

A Study to Correlate Diabetes Self-Management with Glycemic Control in Indian Diabetic Patients for The Assessment of the Glycemic Control**Himanshu Khutan¹, Ritu Bala², Amit Jain³, Urvashi⁴, Sana Grace⁵**¹Associate Professor, Department of General Medicine, Guru Gobind Singh Medical College, Faridkot, Punjab, India²Assistant Professor, Department of Pharmacology, Guru Gobind Singh Medical College, Faridkot, Punjab, India³Professor, Department of Pharmacology, Guru Gobind Singh Medical College, Faridkot, Punjab, India⁴Associate Professor, Department of Community Medicine, Guru Gobind Singh Medical College, Faridkot, Punjab, India⁵Senior Resident, Department of Pharmacology, Guru Gobind Singh Medical College, Faridkot, Punjab, India

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Conflict of interest: Nil

Abstract:

Background: Type 2 diabetes mellitus (T2DM) is a rapidly increasing public health concern, particularly in low- and middle-income countries such as India. Optimal glycemic control significantly reduces diabetes-related complications; however, achieving sustained control remains challenging. Effective self-management plays a crucial role in maintaining glycemic targets. The Diabetes Self-Management Questionnaire (DSMQ) has demonstrated improved validity compared to earlier instruments, but its applicability in the Indian population requires validation.

Objectives: Primary objective was to evaluate the association between diabetes-related self-care activities and glycated hemoglobin (HbA1c) levels. Secondary objective was to validate the Diabetes Self-Management Questionnaire (DSMQ) for assessing glycemic control in the Indian population.

Methods: A cross-sectional, non-interventional study was conducted among 260 patients with T2DM attending outpatient and inpatient services of the Department of Medicine. Eligible participants (age >15 years, diabetes duration ≥6 months) completed the DSMQ in their preferred language after informed consent. The questionnaire assesses four domains: glucose management (GM), dietary control (DC), physical activity (PA), and health-care use (HU). HbA1c levels, measured using fluorescence immunoassay technology, were used as an indicator of glycemic control. Statistical analysis included descriptive statistics and comparative tests, with $p \leq 0.05$ considered significant.

Results: The study population comprised 57.3% males, with the majority aged 51–70 years. Poor glycemic control (HbA1c ≥9%) was observed in 66% of participants. Significant differences were found in DSMQ sum scale scores across glycemic control categories ($p < 0.001$). Glucose management showed the strongest association with lower HbA1c levels, followed by dietary control and physical activity. All four DSMQ subscales significantly correlated with glycemic status.

Conclusion: The DSMQ demonstrated significant associations with HbA1c levels and effectively differentiated between glycemic control categories. It appears to be a valid and reliable instrument for assessing diabetes self-management behaviors among Indian patients with T2DM and may serve as a practical adjunct in routine clinical evaluation.

Keywords: Diabetes Mellitus Type 2, Self Care, Glycosylated Hemoglobin A, Surveys and Questionnaires, Cross-Sectional Studies.

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Introduction

Diabetes mellitus (DM) refers to a group of common metabolic disorders that share the phenotype of hyperglycemia. The worldwide prevalence of DM has risen dramatically over the past two decades [1]. Based on current trends, according to the

International Diabetes Federation this has been projected that 438 million individuals will have diabetes by the year 2030, with maximum increase of cases in India [2]. More than 80% of diabetic deaths occur in low and middle-income countries

[3]. In the United States, DM is the leading cause of end-stage renal disease (ESRD), non-traumatic lower extremity amputations, and adult blindness. It also predisposes to cardiovascular diseases [1]. WHO projects that diabetes will be the 7th leading cause of mortality in 2030 [4].

Diabetes-associated potential complications can be avoided if optimum glycaemic control is achieved. Although the importance of glycaemic control in diabetes patients is well established, as many studies have reported a significant reduction in the incidence of diabetes-related complications, but often it is not achieved [5,6].

Maintaining an optimal blood glucose level depends on several factors, patient self-management in diabetes care is essential. The monitoring and strengthening of diabetes self-management, therefore, has become an aspect of utmost importance. Several questionnaires have been developed in the past decade to measure self-management levels [7].

Goals of administering these questionnaires are twofold: first, they are designed to help doctors evaluate patient adherence as an adjunct to indicative clinical parameters such as HbA1c values, and second, to uncover misunderstandings about the recommended treatments [8].

