Self-management behaviours and glycemic control in diabetic patients. A cross sectional study

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Abstract

Objective: The aim of this study was to explore the status of diabetes self-management (DSM) among patient with diabetes in Qatar and its relationship with glycemic control and other demographic variables.

Methods: A cross sectional study using A structured questionnaire-based study (DSMQ,) and the hospital electronic medical records system to collect sociodemographic and clinical information. among diabetic patients registered in 3 primary health care clinics in Qatar. With a convenience sample of 400 patients with diabetes.

Results : Mean age of participants was 54.36±11.58 years and mean duration of diabetes was 10.53±7.47years. Nearly one third of the patients used insulin and the majority used oral hypoglycemic. The results of this study revealed that good adherence to diabetes self-management was reported among 52.8% of adult diabetic patients while the inadequate cases where around 47.3 % which demonstrated lack of diabetes self-management and subsequently at increased risk of complications. There was no gender difference regarding self-care of diabetes. Additionally, adequate DSM was significantly associated with later onset of DM and with college education. HA1C was significantly negative correlated with Glucose management, Physical activity, positive correlated with Diet control, and total score. For DSM subscales, glucose management was the best followed by diet control, health care utility. however, physical activity scored the lowest mean.

Conclusion: Results indicated that around 47 % of diabetic patients in Qatar do not perform Diabetes self-management (DSM) consistently.

Practice implications: The findings of this study set the stage to empower patient centered care, develop an easy clear teaching strategies for diabetic patients with a lower educational status and activate the role of wellness centers performing regular physical activity sessions for them & the multidisciplinary team that will improve DSM and subsequently improve diabetes management in diabetic patients in Qatar.
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Keywords:
Diabetes mellitus, Self-management behaviors, Diabetes self-management questionnaire (DSMQ).

Introduction / background

Diabetes mellitus is a prevalent and growing chronic disease with multisystem complications and a high burden. The WHO anticipates that diabetes will be the seventh leading cause of death by 2030. In Qatar, the prevalence of diabetes among Qatari adults was estimated at 16.7% in 2012, higher in women, and peaked in the age group 40-49 years of 31.2% [1]. Diabetes is not only the leading cause of short and long-term health complications, but also one of the top deadly diseases worldwide [2,3]. While there has been no cure for diabetes, people with diabetes can maintain individualized glycemic control to protect against the development of complications, and to live a healthy life via treatment modalities including lifestyle modification and/or anti-diabetes medications and self-management strategies which are strongly recommended [4,5,8,12]. Notably, the American Diabetes Association (ADA) emphasizes the importance of person-centered care, defined as being respectful of and responsive to the individuals' preferences, needs, and values; and ensures that the person with diabetes guides all clinical decisions [6,17, 18,20]. Diabetes self-management (DSM) has been defined as how people with diabetes practice self-care. It involves the knowledge, attitude, and behaviors to both maintain personal health and prevent long-term diabetes complications [6,8,9, 21,22]. The target is to empower the patient to be the key player in his diabetic care, and maintenance of individualized goals for glycemic control through comprehensive lifestyle behaviors including 'Glucose Management', 'Dietary Control', 'Physical Activity', and 'Health-Care Use' [9,10, 22,23, 25].

The effect of self-management training on glycemic control is supported by Multiple systematic review and many RCTs [10,11,19,24,26]. Therefore it is important to consider self-management behaviors as a key determinant of diabetic patient outcome. Because DSM and patient-centered care are cornerstones of successful diabetes care, around 40 validated instruments have been developed to investigate its features, prevalence, and related factors which impact DSM.[23]. The majority of these surveys allow evaluation of multiple dimensions of core diabetes treatment such as diet, physical activity, medication, self-monitoring of blood glucose, foot care, interactions with a physician, and management of hypoglycemia [21,23,27,28,29,30, 33,34].

The Diabetes Self-Management Questionnaire (DSMQ) is a 16 item questionnaire to assess self-care activities associated with glycemic control through four subscales, 'Glucose Management' (GM), 'Dietary Control' (DC), 'Physical Activity' (PA), and 'Health-Care Use' (HU), as well as a 'Sum Scale' (SS) as a global measure of self-care. This scale has been shown to have good internal consistency (Cronbach's alpha) of (0.84), and consistencies of the subscales were acceptable (GM: 0.77; DC: 0.77; PA: 0.76; HU: 0.60), and to correlate significantly with HbA1c levels (Schmitt et al., 2013). It was developed, based on theoretical considerations and a process of empirical improvements [23].

