

## Original Research Article

# HbA1c test awareness, sociodemographic characteristics and lifestyle behaviour among type 2 diabetes mellitus patients

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## ABSTRACT

**Background:** Glycated hemoglobin (HbA1c) is a key biomarker for long-term glycemic control. The studies have shown that patients having an understanding of HbA1c values in diabetic patients is associated with better glycemic control and self-care practices. This study aims to assess HbA1c test awareness among type 2 diabetes mellitus (T2DM) patients and examine its association with sociodemographic and lifestyle factors.

**Methods:** This cross-sectional study was conducted among 230 type 2 diabetes mellitus patients using purposive sampling and the participants were recruited from outpatient and laboratory department of a hospital in Mangaluru, Karnataka, India. Awareness of HbA1c test was assessed using a structured questionnaire and analyzed in relation to demographic and lifestyle variables. Chi-square test were used for the analysis of data using statistical package for the social sciences (SPSS) software, and  $p < 0.05$  was considered statistically significant.

**Results:** Out of 230 participants, 56.5% were male and 43.5% were aged 50–69 years. Only a minority of participants (16.1%) were aware of the HbA1c test. The HbA1c test awareness was not significantly associated with age, gender, education, employment, income, smoking, alcohol use, medication adherence, or diet adherence.

**Conclusions:** Awareness of HbA1c test among T2DM patients was limited. Structured patient education and counseling programs focusing on HbA1c monitoring may empower patients to achieve better glycemic control and reduce the risk of diabetes-related complications.

**Keywords:** Type 2 diabetes mellitus, HbA1c, Awareness, Lifestyle behavior, Glycemic control

## INTRODUCTION

Type 2 diabetes mellitus (T2DM) is one of the most common chronic non-communicable diseases worldwide.<sup>1</sup> In 2019, an estimated 463 million people were affected by diabetes, and this number is projected to rise to 578 million by 2030, with the greatest burden occurring in urban settlements and in high income countries.<sup>2</sup> In India, the prevalence of diabetes has reached alarming levels and continues to increase owing to rapidly increasing sedentary lifestyle in individuals across all age groups.<sup>3</sup> Patients with poor glycaemic control are at higher risk of

developing diabetes-related complications which adversely affect their overall well-being and quality of life.<sup>4,5</sup> Thus, maintaining optimal glycaemic control remains the primary goal of diabetes management.<sup>6</sup> Good glycaemic control improves quality of life and helps prevent or delay the onset of long-term complications.<sup>7</sup>

Regular monitoring plays a crucial role in guiding treatment decisions for diabetic patients.<sup>8-10</sup> The haemoglobin A1c (HbA1c) test is widely recognized as a reliable biomarker for assessing glycaemic control and has been approved by the World Health Organization (WHO)

both for diagnosing diabetes and for monitoring long-term glycaemic status.<sup>10-12</sup> Routine testing of glycated haemoglobin should be encouraged, as it provides valuable information on long-term blood glucose levels that cannot be obtained through standard clinical measurements.<sup>13,14</sup> Moreover, the HbA1c test has the advantage of being performed at any time without the need for fasting, while reflecting the average blood glucose concentration over the previous three months. This makes it one of the most effective tools for the long-term management of T2DM.<sup>1,15</sup>

Despite its importance, awareness of the HbA1c test among diabetic patients remains limited, particularly in resource-constrained settings. Therefore, it is necessary to explore the association between HbA1c awareness and demographic as well as lifestyle factors among individuals with T2DM. The objective of the present study was to assess the level of awareness regarding the HbA1c test among patients with T2DM and to examine its correlation with demographic and lifestyle characteristics.

## METHODS

### *Study design and participants*

The participants for this cross sectional study was recruited from outpatient and laboratory department of a private medical college hospital in Mangaluru, Karnataka, India. For this study, a purposive sampling of 230 participants were selected. The participants who were physician diagnosed type 2 diabetes mellitus, 30 years and above, diagnosed with T2DM for at least one year and willing to participate in the study were included. Participants who were unable to understand or follow instructions, with uncorrected hearing or visual impairment, cognitively impaired, terminal ill, or unwilling to participate were excluded from the study.

