

Assessment of self-management care and glycated hemoglobin level among diabetes mellitus patients attend diabetic center in armed forces hospital in southern region, Kingdom Saudi Arabia

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ABSTRACT

Background: Diabetes mellitus (DM) requires patients to take on a high level of responsibility for their daily care. Thus, care for people with diabetes is moving toward patients taking an active role in their own health care. **Objective:** To evaluate the impact of self-management care on glycemic control in individuals with DM and determine the correlation between glycated hemoglobin (A1C) levels and self-management practices. **Material and Methods:** A cross-sectional descriptive study was conducted among diabetes patients at a diabetic center in Armed Forces Military hospitals, Southern region. A questionnaire of demographic and clinical information and self-management measured with the Diabetes Self-Management Questionnaire was used. Glycemic control was assessed using HbA1c levels. **Results:** The study involved 255 patients with diabetes, of which 61.2% were females and 81.6% aged ≥ 41 years. The average diabetic self-management score was 6.49 on a scale of 10. The mean glucose self-management subscale score was 7.83 points, while the mean dietary control (DC) subscale score was 4.89. The patients had a mean physical activity (PA) subscale score of 6.31 and 8.75 for healthcare usage. Patients with higher education were significantly less likely to have poor glycemic control. Diabetes duration was significantly and positively correlated with poorer glycemic control. Mean perceived PA and DC scores were significantly associated with glycemic control. **Conclusion:** Type 2 diabetes patients had satisfactory self-care practices. Many did not achieve the target glycemic control for diabetes.

Keywords: Diabetes mellitus, glycemic control, Saudi Arabia, self-management care

Introduction

As one of the major non-communicable diseases, diabetes mellitus (DM) has become a challenging health problem

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worldwide.^[1] According to estimates of the International Diabetes Federation, 537 million adults (20–79 years old) are living with diabetes, that is, 1 in 10. This number is predicted to rise to 643 million by 2030 and 783 million by 2045. Diabetes is responsible for 6.7 million deaths in 2021, 1 every 5 s.^[2] In the Middle East and North Africa, 1 in 6 adults (73 million) are diabetic; it is expected to reach 95 million by 2030 and 136 million by 2045. One in three adults living with diabetes is undiagnosed.^[3]

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As of February 2022, the population of Saudi Arabia is slightly more than 34.8 million. According to the IDF, adult diabetes prevalence in the Kingdom is currently 17.7%.^[1]

As a chronic disease, DM requires a high level of individual responsibility because most of the daily care is handled by the patient himself/herself. Therefore, patients with chronic diseases need to take care of their everyday health routine activities. To accomplish this change, strengthening self-management has become a major task in the healthcare sector, particularly at the primary level.^[4]

In this context, this study aimed to assess self-management care for DM, find out the glycosylated hemoglobin (A1C) level, compare control DM with and without self-management care, and find a correlation between A1C and self-management.

Materials and Methods

A cross-sectional descriptive study was conducted among a sample of patients with DM who attended the diabetic center in the Armed Forces Military hospitals, Southern region, located in Khamis Mushayt, in 2023. Patients with psychiatric illnesses or learning disabilities were excluded from the study.

The minimum sample size for this study has been decided according to Swinscow and Cohen (2003),^[5] as follows:

$$n = \frac{Z^2 \times P \times Q}{D^2}$$

Here:

n: Calculated sample size

Z: The z-value for the selected level of confidence = 1.96

P: Estimated prevalence of DM^[6] = 17.7% = 0.177

Q: (1 - P) = 0.823

D: The maximum acceptable error [precision level] = 0.05

The estimated sample size was 224 patients. This sample was increased to 250 patients to compensate for dropouts.

The consecutive sampling technique was adopted to select patients.