Participants answered other questions about their demographics and treatment. Recent blood glucose levels (HbA1c) were obtained from patients' medical files.

No research regarding the suggested behavioral mechanisms of self-care assessment has been yielded here in Qatar yet, therefore, in our research we tried to explore if self- management, correlates with glycemic control. This knowledge gap is important because such elements are likely to influence diabetic patients' insights to actively engage in their glycemic control. Therefore, newer information is currently needed to help us understand such influences within the local context.

Methods, Study design and sampling

A cross-sectional study was conducted among diabetic patients registered in 3 primary health care clinics in Qatar, (West Bay, Alrayan, LBB Health Care Centers) which provide health services in the northern, western and central regions of Qatar, from March 2020 to March 2021, Patients with DM were invited to enroll in this study if they met the following inclusion criteria:

1. Patients from 18 to 65 years of age diagnosed with diabetes according to ADA criteria, with and without complications who have been receiving treatment for at least 6 months before the enrollment.
2. Those who can communicate either in English or Arabic.
3. Stable patients with no emergency issues.

A structured questionnaire-based study (DSMQ,) and the hospital electronic medical records system were used to collect sociodemographic and clinical information.

Outcome: evaluate self-care activities as high score of DSMQ indicating a high level of autonomy

The sample size for this study was calculated to be 360 participants. With an anticipated 10% for a refusal rate, the final sample size for the study was 400 participants.

Residents were trained in administration of the DSMQ and covered the total of 400 patients over a duration of 8 weeks.

Ethical approval
The Institutional Review Board of the primary health care corporation (PHC/DCR/2020/10/118) approved the study protocol prior to initiation of study activities. Each participant was informed of the purposes of this study in detail via an information sheet and provided an informed consent form if they agreed to join the study. Participants were free to withdraw at any time, without giving any reason for doing so and without affecting their present or future medical treatment. All participant information was kept confidential and used only for study purposes.

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Data analysis

Data collected throughout history, laboratory investigations and outcome measures were coded, entered, and analyzed using Microsoft Excel software. Data were then imported into Statistical Package for the Social Sciences (SPSS version 20.0) (Statistical Package for the Social Sciences) software for analysis. According to the type of data qualitative represents as number and percentage, quantitative continuous group was represented by mean ± SD. The following tests were used to test differences for significance, difference, and association of qualitative variable by Chi square test (X2). Differences between quantitative independent groups by t test or Mann Whitney, P value was set at <0.05 for significant results & <0.001 for high significant result.

Data were collected and submitted to statistical analysis. The following statistical tests and parameters were used.
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4833481/

1- Mean

$$\overline{x} = \sum x \, / \, \mathbf{n}$$

$\sum x$ is the sum of the values

n is the number of subjects.

2- Standard deviation (SD):

$$SD = \sqrt{\frac{\sum \left(x - \overline{x}\right)^2}{n - 1}}$$

$$\sum \left(x - \overline{x}\right)^2$$

is the sum of the square of the differences of each observation from the mean.

3. The chi square $\left(x^2\right)$ test:

This test was used to compare two groups regarding the distribution of different variables.

$$x^2 = \sum \frac{(O - E)^2}{E}$$

Where:

O: The observed value.
E: The expected value.

4. The t statistic to test whether the means are different can be calculated as follows:

$$t = \frac{\bar{X}_1 - \bar{X}_2}{S_{X_1 X_2} \cdot \sqrt{\frac{2}{n}}}$$

Results

Table 1: Demographic data distribution among studied group (n=400)

		N	%
Age	<30	8	2.0
	30-40	42	10.5
	41-50	104	26.0
	>50	246	61.5
	Mean ±SD	54.36±11.58	
Sex	Female	187	46.8
	Male	213	53.3
Education	Illiterate	27	6.8
	Primary	64	16.0
	Secondary	97	24.3
	College	166	41.5
	Tertiary	46	11.5
Marital Status	Divorced	32	8.0
	Married	334	83.5
	Single	34	8.5
Family support	No	93	18.5
	Yes	307	76.8
Lives with	Alone	60	15.1
	Colleges	1	.3
	Family	299	74.8
	Flat mate	24	6.0
	Friends	2	.6
	Sponsor	14	3.5
Occupation	Employed	250	62.6
	Unemployed	148	37.0
Nationality	Non-Qatari	226	56.5
	Qatari	174	43.5
Salary Enough	No	234	58.4
	Yes	166	41.6
	Total	400	100.0

Age was distributed as 54.36±11.58, males were 53.3% and females 46.7%. The majority were educated in college, (41.5%), and the majority were married 83.5%. 76.8% had family support and the majority lived with their family. 74.8% and 62.6% were employed and 43.5% were Qatari and 56.5% were not Qatari, 58.4% said they had not enough salary.