### *Data collection*

The awareness of HbA1c test was assessed by asking patients whether they have heard of "HbA1c test". The response was marked "yes" if the participant was aware of the test.

Demographic (age, gender, education, employment, income) and lifestyle variables (smoking, alcohol use, physical activity, adherence to prescribed exercise and diet) were collected for the study.

### *Statistical analysis*

Data was analyzed using statistical package for the social sciences (SPSS) version 23.0 with a sample size of 230 participants. Categorical variables were expressed as frequency and percentage. The correlation between HbA1c awareness and demographic and lifestyle variables were examined using the Chi-square test.

The significance level for the study was set at a 95% confidence interval with  $p < 0.05$  considered statistically significant.

## RESULTS

The majority of participants were aged between 50–69 years (62.6%), followed by those aged 30–49 years (31.3%), and a smaller proportion aged 70–89 years (6.1%). Males constituted 56.5% of the study population, while females accounted for 43.5%. Regarding education, 61.7% had studied below the 10th grade, 20.0% had completed 10th–12th grade, and 18.3% had education beyond 12th grade. In terms of occupation, 47.0% were working, 44.8% were unemployed, and 8.3% were retired. Monthly income data showed that 31.7% earned more than ₹5000, 25.2% earned between ₹3000–₹5000, 22.6% earned less than ₹1000, and 20.4% had a monthly income between ₹1000–₹3000 (Table 1).

**Table 1: Sociodemographic characteristics of the participants.**

Variables	Frequency	Percent (%)
<b>Age (years)</b>		
30-49	72	31.3
50-69	144	62.6
70-89	14	6.1
<b>Gender</b>		
Females	100	43.5
Males	130	56.5
<b>Education</b>		
<10 <sup>th</sup>	142	61.7
10 <sup>th</sup> -12 <sup>th</sup>	46	20.0
>12 <sup>th</sup>	42	18.3
<b>Occupation</b>		
Retired	19	8.3
Unemployed	103	44.8
Working	108	47.0
<b>Income/month (Rs)</b>		
<1000	52	22.6
1000-3000	47	20.4
3000-5000	58	25.2
>5000	73	31.7

Most participants had been diabetic for either 5–10 years (36.5%) or less than 5 years (36.1%), while 27.4% had diabetes for more than 10 years. Regarding smoking status, the majority (89.1%) were non-smokers, with only 8.7% currently smoking and 2.2% being ex-smokers. A large proportion (93.5%) were non-alcoholic, 4.3% were current alcohol users, and 2.2% were ex-alcoholics (Table 2).

In terms of anti-diabetic medication adherence, 89.1% always adhered, 9.6% followed most of the time, and 1.3% only sometimes. Most participants monitored their blood glucose at least once a month (68.6%), while others did so

less frequently: 14.6% less than once every six months, 10.9% at least once every three months, 5.2% weekly, and 0.4% always (Table 2).

**Table 2: Lifestyle behaviour characteristics of the participants.**

Variables	Frequency	Percentage (%)
<b>Diabetic duration (years)</b>		
<5	83	36.1
5-10	84	36.5
>10	63	27.4
<b>Smoking status</b>		
Current	20	8.7
Ex current >12 month	5	2.2
Non-current	205	89.1
<b>Alcoholic status</b>		
Current	10	4.3
Ex alcoholic <12	5	2.2
Non alcoholic	215	93.5
<b>Anti-diabetic medication adherence</b>		
Always	205	89.1
Most of the time	22	9.6
Sometimes	3	1.3
<b>Diabetes monitoring</b>		
Always	1	0.434783
At least once/3 month	25	10.86957
at least once/month	158	68.6
Less than once/6 month	35	14.6
Weekly	12.0	5.2
<b>Physical activity</b>		
No	50	21.7
Yes	180	78.3
<b>Exercise adherence</b>		
Always	32	13.9
Most of the time	10	4.3
Never	174	75.7
Sometime	14	6.1
<b>Diet advice adherence</b>		
No	6	2.6
Yes	224	97.4

