Original Article

Association of Diabetic Health Literacy with Glycemic Control in Type-2 Diabetic Patients visiting H.I.T Hospital Taxila

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Abstract

Objective: This study aimed to assess diabetes health literacy among patients with T2DM and determine its association with glycemic control at the Medical Outpatient Department of HIT Hospital, Taxila

Study Design: A descriptive cross-sectional study was conducted.

Place and duration of study: This cross-sectional study was conducted in the Medical Outpatient Department of H.I.T Hospital, Taxila, between April 2024 and August 2024, to assess diabetes-related health literacy among patients with type 2 diabetes.

Material and Methods: A descriptive cross-sectional study was conducted from April to August 2024 using convenience sampling. A total of 377 patients were recruited, with sample size calculated via OpenEpi at 95% confidence and 5% margin of error. Data were collected using a validated 15-item Diabetes Health Literacy Questionnaire rated on a 5-point Likert scale. Statistical analyses were performed using SPSS version 25. Associations between health literacy and glycemic control were evaluated with the Chi-square test ($p < 0.05$ considered significant).

Results: Participants included 167 males (44.3%) and 210 females (55.7%), aged 20–70 years (mean ± SD: 50.6 ± 10.1). Family history of diabetes was reported by 80.4% of participants. High diabetes health literacy was observed in 1.1%, moderate in 38.2%, and low in 60.7%. Good glycemic control was achieved by 51.5% of participants. Diabetes health literacy was strongly associated with glycemic control ($p < 0.001$).

Conclusion: Higher diabetes health literacy is significantly associated with improved glycemic control. Implementing structured patient education and literacy-enhancing interventions is essential to reduce complications and optimize outcomes in T2DM management.

Keywords: Diabetes Health Literacy, Glycemic Control, HbA1c, Type 2 Diabetes Mellitus

1. Introduction

Diabetes mellitus represents a significant public health challenge worldwide, with profound implications for morbidity, mortality, and healthcare expenditure. In 2021, an estimated 537 million individuals were living with diabetes globally, and this figure is projected to rise to 643 million by 2030 and to 783 million by 2045, highlighting a persistent upward trend in disease burden. [(1)] In the United States, total annual healthcare costs associated with diabetes increased by 35 % over five years—from $327 billion in 2017 to $413 billion in 2022—while individuals with diabetes incur roughly twice the healthcare expenditures of those without the disease.[(2)] Globally, at least 966 billion was spent on diabetes-related healthcare in 2021, representing a 316 % increase over the preceding 15 years.[(3)] Diabetes also contributes to a spectrum of disabling complications affecting the lower limbs and other organ systems and remains a major cause of premature mortality, with diabetes-related deaths rising from 1.5 million in 2012 to 6.7 million in 2021.[(4)] Achieving optimal glycaemic control is a central objective in diabetes management. Evidence from landmark clinical trials indicates that maintaining hemoglobin A1c (HbA1c) below 7 % substantially reduces the risk of micro vascular complications. the age of 65 years. . For example, each 1 % reduction in HbA1c is associated with a 37 % decrease in microvascular compilcations.

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For example, each 1 % reduction in HbA1c is associated with a 37 % decrease in micro vascular complications, a 21 % reduction in diabetes-related mortality, and a 14 % lower risk of myocardial infarction.[5] Consequently, precise blood glucose control is integral to reducing morbidity and mortality among individuals with type 2 diabetes. (6)

Despite advancements in treatment and prevention, complications such as nephropathy, retinopathy, and cardiovascular disease remain prevalent. A critical component of effective diabetes care is patient self-management, which depends heavily on adequate health literacy. Health literacy enables individuals to access, understand, and use health information to make informed decisions regarding disease management.(7) A multi-country study reported that only 7.3 % to 82 % of individuals with diabetes had adequate health literacy, underscoring substantial variability and gaps in patient comprehension. (8)