Table 2: Medical history and clinical data distribution among studied group (n=400)

		Mean± SD	Median (Range)
Age of onset of DM		41.51±9.84	41.0 (10-63)
Duration of DM		10.53±7.47	10.0 (1-43)
Last HBA1C		8.37±1.82	7.7 (5.1-14.3)
		N	%
PMH	Negative	104	26.0
	Positive	296	74.0
Number of medications	None	12	3.0
	1-2	190	47.6
	3-4	180	45.1
	>4	18	4.6
On insulin	No	272	68.0
	Yes	128	32.0
FH of DM II	No	102	24.3
	Yes	303	75.8
	Total	400	100.0

Age of onset of DM, Duration of DM and Last HBA1C were distributed as 41.51±9.84, 10.53±7.47 and 8.37±1.82 respectively, PMH was in 74.0%, 47.6% had 1-2 medications and 47.6% had 3-4 medications, 32.0% were on insulin and 75.8% had a family history of DM.
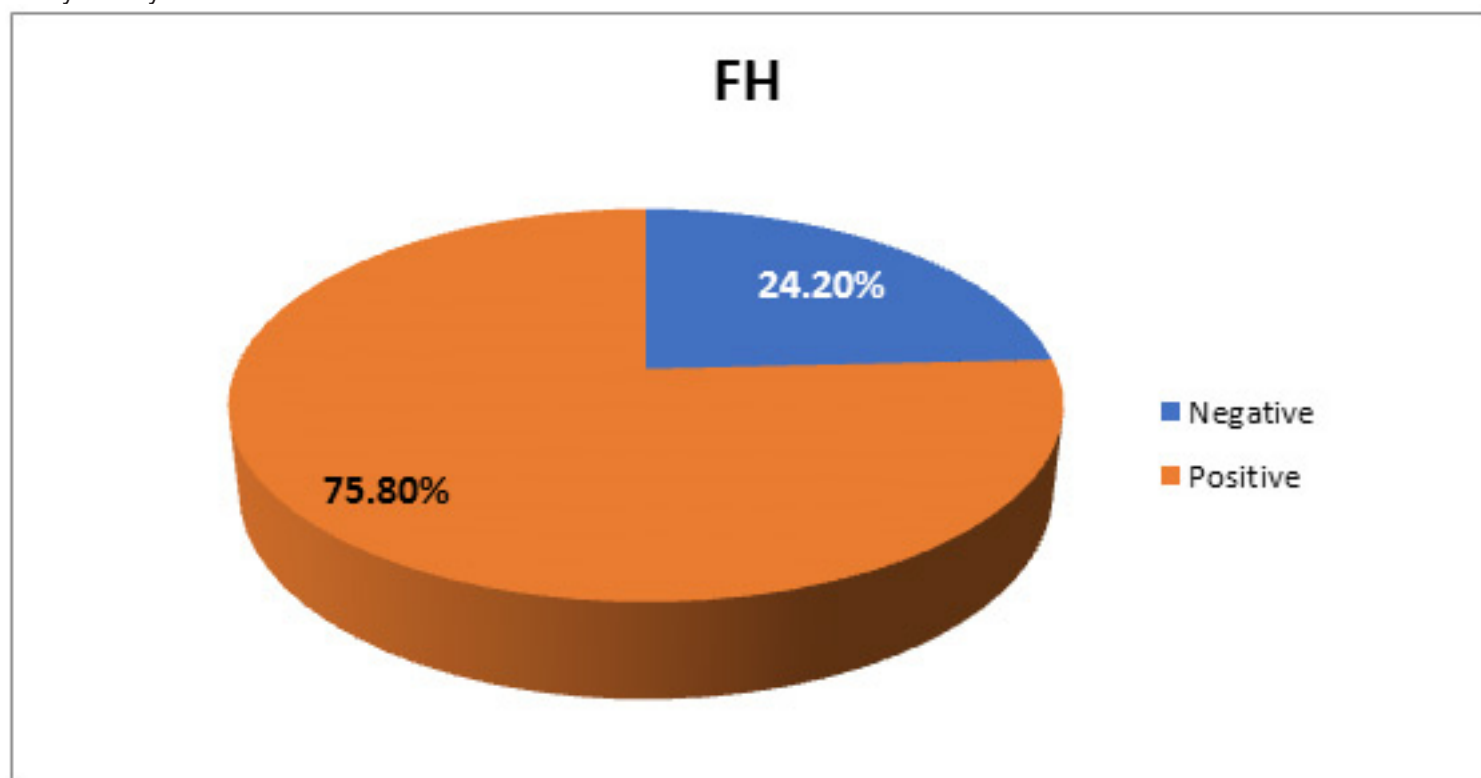
Table 3: Questionnaire parameters distribution among studied group (n=400)