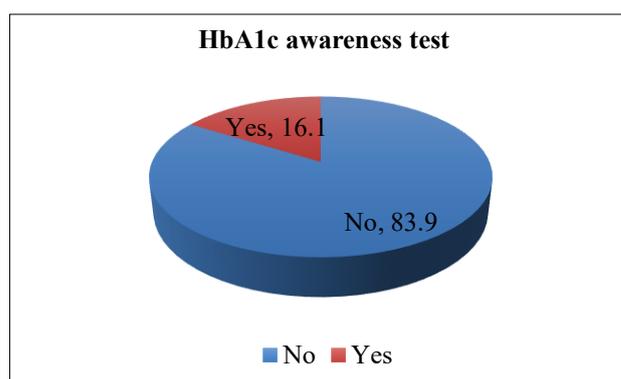
Physical activity was reported by 78.3% of participants, while 21.7% were physically inactive. Regarding exercise, 75.7% never exercised, 13.9% always did, 6.1% exercised sometimes, and only 4.3% followed exercise most of the

time. Diet advice adherence was high, with 97.4% following dietary advice and only 2.6% not adhering (Table 2).

Among the 230 patients with T2DM, only 16.1% were aware of the HbA1c test, while a significant 83.9% had no awareness of it, indicating poor awareness about this important diagnostic marker among the majority (Figure 1 and Table 3).

**Table 3: HbA1c awareness test results of the participants.**

HbA1c awareness test	Frequency	Percentage (%)
No	193	83.9
Yes	37	16.1
<b>Total</b>	<b>230</b>	<b>100</b>



**Figure 1: HbA1c awareness test results among study participants.**

Among the various socio-demographic and behavioral variables analyzed for their association with awareness of the HbA1c test among type 2 diabetes mellitus patients, physical activity and advice to exercise were found to have statistically significant associations ( $p < 0.001$ ). A greater proportion of those who were aware of HbA1c reported being physically inactive (54.1%) and had received advice to exercise, compared to those not aware. Other factors such as age, gender, education, employment, income, smoking status, alcoholic status, medication adherence, and dietary advice adherence did not show any significant association with awareness ( $p > 0.05$ ) (Table 4).

**Table 4: Association between sociodemographic and lifestyle variables and HbA1c awareness.**

Variables	Not aware (%)	Aware (%)	Chi square	P value
<b>Age (years)</b>				
30–49	59 (30.6)	13 (35.1)	0.751	0.687
50–69	123 (63.7)	21 (56.8)		
70–89	11 (5.7)	3 (8.1)		

Continued.

Variables	Not aware (%)	Aware (%)	Chi square	P value
<b>Gender</b>				
Females	86 (44.6)	14 (37.8)	0.494	0.482
Males	107 (55.4)	23 (62.2)		
<b>Education</b>				
<10th	118 (61.1)	24 (64.9)	2.512	0.285
10th–12th	42 (21.8)	4 (10.8)		
>12th	33 (17.1)	9 (24.3)		
<b>Employment</b>				
Retired	16 (8.3)	3 (8.1)	0.042	0.979
Unemployed	87 (45.1)	16 (43.2)		
Working	90 (46.6)	18 (48.6)		
<b>Income/month (Rs)</b>				
<1000	41 (21.2)	11 (29.7)	1.613	0.656
1000–3000	41 (21.2)	6 (16.2)		
3000–5000	49 (25.4)	9 (24.3)		
>5000	62 (32.1)	11 (29.7)		
<b>Smoking status</b>				
Current	18 (9.3)	2 (5.4)	0.685	0.71
Ex >12 months	4 (2.1)	1 (2.7)		
Non-current	171 (88.6)	34 (91.9)		
<b>Alcoholic status</b>				
Current	10 (5.2)	0 (0.0)	2.168	0.338
Ex <12 months	4 (2.1)	1 (2.7)		
Non-alcoholic	179 (92.7)	36 (97.3)		
<b>Anti-diabetic medication adherence</b>				
Always	169 (87.6)	36 (97.3)	3.262	0.196
Most of the time	21 (10.9)	1 (2.7)		
Sometimes	3 (1.6)	0 (0.0)		
<b>Physical activity</b>				
No	30 (15.5)	20 (54.1)	27.913	<0.001
Yes	163 (84.5)	17 (45.9)		
<b>Exercises</b>				
Always	22 (11.4)	10 (27.0)	18.346	<0.001
Most of the time	7 (3.6)	3 (8.1)		
Never	156 (80.8)	18 (48.6)		
Sometimes	8 (4.1)	6 (16.2)		
<b>Diet advice adherence</b>				
No	4 (2.1)	2 (5.4)	0.944	0.331
Yes	189 (97.9)	35 (94.6)		