Diabetes self-management includes several points: physically activity, diet, keep tracking blood glucose levels, prevention of complications and maintaining the desired HbA1c level [9]. Good glycaemic control has been associated with the decrease in complications related to Diabetes and hence, the better quality of life [9]. Many scales have been intended to measure patients' diabetic controls [10-15]. most widely used scale to measure diabetes self-management and routine adherence is SDSCA established by Toobert et al [15]. Current assessments have not acknowledged its coherent and significant relationships with HbA1c [13,16]. DSMQ was described to display improved internal uniformity and validity [17,18].

As there was no reliable diabetes self-management questionnaire [19] for use in Indian population, our goal is to validate and adapt one of the internationally available self-administered questionnaires and its assessment for glycaemic control

Aims and Objectives:

1. To evaluate the association of various diabetes-related self-care activities with glycated hemoglobin (HbA1c) levels
2. To validate the use of Diabetes Self-Management Questionnaire (DSMQ) in assessment of glycaemic control in Indian population.

Material and Method

This cross-sectional, non-interventional and time bound study that was carried out in OPD and hospitalised diabetic patients from Department of Medicine. 100 patients with T2DM were recruited in two months period.

Inclusion Criteria:

1. Diagnosed with Diabetes for at least half a year
2. Age more than 15years

Exclusion Criteria:

1. History of other chronic diseases such as malignancy, chronic liver disease, chronic renal failure or cardiac failure
2. History of psychiatric illness or being treated with psychotropic drugs.
3. Inability to complete the questionnaire (e.g. severe cognitive impairment or visual impairment)

A set format of questionnaire containing demographic, disease description / stage / extend, treatment (chemotherapy/radiotherapy/surgery or any combination etc) was filled from patients interview and from patients personal file, The Diabetes Self-Management Questionnaire (DSMQ) was provided to diabetic patients in their respective understandable language. Before being asked the subjects to participate; a prescribed voluntarily consent was obtained from all the participants.

Data Collection: Data collection was done in two parts, part one will contain demographic information like age, gender, education, occupation, duration of diabetes, treatment history, etc. Second part will be a structured questionnaire taken from Diabetes Self-Management Questionnaire (DSMQ).

DSMQ Scoring Criteria: The diabetes self-management questionnaire (DSMQ) [9] consists of 16 statements, with four answer options each (3 = "Applies to me very much"/0 = "Does not apply to me"). Besides the sum score, scores were calculated on four subscales, covering the most important aspects of self-management: glucose management (GM, items 1, 4, 6, 10, 12), dietary control (DC, items 2, 5, 9, 13), physical activity (PA, items 8, 11, 15) and health-care use (HU, items 3, 7, 14).[9] Item 16 is to be included in the "Sum Scale" only. The scoring of the DSMQ involves summing of all the answer scores after reversing the scores of nine negatively keyed statements. The scale scores were then transformed into a scale ranging from 0 to 10, where a score of 10 indicates the most effective self-care behaviour. However, in case of missing values for more than half of the items of a scale, a scale score was not computed.

Glycaemic Control: Glycated haemoglobin values were used as indicator of glycaemic control. All

blood samples will be analysed Central hospital laboratory using fluorescence immunoassay technology based on competitive immunodetection method done on i chroma instrument. The period between blood sampling and questionnaire assessment will be usually less than one week.

Statistical Analysis: Baseline distinctiveness (demographic, diabetic specific parameter and DSMQ scoring) were summarized by descriptive statistics. Frequency, mean, percentages, and standard deviation were calculated wherever appropriate. DSMQ scoring and its relation to

different clinical and demographic characteristics was compared with appropriate statistical test. All *P*-values ≤ 0.05 will be considered as significant.

Results and Observations

Our study sample consisted of slightly more men as compared to women (57.3%/42.7%) and half of the patients were in the age group of 51-70 years, almost 44.6% in the age group of 31-50 yrs and only 8 patients were having age less than 30yrs as depicted in Table 1.

Table 1: Distribution of study subjects according to age and gender (n=260)

Age	Male	Female	Percentage
≤30	5	3	3.1%
31-50	66	50	44.6%
51-70	78	58	52.3%
Total	149(57.3%)	111(42.7%)	260

60.8% of study participants had been diagnosed with T2DM for 2-5yrs and 30% for more than 5yrs. (table 2) Mean diabetes duration was 4.6 ± 3.2 years.