A self-administered questionnaire composed of two main parts was utilized: The first part of the questionnaire includes demographic questions about employment and marital status, age, educational level, and gender, as well as clinical characteristics such as glycosylated hemoglobin (HbA1c) and body mass index (BMI). The second part asks about self-management, as given in the Diabetes Self-Management Questionnaire (DSMQ) (Schmitt *et al.* 2013).^[7] The DSMQ is a self-reported, appropriate, validated, and

widely used questionnaire. It has 16 items and uses a four-point Likert-type scale, ranging from 0 (does not apply to me) to 3 (applies to me very much). It comprises four subscales: glucose management (GM), consisting of items 1, 4, 6, 10, and 12 of the questionnaires, which evaluate medication adherence and blood glucose monitoring. The second subscale is dietary control, related to management behaviors, and scored by items 2, 5, 9, and 13. Physical activity is the third subscale measuring exercise and activity related to the management of diabetes and is scored by items 8, 11, and 15. The last and fourth subscale evaluates the healthcare use related to clinical or physician appointments and is scored by items 3, 7, and 14. A sum scale score was derived as a global measure of self-care, and higher scores represent better self-care management.^[8]

HbA1c levels served as a gauge of glycemic control. The data were obtained from electronic medical records. The criteria for good or bad control were based on the study by Ogbonna *et al.*, and an HbA1c level of <7% was considered good control, and that of ≥7% was deemed poor control.^[8] A validated Arabic version of DSMQ was used in this study.^[9]

Data were collected by the researchers with the help of nurses from the diabetic center and medical students after their training and explaining the questionnaire to them. Within each clinic, the nurses read and filled out the study questionnaire for all patients to make sure that there was no missing data, and they replied to any of their inquiries.

The proposal for the study was approved by the local Research and Ethics Committee at the Armed Forces Hospital, Southern Region.

Statistical analysis

The mean and standard deviation were used to describe continuous variables, whereas the frequencies and percentages were used to describe categorical variables. The bivariate Pearson's correlations test was used to assess the correlations between continuous variables. The multivariable linear regression was used to assess the statistically significant predictors for diabetic patients' mean perceived diabetes self-management score. Multivariate logistic regression analysis was used to identify determinants of poor glycemic control. The Statistical Package for the Social Sciences (SPSS by IBM), version 28, was used for the data analysis, and the statistical significance level was considered at 0.50.

Results

Two hundred and fifty-five patients with diabetes were included in the study. Their sociodemographic characteristics are shown in Table 1. Most of them (61.2%) were females and 81.6% were aged ≥41 years. About 31.6% were overweight, 28.2% were obese class I, and 11.8% were obese class III. The majority of patients (79.6%) were married. Regarding the educational level of the patients, 32.9% of them were illiterate with no formal

Table 1: Sociodemographic characteristics of the patients (n=255)

Variables	Frequency	Percentage
Sex		
Female	156	61.2
Male	99	38.8
Age group		
20—30 years	21	8.2
31—40 years	26	10.2
≥41 years	208	81.6
Body mass index (BMI), mean (SD)		
BMI level		31.32 (6.44)
Underweight	10	3.9
Normal	22	8.6
Overweight	80	31.4
Obese class I	72	28.2
Obese class II	41	16.1
Obese class III	30	11.8
Marital state		
Never married	22	8.6
Married	203	79.6
Divorced/widowed	30	11.8
Educational Level		
Illiterate	84	32.9
Primary education	60	23.5
Secondary education	80	31.4
University degree or higher	31	12.2
Employment state		
Unemployed	149	58.4
Employed	36	14.1
Retired	70	27.5
Households monthly income (SAR), mean (SD)		6127.6 (3706.3)
Households monthly income level		
<3000 SAR/M	45	17.6
3000—6000 SAR/M	107	42
7000—10000 SAR/M	59	23.1
>10000 SAR/M	44	17.3
Comorbidity		
No	90	35.3
Yes	165	64.7
Type of comorbidity		
Hypertension	115	46.6
Diabetes	78	31.6
Hypothyroidism	21	8.5
Chronic kidney disease	5	2
Heart failure	10	4
Cerebrovascular accident CVA/stroke	2	0.8
Other	16	6.5
Diabetes mellitus type		
T1DM	28	11
T2DM	227	89
Diabetic disease duration years		
One year or less	6	2.4
1—5 years	29	11.4
6—10 years	57	22.4
>10 years	163	63.9

Contd...

Table 1: Contd...