## DISCUSSION

The present study explored the level of awareness regarding HbA1c and its association with glycemic control among patients with T2DM. Our findings revealed that a considerable proportion of participants demonstrated limited awareness about the role of HbA1c testing, its target values, and its implications for diabetes management. This aligns with earlier studies from India and other developing countries, where inadequate patient awareness has been reported as a key barrier to achieving optimal glycemic outcomes.<sup>1,3,6</sup>

Several studies have emphasized that awareness of HbA1c is positively associated with better diabetes self-

management and improved glycemic control.<sup>16,17</sup> A study done by Trivedi et al reported that patients in United States who were familiar with HbA1c targets demonstrated greater adherence to medication and lifestyle modifications compared to those unaware of the same.<sup>17</sup> Similarly, Al-Khaldi et al observed in Saudi Arabia that poor understanding of HbA1c was strongly correlated with uncontrolled diabetes.<sup>16</sup>

The UK Prospective Diabetes Study (UKPDS) has long established the relationship between glycemic control and the risk of both microvascular and macrovascular complications.<sup>4</sup> Consistent with these findings, our study reinforces the clinical importance of patient education, as lack of HbA1c awareness may delay treatment intensification and increase the risk of complications.

International guidelines, including those from the American Diabetes Association (ADA) and the International Diabetes Federation (IDF), recommend HbA1c monitoring at least twice annually in patients with stable glycemic control and quarterly in those not achieving targets.<sup>11,19</sup> However, awareness of these guidelines among patients remains insufficient, particularly in low- and middle-income countries.<sup>18</sup>

From a psychosocial perspective, lack of knowledge about HbA1c has been associated with reduced motivation and poor quality of life among diabetic patients.<sup>7,8</sup> Glasgow et al demonstrated that patients with limited understanding of their glycemic targets often report frustration and helplessness, which can further impede adherence suggesting that along with clinical care, structured patient education programs is essential for the diabetes care.<sup>7</sup>

In India, cultural, educational, and socioeconomic factors play a significant role in patient awareness. Studies by Pradeepa and Mohan have highlighted the increasing burden of type 2 diabetes in the country, where disparities in healthcare access may compound the problem of low HbA1c literacy.<sup>3</sup> Our findings are in line with these observations, as a notable proportion of participants were unaware of the test despite being on regular follow-up with their diabetes management.

This study also raises important implications for clinical practice. Strengthening patient education through targeted interventions such as structured diabetes education programs, use of visual aids, and digital health platforms could improve HbA1c awareness and thereby enhance overall disease management.<sup>20</sup>

Furthermore, integrating HbA1c education into routine consultations could empower patients to actively participate in treatment decisions, potentially improving long-term outcomes. This study includes important confounding factors like age, gender, duration of diabetes, BMI, educational level and income.

### Limitations

Although our study provides valuable insights, certain limitations must be acknowledged. The use of non-probability sampling and T2DM patients may limit the generalization of the findings. The cross-sectional design prevents establishing causality between HbA1c awareness and glycemic control. The study was conducted in a limited number of center, which may restrict generalizability.

### CONCLUSION

Despite its important role in monitoring long-term blood sugar control, the study indicates that a large number of T2DM patients are still unaware about the HbA1c test. The study found a significant relationship between HbA1c test awareness and lifestyle, education and age. Better care for

diabetes, less complications, and better health outcomes essentially depend on routine HbA1c testing and better patient education.

### Recommendations

Future longitudinal studies with larger, more diverse populations and their target values are recommended to validate these findings and evaluate the effectiveness of structured educational interventions.

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