More than half the patients had positive family history of diabetes i.e 62.5% in their first-degree relatives. Most of the patients i.e 76% were on oral

hypoglycemic agents and rest were on both Insulin and OHAs.

58% of the study participants were from rural background and rest from urban. Only 43% of the patients were studied till secondary level, 22% till primary, 17% till university and 18% of the patients didn't have any formal education.

Table 2: Distribution of study subjects according to years of Diabetes Mellitus (n=260)

Years of DM	No.	Percentage
≤1	24	9.2%
2-5	158	60.8%
6-9	57	21.9%
≥10	21	8.1%

Significant difference was found between the DSMQ sum scale means and well controlled, moderately controlled and poorly controlled glycemic levels on the basis of glycated hemoglobin (HbA1C) as shown in table 3.

Further, analysis indicated that Glucose management (GM) was the strongest predictor for patients' low levels of glycated hemoglobin, followed by Dietary control (DC) and physical activity (PA).

Table 4. DSMQ Scores of Total study subjects (n=100) and its correlation with HbA1c levels

	Mean ± S.D. n=260	HbA1C ≤7.5 n=31	HbA1C 7.6-8.9 n=57	HbA1C ≥9 n=172	p-value
Glucose Management (GM)	5.6 ± 1.4	6.6 ± 1.5	6.4 ± 0.5	5 ± 1.3	<0.001
Dietary Control (DC)	6 ± 1.9	7 ± 2.3	6.4 ± 0.6	5.3 ± 1.7	<0.001
Physical Activity (PA)	5 ± 1.3	6.7 ± 3.2	6.5 ± 0.9	4.1 ± 1.9	<0.0002
Health care use (HC)	3.9 ± 1.9	5.1 ± 2.3	4.5 ± 0.9	3.2 ± 1.6	<0.003
Sum scale	5.5 ± 1.6	6.8 ± 2.2	6.1 ± 0.3	4.8 ± 1.2	<0.001

Discussion

Diabetes is becoming a serious health problem, especially in low- and middle-income countries such as India. The prevalence of T2DM in North India is relatively high (i.e., 10% to 20%) compared to other parts and has been increasing in recent years. Preliminary results from a large study conducted by the Indian Council of Medical Research (ICMR) in

2018 revealed that the prevalence of T2DM in North India was 15.3% in the urban and 11.5% in the rural population [20]. Prevalence of T2DM in Punjab ranges from 10% to 20% of the population according to the studies [21]. Efficient management is required to achieve the objective of glycemic control in order to minimize the progression of disease and associated complications. The approach of the

DSMQ scale helped in identifying the problems regarding self-care activities.

Majority of the participants in this study were in the age group of 31-70 years. More than 60% of the patients had poor glycaemic control i.e HbA1C levels more than 9 and only 12% had good glycaemic control i.e HbA1C level <7.5. our study had 57% males and majority of patients had poor glycaemic control. These findings were in match with the similar study conducted by Khan et al [22] and these observations were also similar to studies done by Karampadmaat et al and Shah et al where majority of the patients were in the age group of 40-70 years with mean age of 55 yrs. majority of the patients in these studies also had with poor glycaemic control belonged to this age group.

Based on the result of comparison between DSMQ subscale and glycated hemoglobin for validity, we can say that the questionnaire differentiated between all the four subscales i.e glucose management, physical activity, health care use and dietary control subgroups. In study, there was significant differences in DSMQ sum scores between the well- (HbA1c values $\leq 7.5\%$) and poorly controlled (HbA1c values $\geq 9\%$) groups, and between the medium- ($7.6\% < \text{HbA1c} < 8.9\%$) and poorly controlled groups, but no significant differences between the good and medium glycaemic control groups. similar results were obtained with other studies like Agnes et al.

Conclusion:

A wide range of measuring instruments are available for diabetes self-management. According to various studies, a relatively new instrument, the diabetes self-management questionnaire (DSMQ), shows a consistent relationship with outcomes of diabetes treatment as well as measure for glycaemic control such as, such as glycated haemoglobin (HbA1c). The questionnaire covers the main aspects of diabetes management and enables efficient assessment of self-care activities and their adherence among type 2 diabetes patients.

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