Variables	Frequency	Percentage
Last month serum glycated hemoglobin (HbA1c) score, mean (SD)		8.16 (1.50)
Serum Hab1c level		
≤8	135	52.9
>8%	120	47.1

schools, whereas 12.2% had a university degree or higher education. More than half (58.4%) of patients were unemployed. About 42% had households monthly income of 3000-6000 Saudi Riyals/month, while 17.3% had households monthly income of >10,000 Saudi Riyals. Most of them (64.7%) had at least one comorbidity, mainly hypertension (46.6%). The majority of them (89%) were type 2. The duration of diabetes exceeded 10 years in 63.9% of patients. The most recent serum glycated hemoglobin (HbA1c) was >8% in 47.1% of patients (poor glycemic control).

Patients' perceptions of their diabetic management

Table 2 displays the results of the patients' perceptions of diabetic self-management (DSMQ).

Indicators of GM: The patients' main perceived indicator of diabetic GM was taking prescribed medication as ordered by their physicians (2.76 ± 0.8), then checking their blood sugar levels with care and attention (2.36 ± 0.92) and keeping a record of their checked blood glucose levels regularly (1.67 ± 1.01).

Indicators of diet control: The patients' main perceived indicators of good diabetic diet control were choosing foods that can easily achieve optimal blood glucose levels (1.47 ± 0.93), then having sometimes of food binges and cravings (1.36 ± 0.96), and eating lots of sweets or other carbohydrate-rich foods (1.16 ± 0.81).

Healthcare use indicators: The patients' main perceived indicator of using healthcare services for their diabetic self-management was attending and keeping all medical appointments recommended for their diabetic disease management (2.85 ± 0.48).

Indicators of physical activity level: The patients' main self-rated physical activity indicator was doing regular physical activity to achieve optimal blood glucose levels (91.55 ± 1.02).

The patients' overall mean perceived diabetic self-management score was 6.49 ± 1.19 out of a maximum score of 10. The highest score was observed regarding healthcare usage (HU) (8.75 ± 1.57), while the lowest one was observed regarding dietary control (4.89 ± 1.81) [Table 3].

Correlations between the diabetic patients' self-management perceptions and other diabetic and health outcomes and factors

The bivariate correlations between the diabetic patients' perceptions of diabetic self-management and the other relevant

Table 2: Patients’ perceptions of their diabetic management (DSMQ) indicators

	Mean	SD	Rank
My diabetes self-care is poor	1.01	0.80	
Glucose management			
Check blood sugar levels with care and attention	2.36	0.92	2
I take my medication (insulin, tablets) as prescribed	2.76	0.80	1
I record my blood sugar levels regularly	1.67	1.01	3
I do not check my blood sugar levels frequently enough as would be required for achieving good blood glucose control (R)	0.55	0.81	4
I tend to forget to take or skip my diabetes medication (R)	0.39	0.70	5
Dietary control			
Choose food to easily achieve optimal blood sugar	1.47	0.93	1
Occasionally I eat lots of sweets or other foods rich in carbohydrates (R)	1.16	0.81	3
I strictly follow the dietary recommendations given by my doctor or diabetes specialist	0.93	0.96	4
Sometimes I have real food binges (not triggered by hypoglycemia)®	1.36	0.96	2
Healthcare use			
I keep all doctor appointments recommended for my diabetes treatment	2.85	0.48	1
I tend to avoid diabetes-related doctor appointments	0.23	0.63	3
Regarding my diabetes care, I should see my medical practitioner more often.®	0.73	0.86	2
Physical activity			
I do regular physical activity to achieve optimal blood sugar levels	1.55	1.02	1
I avoid physical activity, although it would improve my diabetes	0.93	1.02	3
I tend to skip planned physical activity (R)	0.94	0.98	2

Items denoted by (R) required reverse scoring before computing the total subscale scores and the overall scale score of the DSMQ

Table 3: Patients’ overall perceptions of their diabetic self-management (DSMQ) scale and its subscale scores

	Mean	SD
Overall DSMQ scale score	6.49	1.19
GM score	7.83	1.83
DC score	4.89	1.81
PA score	6.31	2.86
Healthcare use score	8.75	1.57

The maximum possible scores for each concept is 0–10 points

covariates and factors are shown in Table 4. The patients overall perceived diabetic self-management (DSMQ) score had correlated significantly and positively to its subscale scores, GM, dietary control, physical activity, and healthcare service usage perceptions ($P < 0.01$). Also, the patients' DSMQ correlated significantly but negatively with the patients' BMI score, $r = -0.258$, $P < 0.01$. The patients' socioeconomic state index score correlated positively with their DSMQ score ($P < 0.05$). The patients' perceived GM score correlated negatively with their dissatisfaction with their self-care ($P < 0.001$) [Table 4].

