Original Article

Knowledge and Use of HbA$_{1c}$ Among Patients with Type 2 Diabetes Mellitus Admitted in A Tertiary Care Hospital

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Abstract

Background: HbA$_{1c}$ test provides an index of average blood glucose level during the past 2-3 months. It is now widely used in management of diabetes both as a measure of long-term glycemic and as a predictor of risk for diabetic complications. In recent years there has been an increased focus on encouraging patients to be aware of HbA$_{1c}$. Hence, this study was designed to explore the level of knowledge and use of HbA$_{1c}$ test in type 2 diabetic patients in a tertiary hospital.

Methods: This cross-sectional descriptive study was conducted among 220 cases of type 2 diabetes mellitus admitted in the medicine ward of Dhaka Medical College and Hospital during the period of May 2024 to November 2024. Each individual was subjected to personal interview regarding demographic details and their level of knowledge of HbA$_{1c}$ by a semi-structured questionnaire. The collected data were analyzed using computer aided statistical software SSPS version 22. Chi2 test and Multivariable Logistic Regression were done to assess the relationship.

Results: Among the participants, 59.1% were male and 40.9% were female. Majority (37.3%) were between 41-50 years age group, 26.8% completed higher secondary education and most (71.8%) lived in rural areas. Regarding knowledge of HbA$_{1c}$ test, majority of patients (63.6%) did not know about it. Moreover, only 21.4 % were aware of their target goal. Among aware patients, mean HbA$_{1c}$ was 8.1% whereas among unaware patients who did not know about the test, mean HbA$_{1c}$ was 9.2%. Higher education, urban residence, higher income, and the presence of diabetic complications were significantly associated with greater odds of HbA1c awareness. Patients with graduate-level education had the highest odds (OR = 5.80, 95% CI: 2.50–13.48, p < 0.001). Urban residents (OR = 3.10, 95% CI: 1.76–5.46, p < 0.001) and those with diabetic complications (OR = 2.20, 95% CI: 1.15–4.19, p = 0.017) were also more likely to be aware. Conversely, higher HbA1c levels were associated with lower odds of awareness (OR = 0.75, 95% CI: 0.62–0.91, p = 0.003).

Conclusion: Diabetes poses a global health challenge, especially in Bangladesh, where low awareness of HbA1c leads to poor control and complications. This study reveals that most patients lack HbA1c knowledge, resulting in higher levels and more complications. Education and routine testing are crucial to improving diabetes management and outcomes in resource-limited settings. The findings suggest targeted interventions should focus on improving awareness among rural, lower-income, and less-educated populations, as well as patients with poorer glycemic control.

Keywords: HbA1c, Diabetes Mellitus, Knowledge of DM.

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Background:

Diabetes mellitus (DM) is a growing global health crisis, particularly affecting low- and middle-income countries. According to the International Diabetes Federation, 415 million people worldwide were living with diabetes in 2015, a number projected to rise to 642 million by 2040 without preventive action[1]. In Bangladesh, 7.1 million people have diabetes, with a 7.4% prevalence in adults, and type 2 diabetes mellitus accounts for over 90% of cases. Diabetes is associated with both microvascular (retinopathy, nephropathy, neuropathy) and macrovascular (heart attacks, peripheral vascular disease, stroke) complications, contributing to significant mortality, morbidity, and financial

strain, especially in countries like Bangladesh, where health insurance is scarce[2]. Effective management of diabetes requires patient education and self-care. Proper diabetes education improves glycemic control and reduces complications, while lack of awareness can lead to increased healthcare costs. Glycosylated hemoglobin (HbA1c) is the gold standard for assessing long-term glycemic control[4]. HbA1c testing is recommended biannually for patients with stable diabetes and quarterly for those not meeting treatment goals. The American Diabetes Association (ADA) recommends HbA1c targets of <7% for most adults, with adjustments based on individual health conditions and risk factors[5]. Achieving optimal HbA1c levels can significantly reduce diabetes-related complications. However, the awareness of HbA1c among patients is low[14]. Many studies show that even in managed healthcare settings, patients often do not know their HbA1c levels or target goals, hindering effective diabetes management[6-8]. Studies in the U.S. and India reveal similar trends, where a significant percentage of patients were unaware of HbA1c testing and its importance. In resource-limited settings like Bangladesh, raising awareness about HbA1c and promoting its regular use among patients with type 2 diabetes is crucial for reducing complications and mortality[9].

