of diabetes was proportionally associated with HbA1c levels. This aligns with other studies demonstrating a decline in glycemic control over time [20]. Both the highest and lowest plasma glucose levels within the last three months showed a positive correlation with HbA1c, indicating frequent blood sugar fluctuations in poorly controlled patients. Furthermore, our findings revealed a strong positive correlation between glycemic variability (highest and lowest blood glucose levels in the past three months) and HbA1c. Wide fluctuations in blood sugar suggest potential issues with medication adherence, inadequate follow-up, or uncontrolled comorbidities. Further research with larger, more diverse samples is needed to confirm these findings and explore the underlying causes of poor glycemic control among Bangladeshi diabetics. Investigating the effectiveness of existing diabetes management strategies and exploring interventions to improve adherence, education, and access to care are crucial next steps.

Conclusions

This study reveals a high burden of poor glycemic control among Type 2 diabetics in Dhaka, Bangladesh. Addressing factors like education, dietary habits, and potential non-compliance with treatment regimens is crucial to improve glycemic control and prevent complications. Further research is needed to explore the inconclusive association between physical activity and glycemic control in this population

Conflicts of Interest: None.

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