		N	%
My diabetes self-care is poor	Does not apply to me	136	34.0
	Applies to me in some degree	82	20.5
	Applies to me to a considerable degree	83	20.8
	Applies to me very much	99	24.8
The food I choose to eat makes it easy to achieve optimal blood sugar levels	Does not apply to me	54	13.5
	Applies to me to some degree	150	37.5
	Applies to me to a considerable degree	136	34.0
	Applied me to me very much	60	15.0
I keep all doctors' appointments recommended for my diabetes treatment.	Does not apply to me	15	3.8
	Applies to me to some degree	42	10.5
	Applies to me to a considerable degree	56	14.0
	Applies to me very much	287	71.8
I take my diabetes medication (e. g. insulin, tablets) as prescribed	Does not apply to me	14	3.5
	Applied to me to some degree	14	3.5
	Applies to me to a considerable degree	64	16.0
	Applies to me very much	308	77.0
Occasionally I eat lots of sweets or other foods rich in carbohydrates	Does not apply to me	89	22.3
	Applies to me to some degree	190	47.5
	Applies to me to a considerable degree	94	23.5
	Applies to me very much	27	6.8
I record my blood sugar levels regularly (or analyse the value chart with my blood glucose meter).	Does not apply to me	207	51.8
	Applies to me to some degree	64	16.0
	Applies to me to a considerable degree	53	13.3
	Applies to me very much	76	19.0
I tend to avoid diabetes-related doctors' appointments	Does not apply to me	333	83.3
	Applies to me to some degree	33	8.3
	Applies to me to a considerable degree	21	5.3
	Applies to me very much	13	3.3
I do regular physical activity to achieve optimal blood sugar levels	Does not apply to me	141	35.3
	Applies to me to some degree	89	22.3
	Applies to me to a considerable degree	65	16.3
	Applies to me very much	105	26.3
I strictly follow the dietary recommendations given by my doctor or diabetes specialist.	Does not apply to me	78	19.5
	Applies to me to some degree	154	38.5
	Applies to me to a considerable degree	123	30.8
	Applies to me very much	45	11.3

Table 3: Questionnaire parameters distribution among studied group (n=400) (continued)

I do not check my blood sugar levels frequently enough as would be required for achieving good blood glucose control	Does not apply to me	139	34.8
	Applies to me to some degree	76	19.0
	Applies to me to a considerable degree	71	17.8
	Applies to me very much	114	28.5
I avoid physical activity, although it would improve my diabetes.	Does not apply to me	158	39.5
	Applies to me to some degree	51	12.8
	Applies to me to a considerable degree	64	16.0
	Applies to me very much	127	31.8
I tend to forget to take or skip my diabetes medication (e. g. insulin, tablets).	Does not apply to me	314	78.5
	Applies to me to some degree	51	12.8
	Applies to me to a considerable degree	25	6.3
	Applies to me very much	10	2.5
Sometimes I have real 'food binges' (not triggered by hypoglycaemia)	Does not apply to me	253	63.3
	Applies to me to some degree	92	23.0
	Applies to me to a considerable degree	44	11.0
	Applies to me very much	11	2.8
Regarding my diabetes care, I should see my medical practitioner(s) more often.	Does not apply to me	198	49.5
	Applies to me to some degree	82	20.5
	Applies to me to a considerable degree	57	14.3
	Applies to me very much	63	15.8
I tend to skip planned physical activity.	Does not apply to me	141	35.3
	Applies to me to some degree	66	16.5
	Applies to me to a considerable degree	62	15.5
	Applies to me very much	131	32.8
My diabetes self-care is poor	Does not apply to me	127	31.8
	Applies to me to some degree	128	32.0
	Applied to me to a considerable degree	105	26.3
	Applies to me very much	40	10.0
	Total	400	100.0