HbA1c is now commonly used in diabetes management as a measure of long-term glycemic control and as a predictor of potential diabetic complications. Ensuring that patients are aware of their HbA1c levels and target values is crucial for improving adherence to treatment and enhancing overall health outcomes[10]. However, there is often a gap between the recommended frequency of HbA1c testing and its actual practice, largely due to a lack of patient awareness. This gap could be addressed through efforts to improve patient education regarding the importance of HbA1c monitoring[12-14].

Diabetes mellitus is a significant non-communicable disease with rising prevalence globally and in Bangladesh. It is associated with high morbidity and mortality, particularly from complications like renal failure, cardiovascular disease, and blindness. The number of people with type 2 diabetes is increasing due to lifestyle changes and rapid economic development. Many individuals remain undiagnosed, especially in low- and middle-income countries, which puts them at risk for serious complications[15]. In Bangladesh, the prevalence of diabetes is 7.4%, with 7.1 million people living with the condition in 2015.[16]

Poor glycemic control due to inadequate awareness of diabetes management is a key factor contributing to the development of complications. Studies have shown that maintaining stable blood glucose levels through proper self-care, including medication adherence, diet, exercise, and self-monitoring, can reduce complications[17]. HbA1c, a measure of long-term glycemic control, is crucial for monitoring diabetes and guiding patient management[18-20].

However, many patients lack awareness about HbA1c and its significance. Studies in different regions, including Bangladesh, indicate poor knowledge of HbA1c among diabetic patients, with many not knowing their last HbA1c values or their target goals[21]. Improving patient education about HbA1c can enhance glycemic control and reduce diabetes-related complications, but knowledge gaps remain, especially in low-income countries[22]. Therefore, promoting awareness about HbA1c through education and routine clinical practices is critical for better diabetes management and health outcomes.

In Bangladesh, there are limited studies that investigate how much patients know about their HbA1c levels and target values, or how this knowledge has evolved over time[23-25]. Given this, a hospital-based cross-sectional study has been designed to assess the level of knowledge among type 2 diabetes patients regarding HbA1c. The study aims to explore the role of patient awareness in achieving better glycemic control and increasing the frequency of HbA1c testing, with the ultimate goal of improving diabetes management, reducing complications, and lowering morbidity and mortality[2].

The general objective of this study is to observe the level of knowledge about HbA1c and its use among patients with type 2 diabetes mellitus in the medicine ward of Dhaka Medical College Hospital. The specific objectives include assessing the socio-demographic status of the patients, evaluating their knowledge of their recent and target HbA1c values, and analyzing the relationship between this awareness and their actual glycemic control and other sociodemographic factors.

Methods:

This descriptive cross-sectional study was conducted on 220 patients with type 2 diabetes mellitus admitted to the Medicine Ward of Dhaka Medical College Hospital. The study took place over a six-month period from May 19, 2024, to November 18, 2024. Participants included both male and female patients aged 18 and older, who provided informed written consent. The study excluded unconscious patients, those with mental illness, pregnant diabetic patients, individuals who had undergone recent blood transfusions, those with hemoglobinopathies, and patients who were unwilling to participate.

The sample size was calculated using a standard formula, based on a 95% confidence level and an estimated prevalence of 50% due to the lack of specific prevalence data for the population. Although the calculated sample size was 384, the final sample size was adjusted to 220 for logistical reasons.

The operational definitions for this study include criteria for diagnosing diabetes mellitus and defining glycemic control. A diagnosis of diabetes mellitus is made if a patient presents with classic hyperglycemia symptoms or a hyperglycemic crisis, with a random plasma glucose of ≥200 mg/dL (11.1 mmol/L), HbA1c ≥6.5%, fasting plasma glucose (FPG) ≥126 mg/dL (7.0 mmol/L), 2-hour plasma glucose ≥200 mg/dL during an oral glucose tolerance test (OGTT), or if the patient is already on anti-diabetic medications.