The World Health Organization defines health literacy as "the cognitive and social capabilities that determine the motivation and ability of people to gain access, understand, and utilize information in such ways that enhance and maintain good health." (9) In the context of diabetes, health literacy encompasses understanding disease processes, communicating with healthcare providers, and applying information to daily self-care and clinical decision-making. (10)

Pakistan is currently experiencing a severe diabetes epidemic. According to estimates from the International Diabetes Federation, approximately 34.5 million adults aged 20–79 years in Pakistan were living with diabetes in 2024, representing one of the highest national prevalence rates globally (age standardized prevalence ≈ 31.4 %). (11) The substantial burden of diabetes in Pakistan is driven by rapid urbanization, shifts in lifestyle patterns, limited healthcare infrastructure, and socioeconomic constraints that exacerbate disparities in disease detection and management. (11) Effective diabetes control in this context requires empowering patients with the requisite knowledge and skills to manage their condition, while addressing cultural beliefs and misconceptions that influence health seeking behaviors. Enhancing health literacy through targeted interventions can improve self management practices, reduce the risk of complications, and improve overall health outcomes. (11)

Inadequate diabetes specific health literacy remains a significant barrier to effective disease control. Standardized instruments such as the Diabetes Health Literacy Scale (DHL) and the Short Test of Functional Health Literacy in Adults (S TOFHLA) are used to assess literacy levels in diabetic populations.(12,13) Individuals with limited understanding of diabetes are more likely to experience poor glycaemic control, increased healthcare utilization, and higher treatment costs, with consequent elevations in the risk of complications. Conversely, patients with higher health literacy demonstrate better self care behaviors and more favorable health outcomes. (13)

2. Materials & Methods

This cross-sectional study was conducted in the Medical Outpatient Department of H.I.T Hospital, Taxila, between April 2024 and August 2024, to assess diabetes-related health literacy among patients with type 2 diabetes. The sampling frame included all patients attending the OPD during the study period who met the eligibility criteria. Convenience sampling was employed to recruit participants, as it allowed for efficient enrollment of eligible patients within the limited study duration and ensured access to patients with documented HbA1c results.

The study included male and female patients of all ages who had a confirmed diagnosis of type 2 diabetes for 1–10 years and a documented HbA1c level within the previous six months, which was verified directly from laboratory records to ensure accuracy. Patients with type 1 diabetes, gestational diabetes, or severe illnesses such as cancer or

kidney failure were excluded to reduce confounding factors that could affect disease management or health literacy. A total sample size of 377 participants was calculated using the OpenEpi sample size calculator, with a 95% confidence level, a 5% margin of error, and an anticipated frequency of 50%, ensuring adequate statistical power for the study objectives. Data collection was conducted using a structured questionnaire, which included the Diabetes Health Literacy Scale (DHL) to assess patients' knowledge, comprehension, and ability to apply diabetes-related information in daily self-care. The questionnaire also collected socio demographic details, disease duration, and recent HbA1c values. Prior to data collection, participants were provided with information about the study objectives and procedures, and written informed consent was obtained. Ethical approval for the study was obtained from the institutional review board of HITEC-IMS, Taxila. Data was entered and analyzed using statistical software, with descriptive statistics used to summarize socio demographic variables, disease characteristics, HbA1c levels, and health literacy scores. Associations between health literacy and glycaemic control were assessed using appropriate statistical tests, with significance set at $p < 0.05$.

Data collection procedure:

Data was collected by researchers through printed forms consisting of two sections.

First section of demographic variables comprising of gender, educational status, duration and family history of diabetes and glycemic control of type 2 Diabetic patients and second section comprised 15 diabetes health literacy items scored on a 5 point Likert scale. The instrument demonstrated excellent internal consistency (Cronbach's $\alpha = 0.928$) in the present sample. While versions of the Diabetes Health Literacy Scale have shown acceptable reliability and validity in other populations, this tool has not been previously formally validated in the Pakistani diabetic population, and its use in this study represents an applied evaluation in a new context. Scores were converted to percentages (with 5 points representing 100 %) to classify diabetes health literacy as high moderate (60–74 %), or low (< 60 %). Glycaemic control was categorized as good (HbA1c < 7 %) or poor (HbA1c ≥ 7 %) (≥ 75 %), based on documented laboratory records.