Multivariable linear regression analysis showed that the employed/retired patients had significantly higher mean perceived overall DSMQ scores compared to unemployed patients ($P = 0.015$). Patients BMI was significantly and negatively correlated with DSMQ score ($P = 0.001$). Patients' mean recent serum HbA1c was correlated significantly but negatively with their DSMQ ($P = 0.038$) [Table 5].

Multivariable binary logistic regression analysis that the patients with university or higher educational degrees were less likely to have poor glycemic control compared to those with secondary

or lower educational levels ($P = 0.005$). Patients with a longer duration of diabetes (≥ 6 years) were more likely to express poorer glycemic control compared to those who had a diabetic disease duration of five or fewer years ($P = 0.005$). Patients' mean perceived physical activity (PA) score was significantly associated positively with poorer glycemic control ($P = 0.045$). However, patients' mean perceived dietary control (DC) score was significantly associated negatively with poor glycemic control ($P = 0.005$) [Table 6].

Discussion

This study demonstrated the predominance of female patients, which might be because women usually seek medical care more frequently than males. The same has been observed in Brazil.^[10-12]

The findings of this study revealed that the diabetes patients had above average scores of diabetes self-management as its mean \pm standard deviation was 6.49 ± 1.19 , on a scale ranging between 0 and 10. This indicates a satisfactory level of self-care practice for patients with type 2 diabetes in our region. The same has been reported in a recent Saudi study carried out in Riyadh.^[13]

In the present study, poor glycemic control was observed in 47.1% of patients (using a cut-off 8% for HbA1c), which is better than that reported in Riyadh as 76.9% of patients had poor glycemic control. However, a cut-off 7% was utilized in the study conducted in Riyadh,^[13] which could explain the higher rate of glycemic control. Also, another Saudi study reported that more than half of patients with diabetes with type 2 had poor glycemic control using a cut-off 7% for HbA1c.^[6]

Table 4: Correlations between the diabetic patients’ self-management perceptions and other diabetic and health outcomes and factors

	DSMQ	GM	DC	PA	HU	Hba1c	BMI	SES
Overall diabetic self-management (DSMQ) scale score	1.000							
GM score	0.720**							
DC score	0.577**	0.123*						
PA score	0.732**	0.254**	0.341**					
Healthcare use score	0.430**	0.318**	-0.063	0.122				
Recent serum glycated hemoglobin (HbA1c) level	-0.094	-0.079	-0.147*	-0.016	0.028			
BMI score	-.258**	-0.078	-.131*	-.285**	-.173**	-0.089		
Socioeconomic state (SES) index	0.135*	0.122	-0.060	0.129*	0.168**	-0.091	-.323**	
My diabetes self-care is poor	-.433**	-.244**	-.198**	-.393**	-.257**	0.106	0.192**	-0.098

**Correlation is significant at the 0.01 level (two-tailed). *Correlation is significant at the 0.05 level (two-tailed)

Table 5: Multivariable linear regression analysis of the diabetic patients’ perceived self-management (DSMQ) score

	Unstandardized Beta Coefficients	95.0% CI for Beta		P
		Lower Bound	Upper Bound	
(Constant)	9.194	7.811	10.577	<0.001
Gender	-0.168	-0.532	0.196	0.365
Age Group	-0.104	-0.429	0.221	0.529
Marital status=ever married	0.072	-0.239	0.383	0.647
Educational level	-0.124	-0.279	0.031	0.116
Employment state=employed/retired	0.477	0.095	0.858	0.015
Comorbid	-0.190	-0.478	0.098	0.195
BMI score	-0.035	-0.056	-0.014	0.001
Recent serum glycated hemoglobin (HbA1c) score	-0.086	-0.168	-0.005	0.038
Type of DM=T2DM	0.075	-0.535	0.685	0.809
Duration of diabetes disease (years)	-0.003	-0.166	0.161	0.972
Satisfaction with own diabetes self-care-Q16*	0.634	0.475	0.793	<.001