HbA1c, or glycosylated hemoglobin, reflects average blood glucose levels over the previous three months and helps predict diabetic complications. It is measured quarterly to assess whether patients have achieved and maintained their glycemic targets, with the ideal HbA1c goal being <7% to reduce microvascular and macrovascular complications. Glycemic control is defined as HbA1c <7%, fasting plasma glucose between 4.4-7.2 mmol/L, and 2-hour postprandial glucose <10 mmol/L.

Study population:
Admitted patients of type 2 diabetes mellitus in the medicine ward of Dhaka Medical College Hospital from May to November 2024.

Sampling method and technique:
Purposive type non-probability sampling technique was applied. Patients admitted in the medicine ward of Dhaka Medical College Hospital who fulfilled the inclusion and exclusion criteria were enrolled in the study.

Data collection:
A data collection sheet was designed to record all the information of interest. After fulfilling inclusion and exclusion criteria, admitted patients with type 2 diabetes were enrolled with unique ID. Patients were briefed about the objectives of the study, risk and benefits, freedom for participating in the study and confidentiality. Informed written consent was obtained who agreed to participate in the study. The details of baseline socio-demographic data, educational level, monthly income, glycemic status as well as treatment modalities and complications of diabetes were obtained. The patients were also interviewed to assess their level of knowledge of Hba1c and its target goal as well as their practice of HbA1c test and glycemic control using a researcher-filled questionnaire. This was through a series of simple and self-reported questions that included for example, "Do you know about HbA1c?" (Yes, No). Respondents were coded as 'aware about HbA1c' if they answered, Yes' and 'unaware of HbA1c' if they answered 'No'. The respondent answers were tabulated and analyzed. Recent HbA1c results were documented after reviewing medical records.

The questionnaire was pre-tested to ensure that respondents would be able to understand easily and answer accordingly. The investigator herself collected the data that was shown to the corresponding guide weekly for feedback and necessary collection.

Data processing and analysis:
All the necessary information was collected in a standardized data sheet by interviewing patients and reviewing lab investigations. Finally, all the necessary data were processed and analyzed by using the SPSS 23 program. The results were presented in tables and diagrams in mean, standard deviation (SD) and percentages Association of HbA1c awareness with glycemic control and diabetic complications were assessed by Chi-square test and others were done by t test. A "P" value <0.05 was considered as significant. Logistic regressions were done to evaluate association between HbA1c Awareness and glycemic control and other socioeconomic status. The model was adjusted for age, sex, education, income, geography, smoking status and pre-existing illness.

Ethical assurances for the protection of human rights:
When patients met the criteria of inclusion, before enrolment in the study, the aims and objectives of the study along with its procedure and benefits or drawbacks were explained in detail in a clear manner. In case of any query, they were answered appropriately. When the patients were satisfied, informed consent was obtained from the patients. They had the freedom to withdraw from study at any time. No data or information was collected without permission from the participant. Neither investigation/ procedure was done against his/ her will. Confidentiality was assured and anonymity was maintained; special caution is taken that no participant can be identified in any report or publication under this study.

Results:
Among total 220 cases of type 2 diabetes mellitus in this study, 130 (59.1%) were male and 90 (40.9%) were female. Mean age of study population was 54.7 ± 10.3 years. Majority of patients were married (76.8%). About 26.8% of participants completed higher secondary education while 35.5% patients were housewife. Family income of majority

of patients (30.9%) was 10,000- 20,000 BDT per month. 158 patients lived in rural areas while only 62 patients came from urban areas (Table 1).