3. Results

The study included 377 participants visiting Medical OPD of H.I.T Hospital Taxila with age range from 20 to 70 years with a mean age of 50.62 ± 10.1 years.

Variable	Frequency	
Gender	Male	44.3% (n=167)
	Female	55.7% (n=210)
Family History of Diabetes	Yes	80.4% (n=303)
	No	19.6% (n=74)
Duration Of Diabetes	1-5 years	37.7% (n=142)
	6-10 years	62.3% (n=235)
Education Status	Illiterate	25.2% (n=95)
	Literate	74.8% (n=282)

Table: 01 Socio-Demographic characteristics and clinical information of the Diabetic Patients Visiting OPD of HIT Hospital

Patients who had a family history of Diabetes were accounted for 80.4% of the participants and 19.6% had no family history of Diabetes. 37.7% of patients had duration of diabetes from 1-5 years and 62.3% of patients had duration of diabetes from 6-10 years. When considering the formal education status, it revealed that 74.8% were literate and 25.2% were illiterate.

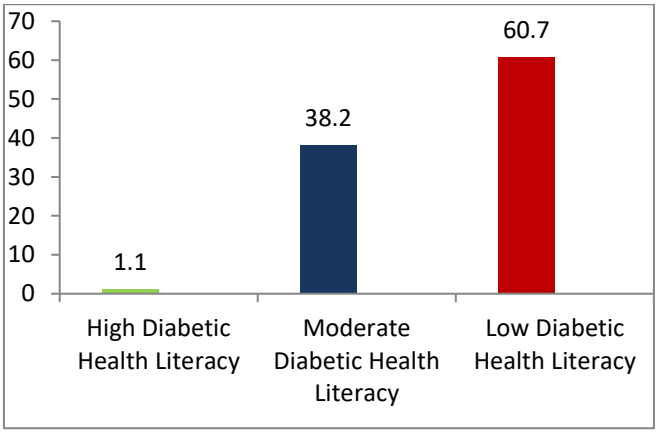

Figure 01: Frequency of Diabetes Health Literacy among type 2 Diabetic Patients

Glycemic Control: Respondents who achieved good glycemic control (HbA1c < 7) account for 51.5%, whereas 48.5% had poor control (HbA1c > 7).

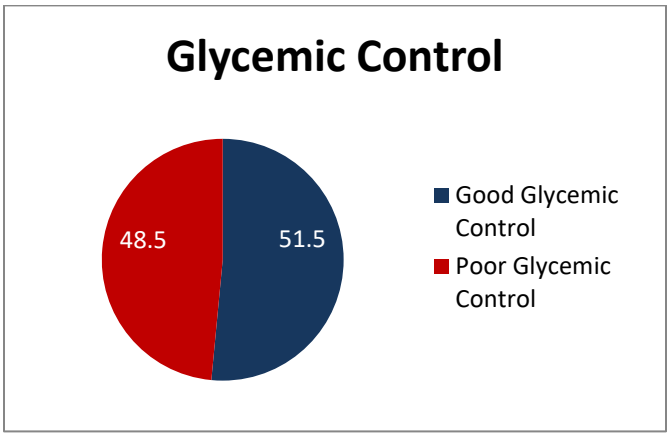

Figure 02: Frequency of Glycemic Control

Variable	Frequency		P-value
Diabetic Health Literacy	High Diabetic Health Literacy	1.1%(n=4)	0.000
	Moderate Diabetic Health Literacy	38.2%(n=144)	
	Low Diabetic Health Literacy	60.7%(n=229)	
Glycemic Control	Good	51.5% (n=194)	
	Poor	48.5% (n=183)	
Pearson Chi- Square		66.587[a]	.000
Likelihood ratio		70.249	.000

Table: 02 Association of Diabetic Health Literacy with Glycemic Control

Chi-square test revealed a highly significant association between Diabetic health literacy and glycemic control ($p < 0.001$).