Dependent outcome variable=Patients perceived overall diabetic (DSMQ) Self-management score. Model overall significance: $f(11, 233)=11.10, P<0.001$. Model $R^2=0.344$, Adj. $R^2=0.313$. Not=question#16 was reverse scored so a higher score will imply more satisfaction with diabetic self-care

Table 6: Predictors of poor glycemic control (HBA1c >8): Results of multivariable binary logistic regression analysis

	Multivariable adjusted odds ratio (OR)	95% CI For OR		P
		Lower	Upper	
Sex=Male	0.925	0.489	1.748	0.809
Age group	0.644	0.303	1.365	0.251
BMI score	0.985	0.938	1.034	0.535
Educational level=university or higher	0.613	0.437	0.861	0.005
Duration of diabetic disease	1.766	1.191	2.618	0.005
Type of DM=T2DM	0.547	0.139	2.142	0.386
Comorbidity	0.552	0.284	1.076	0.081
Mean perceived HU score	0.858	0.708	1.040	0.119
Mean perceived PA score	1.116	1.002	1.242	0.045
Mean perceived DC score	0.784	0.662	0.929	0.005
Mean perceived GM score	0.945	0.806	1.106	0.480
Constant	97.350			0.006

Dependent outcome variable=recent serum hab1c >8% (No/Yes). Model overall statistical significance, $\chi^2(11)=35.80, P<0.001$

The possible explanation for this finding in the present study is the behavior of patients regarding self-care management; thus, even if patients have adequate knowledge regarding self-care management, they have low self-efficacy in disease management, reflected as poor glycemic control. In this context, other studies found that high self-efficacy was significantly associated with the level of glycosylated hemoglobin and other self-care behaviors such as compliance with proper diet, foot care, and practicing physical activity.^[14,15]

In the current study, glucose self-management was a significant predictor for Hba1c levels. The same has been observed in another recent Saudi study.^[13] Therefore, physicians should evaluate patients’ understanding of the diabetes self-care management guidelines and how they perform them as HbA1c levels were significantly associated with self-care management practices.

In accordance with the American Diabetes Association (2004),^[16] the present study revealed that diabetic patients’ physical activity

was associated with better glycemic control and this could be explained by the fact that physical activity can increase insulin sensitivity and consequently decrease high glucose levels into the standard range. Also, it has been documented that daily physical activity is responsible for delaying the onset of diabetic complications.^[17,18]

In this study, no gender variation was observed as regards diabetes self-care management. However, some others in Saudi Arabia^[13] and Iran^[19] observed that female patients expressed more self-care management practices compared to male patients. On the other hand, some authors in Jordan^[20] and Taiwan^[21] observed that men had higher self-care management compared to females. This difference between various studies in this regard could be explained by variations in patients' knowledge, practices, adherence, level of self-efficacy, and educational programs.

It has been recommended by the American Diabetes Association that each patient with diabetes of any type should have self-care management at the time of his/her diagnosis,^[6] to avoid the development of complications in the future.^[22]

The study is not without limitations. It was conducted in one healthcare facility, which could impact the generalizability of its results over other healthcare settings. Also, including only patients attending the diabetic center could be a limitation as patients with severe diabetes who could not attend the diabetic center were not included. Despite those important limitations, the study could assist future researchers in the self-care management practices of diabetes patients in Saudi Arabia.

Conclusion

The type 2 diabetes patients had a satisfactory level of self-care practice. However, a high percentage of them did not attain the target glycemic control of diabetes. Therefore, there is a need to improve the involvement of patients and healthcare professionals both at the primary level and specialized sector with regard to self-care management practice. Additionally, further studies are warranted to explore factors that could be associated with self-care.

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Conflicts of interest

There are no conflicts of interest.

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