Table 1. Socio-demographic characteristics of study subjects (n=220)

Variables	Frequency (n=220)	Percentage (%)
Age (years), mean ± SD	54.7±10.3	
Gender		
Male	130	59.1
Female	90	40.9
Marital status		
Unmarried	21	9.5
Married	169	76.8
Widowed	30	13.6
Education		
Illiterate	36	16.4
Primary	34	15.5
SSC	49	22.3
HSC	59	26.8
Graduate and above	42	19.1
Occupational status		
Service holder	65	29.5
Self employed	54	24.5
Housewife	78	35.5
Retired	17	7.7
Unemployed	6	2.7
Monthly income		
<5,000 BDT	52	23.6
5-10,000 BDT	56	25.5
10,000-20,000 BDT	68	30.9
>20,000 BDT	44	20.0
Area of living		
Rural	158	71.8
Urban	62	28.2

A total of 220 cases of type 2 diabetes mellitus patients were enrolled in this study of which maximum number of patients (37.3%) were between 41-50 years age group, next (29.5%) were between 51-60 years age group followed by (19.5%) were >60 years age group. Out of 220 cases of type 2 diabetes mellitus 59.1% were male and 40.9% were female. Male-female ratio was 1.4:1. Of the study population, Majority of participants (26.8%) completed higher secondary education followed by SSC (22.3%), graduate and above (19.1%), primary (15.5%). Among them, 16.4% were illiterate. Out of 220 cases, majority of patients 71.8% lived in rural area while only 28.2% resided in urban areas. Out of a total of

220 cases, only 25.5% of patients had HbA1c <7% whereas 74.5% patients had HbA1c >7%. Regarding complications of diabetes, 29.5% of patients had diabetic complications. It was found that 29.5% of patients out of total 220 cases had diabetic complications. Among them, 9.5% of patients had coronary artery disease followed by diabetic neuropathy (6.4%), nephropathy (4.5%) and stroke (4.1%). Diabetic retinopathy was found in 3.2%. (Figure 1).

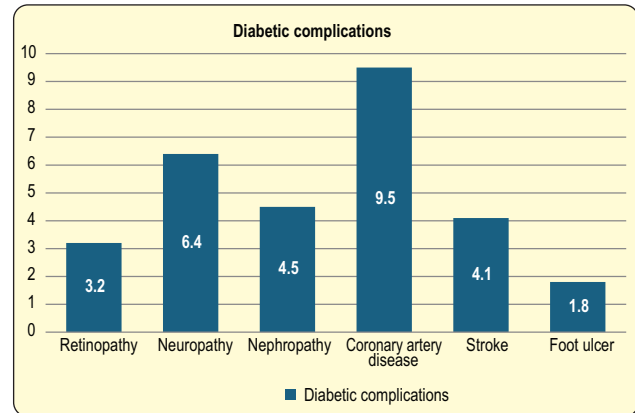Out of total 220 cases, majority of patients (63.6%) did not

Figure 1. Frequency distribution of diabetic complications (n=220)

know about the HbA1c test and only 36.4% were familiar with HbA1c. Moreover, 21.4 % were aware of their target goal whereas 78.6% did not know about the target goal of HbA1c. Out of a total 220 study population, only 21.8% patients did the HbA1c test at regular interval and majority of patients (78.2%) did the test infrequently. Among aware patients, mean HbA1c was 8.1% whereas among unaware patients who did not know about the test, mean HbA1c was 9.2% (Figure 2).
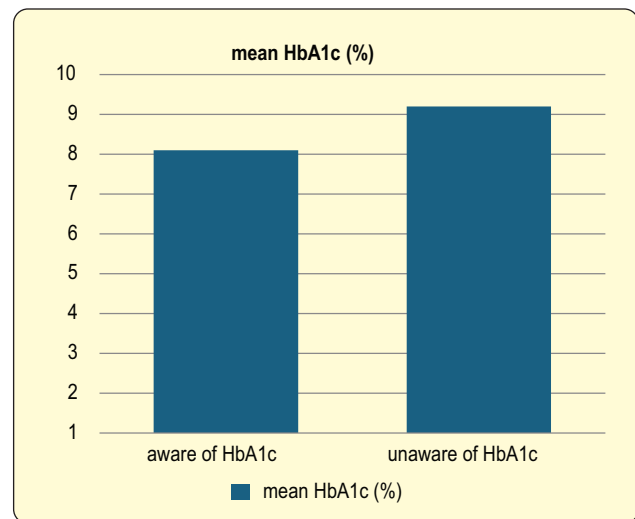

Figure 2. Mean HbA1c (%) between aware and unaware patients

It was found that there was a significant association between knowledge of HbA1c and glycemic control (P value 0.001). Aware patients had significantly fewer diabetic complications than unaware patients (P <0.001). Moreover, education had a positive impact on knowledge of HbA1c whereas no association was found with age and duration of diabetes.