4. Discussion

The findings of this study highlighted several critical aspects regarding diabetic health literacy and its impact on glycemic control among type 2 diabetic patients visiting H.I.T Hospital Taxila. There is a significant association observed between health literacy and glycemic control underscores the importance of patient education and empowerment in diabetes management.

Individuals with higher health literacy levels are more likely to understand their condition, engage in self-care practices, and adhere to treatment plans effectively. Respondents with inadequate understanding of diabetes management may hinder individuals from effectively controlling their blood glucose levels, leading to poorer health outcomes and increased healthcare utilization.. These findings extend beyond mere description of results by highlighting the role of health literacy as an active driver of diabetes self management, rather than a passive correlate. Our results corroborate a growing body of evidence that suggests health literacy directly influences diabetes outcomes. In a cross sectional study from Lahore, Pakistan, [16] inadequate health literacy was significantly associated with poor glycemic control, with a majority of patients exhibiting high HbA1c when literacy levels were low. This study, similar to ours, found that patients with poorer understanding of disease and management practices had worse glycemic profiles and higher odds of complications. In our study, 48.5% of participants with poor glycemic control (HbA1c > 7%) had inadequate health literacy ($p < 0.01$). This finding aligns with a study conducted in Lahore, Pakistan, where 86.1% of participants with poor glycemic control exhibited inadequate health literacy, and a significant association was observed between low literacy and diabetic complications, such as retinopathy (Munir et al., 2018). [14] Similarly, Al Sayah et al. (2013) reported that health literacy independently predicted glycemic control, with the low literacy group demonstrating a 1.2% higher mean HbA1c compared to participants with higher literacy levels. A similar approach was adopted by Osborn et al. (2010), who found that health literacy interventions specifically designed for underserved populations significantly improved diabetes outcomes over six months.

Our findings align with the study by Gazmararian et al. (2003), which showed that patients with limited health literacy were more likely to have complications and higher average HbA1c levels. However, unlike some studies that failed to find a significant association (e.g., Cavanaugh et al., 2008).

In Saudi Arabia, research showed that almost 69 out of 100 patients with diabetes were able to understand health information well. However, this did not seem to improve their control over their blood sugar levels. The reasons could be different health care systems, how education about diabetes is provided, or the way people there approach caring for themselves when they have diabetes. [15]

Furthermore, an Ethiopian study reported that 56.5% of participants had high diabetic health literacy and found that those individuals were 1.85 times more likely to have good glycemic control.([15]

Enhancing diabetic health literacy through targeted educational interventions is crucial in improving outcomes for diabetic patients. Healthcare providers should focus on clear communication, patient-centered education, and simplifying health information to empower patients with the knowledge and skills necessary for effective self-management. Our findings match up with earlier work. This work showed that knowing more about health helps people handle diabetes better. One example is a study by Schillinger and his team. They found that those who knew more about health could control their blood sugar better. Similarly, a study by Cavanaugh and his colleagues showed that when efforts were made to help people know more about health, it led to a big improvement in their understanding of diabetes. They even discovered a big improvement in HbA1c levels, a key indicator of how well diabetes is being managed.

Conclusion:

Diabetic health literacy is positively associated with better glycemic control in patients with type 2 diabetes. Enhancing patient education and targeted support may help improve self-management and reduce the risk of complications.

Limitations

This study utilized a cross-sectional design with convenience sampling, which limits causal inference. There is often overestimation of high health literacy

since some patients who have inadequate health literacy skills often deny or conceal their deficit. may affect the generalizability of the results.

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