**Table 4: total questionnaire score distribution among studied group (n=400)**

G management	Mean± SD	9.29±3.56	
	Median (Range)	9.0 (1-15)	
Diet control	Mean± SD	7.16±2.32	
	Median (Range)	7.0 (0-12)	
Physical activity	Mean± SD	4.47±3.52	
	Median (Range)	4.0 (0-9)	
Health care utility	Mean± SD	6.21±1.45	
	Median (Range)	6.0 (0-9)	
Poor control (Q16)	Mean± SD	1.14±0.98	
	Median (Range)	1.0 (0-3)	
Total score	Mean± SD	29.01±7.38	
	Median (Range)	29.0 (11-47)	
		N	%
Total score	Inadequate <60%	189	47.3
	Adequate >60%	211	52.8
	Total	400	100.0

Total score was 29.01±7.38 and adequate was 52.8%
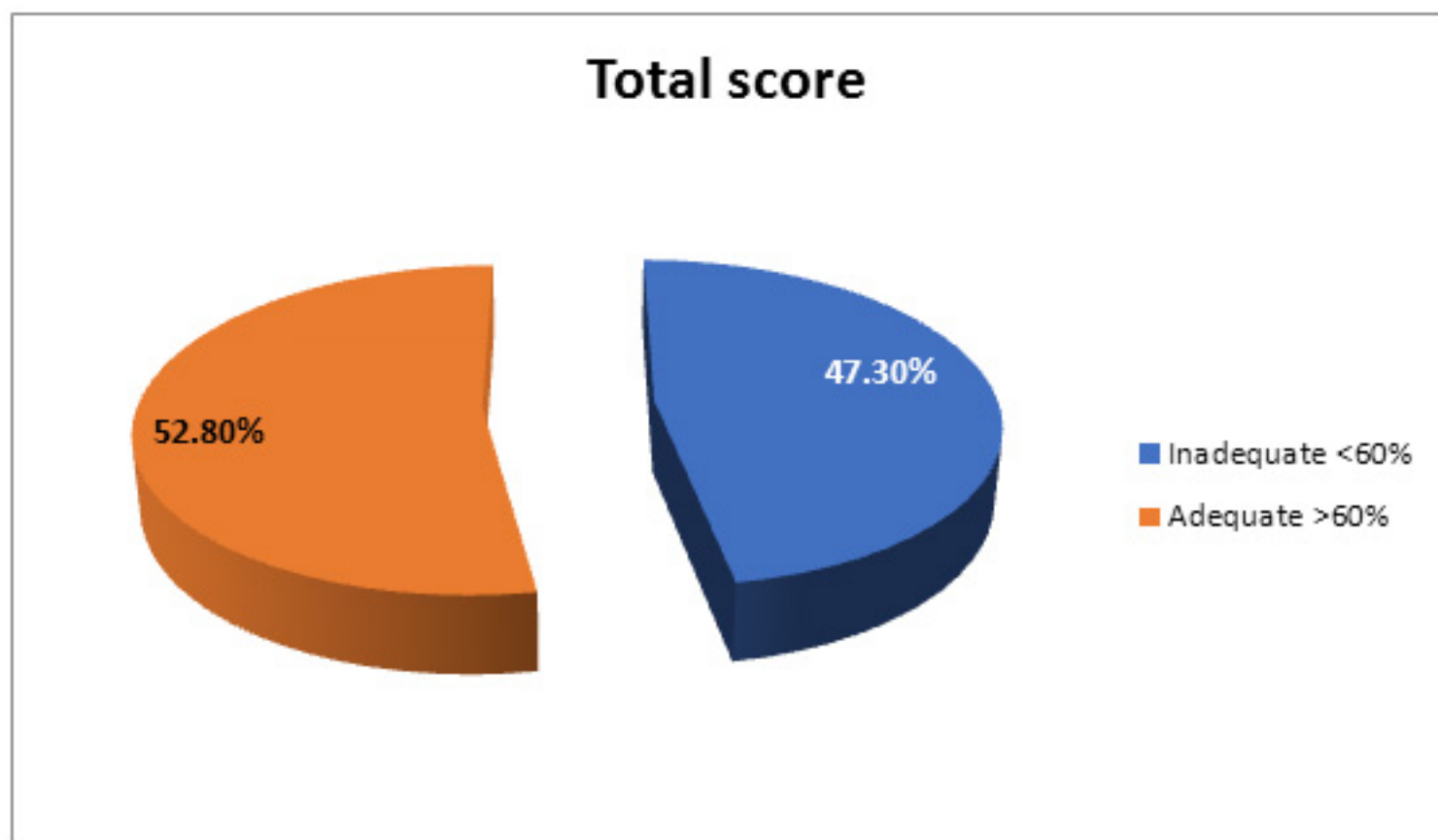
		Last HBA1C
G management	r	-0.116*
	P	0.021
Diet control	r	0.279**
	P	0.000
Physical activity	r	-0.113*
	P	0.025
Health care utility	r	-0.015
	P	0.763
Control	r	0.386**
	P	0.000
Total score	r	0.226**
	P	0.000