In this study, 50% patients had HbA1c <7% among 80 aware patients whereas only 27.1% patients had glycemic control among 140 patients who were unaware (Table 2).

Higher education, monthly income, urban residence, and the presence of diabetic complications were significantly associated with increased odds of HbA1c awareness. Patients with an HSC education (OR = 4.60, 95% CI: 2.10–10.06, p < 0.001) and those with graduate-level education or higher

(OR = 5.80, 95% CI: 2.50–13.48, p < 0.001) had substantially greater odds of being aware of HbA1c compared to patients with no education. Similarly, individuals earning over 20,000 BDT per month were 3.5 times more likely to be aware of HbA1c (OR = 3.50, 95% CI: 1.52–8.05, p = 0.003), and urban residents had over three times the odds compared to rural residents (OR = 3.10, 95% CI: 1.76–5.46, p < 0.001).

Furthermore, patients with diabetic complications were significantly more likely to be aware of HbA1c (OR = 2.20, 95% CI: 1.15–4.19, p = 0.017), suggesting that experiencing complications may act as a motivator for increased awareness. However, higher HbA1c levels were associated with reduced odds of awareness (OR = 0.75, 95% CI: 0.62–0.91, p = 0.003) (Table-3).

Table 2: Comparison between aware and unaware patients about HbA1c

Variables	Aware patients n=80	Unaware patients n=140	P value
Values are mean ± SD			
Age (years)	53.2 ± 12.9	55.5 ± 8.4	0.112
Duration of DM (years)	8.1 ± 6.2	9.3 ± 5.3	0.129
Mean HbA1c (%)	8.1 ± 1.7	9.2 ± 1.3	<0.001
Values are n (%)Education			
Illiterate	2 (2.5)	34 (24.3)	<0.001
Primary	5 (6.3)	29 (20.7)	<0.001
SSC	7 (8.75)	42 (30)	<0.001
HSC	32 (40)	27 (19.3)	0.51
Graduate and above	34 (42.5)	8 (5.7)	<0.001
Glycemic control			
HbA1c <7%	40 (50)	38 (27.1)	0.001
Diabetic complications	15 (18.8)	50 (35.7)	0.008

Table 3: Significant Factors Associated with HbA1c Awareness

Variable	OR	95% CI	p-value
Diabetic Complications	2.20	1.15–4.19	0.017
Education- SSC	2.85	1.15–7.08	0.024
Education - HSC	4.60	2.10–10.06	<0.001
Education - Graduate and above	5.80	2.50–13.48	<0.001
Monthly Income (>20,000 BDT)	3.50	1.52–8.05	0.003
Area of Residence (Urban)	3.10	1.76–5.46	<0.001
HbA1c Level (per %)	0.75	0.62–0.91	0.003

Discussion:

Diabetes mellitus has become a major public health concern globally, particularly in low- and middle-income countries, which bear a substantial burden of this chronic disease. Research indicates that poor glycemic control is the leading cause of hospital admissions for diabetic patients, emphasizing the need for effective management strategies[25]. The HbA1c test is widely recognized as a primary measure for assessing glycemic control and is crucial for preventing both acute and long-term complications associated with diabetes[26]. It is essential for patients to not only comply with treatment and modify their lifestyle but also to understand the significance of glycemic control to achieve optimal clinical outcomes[27].

A study conducted at Dhaka Medical College Hospital from May to November 2024 aimed to explore the knowledge and practices related to HbA1c among patients with type 2 diabetes mellitus. A total of 220 patients were included in this descriptive cross-sectional study[1]. The demographic profile of the participants revealed a mean age of 55 years, with a significant proportion (76.8%) of being married. Employment status indicated that the majority were housewives (35.5%), followed by service holders (29.5%) and self-employed individuals (24.5%). Notably, 78.2% of the participants resided in rural areas, contrasting with other studies that found a higher prevalence of diabetes among urban populations.

The findings regarding glycemic control were concerning. Out of the 220 patients, only 25.5% achieved an HbA1c level of less than 7%, which is considered the target for optimal glycemic control. The remaining 74.5% had HbA1c levels above this threshold, placing them at significant risk for developing long-term vascular complications. Among the participants, 29.5% exhibited diabetic complications, including retinopathy (3.2%), neuropathy (6.4%), nephropathy (4.5%), coronary artery disease (9.5%), stroke (4.1%), and foot ulcers (1.8%).

The study also assessed the patients' knowledge regarding HbA1c. Alarmingly, 63.6% of the participants were not aware of what HbA1c signifies, while only 36.4% were familiar with the term. Furthermore, only 21.4% understood their target HbA1c levels, highlighting a critical gap in knowledge that correlates with poorer glycemic control. These findings are consistent with studies conducted in other regions, where low awareness of HbA1c was prevalent among diabetic patients. For instance, in a study in India, 43% of patients were aware of their HbA1c goals, while a Chinese study reported that only 25.3% had a good understanding of HbA1c.

The relationship between knowledge of HbA1c and glycemic control was evident in the study's results. Patients who were aware of their HbA1c levels had significantly lower mean HbA1c levels (8.1%) compared to those who were unaware (9.2%). A significant association (P < 0.001) was found between knowledge of HbA1c and glycemic control, indicating that those who understood the importance of HbA1c were more likely to achieve better outcomes. This aligns with findings from other studies that suggest a clear link between patient awareness and improved glycemic control, as well as a reduction in diabetic complications.

Additionally, education level emerged as a positive predictor of a good understanding of HbA1c[9]. Patients with higher education levels were more likely to engage in behaviors that promote better glycemic control compared to those with lower education levels. This underscores the importance of educational interventions in improving patient outcomes[28].

Despite the known benefits of regular HbA1c monitoring, only 21.8% of patients in this study had their HbA1c tested at regular intervals, indicating a significant gap between recommended practices and real-life adherence. This finding was consistent with a study from Kenya, where a similar percentage of patients reported infrequent HbA1c testing[28].

Overall, the study highlighted a critical need for enhanced patient education regarding glycemic control and HbA1c management. With only 50% of aware patients achieving target HbA1c levels compared to 27.1% among the unaware group, it is evident that more targeted educational strategies are necessary to empower patients with the knowledge and resources needed for effective diabetes management. Improving awareness and understanding of HbA1c could lead to better clinical outcomes and reduced complications, ultimately enhancing the quality of life for patients with type 2 diabetes mellitus[29].

There are some limitations of the study. The study was conducted among a limited number of admitted patients with type 2 diabetes mellitus at the Dhaka Medical College Hospital over a short timeframe, which may not accurately represent the broader situation of diabetes in Bangladesh. The data were restricted to type 2 diabetes patients and does not reflect the general diabetic population in the country[7]. Additionally, there was no validated questionnaire available to measure knowledge specifically related to HbA1c in this population. Finally, while several patient-related and lifestyle factors are known to influence glycemic control, these associations were not explored in the study. The model was adjusted for confounding variables but there are more potential confounders that are missed in this study.

A lack of knowledge about HbA1c and its target goal may increase the risk of developing diabetic complications. Clinicians and diabetes educators should not only educate patients about the HbA1c test but also inform them about their target goals, which can motivate patients to manage their diabetes more effectively. Implementing strategies to enhance the quality of diabetic education regarding glycemic control is crucial for ensuring optimal diabetes management.

Conclusion

In conclusion, diabetes mellitus is a significant global health challenge, particularly in low- and middle-income countries like Bangladesh, where limited awareness of HbA1c contributes to poor glycemic control and increased complications. This study highlights that a majority of patients lack knowledge about HbA1c testing and its target goals, which is associated with higher HbA1c levels and complications. Enhancing patient education and routine HbA1c testing is essential for better diabetes management, reducing complications, and improving health outcomes. Promoting awareness through targeted educational programs could bridge this critical knowledge gap and foster improved glycemic control in resource-limited settings.

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