HA1C was significantly negative correlated with G management, Physical activity, positive correlated with Diet control, Control and total score
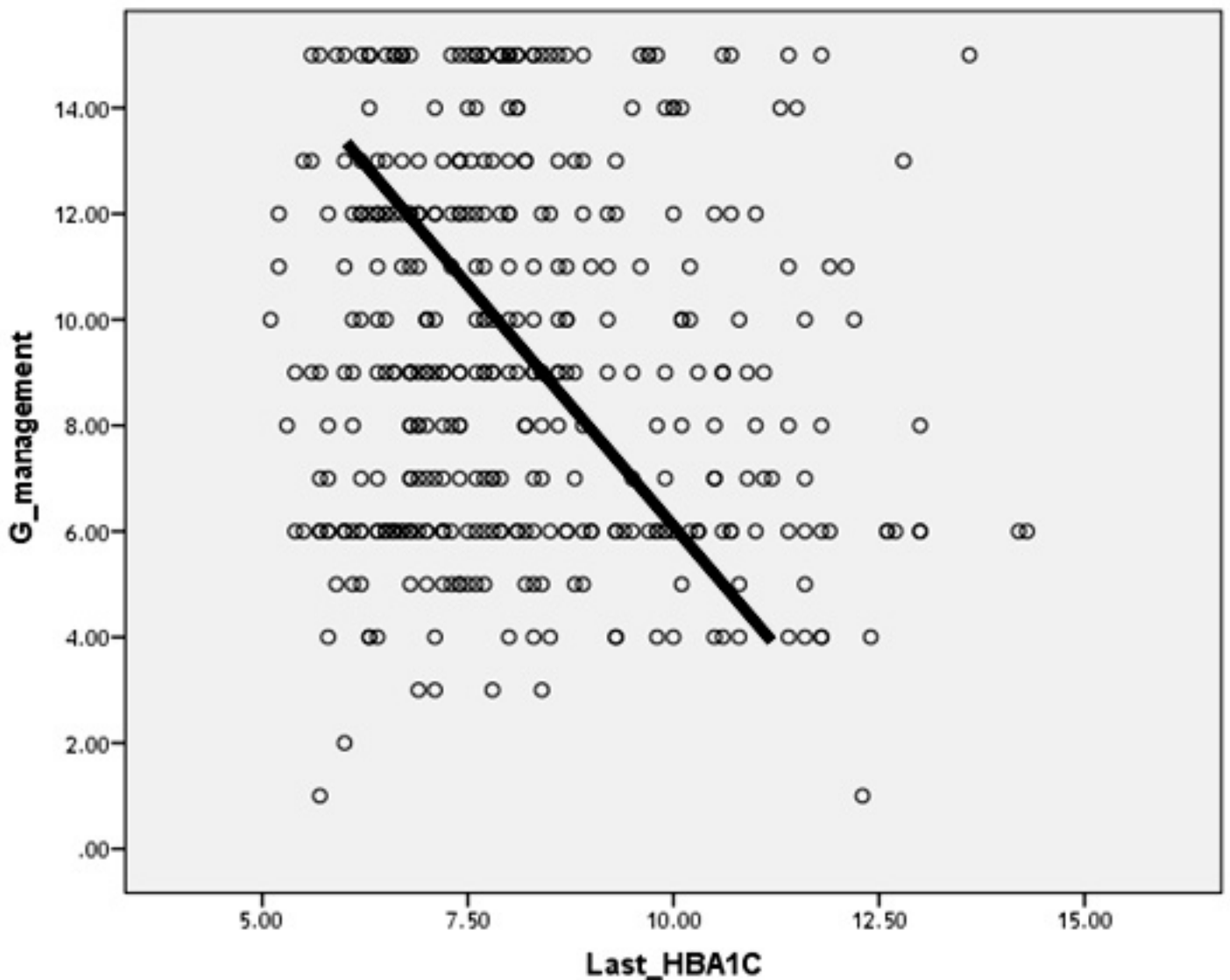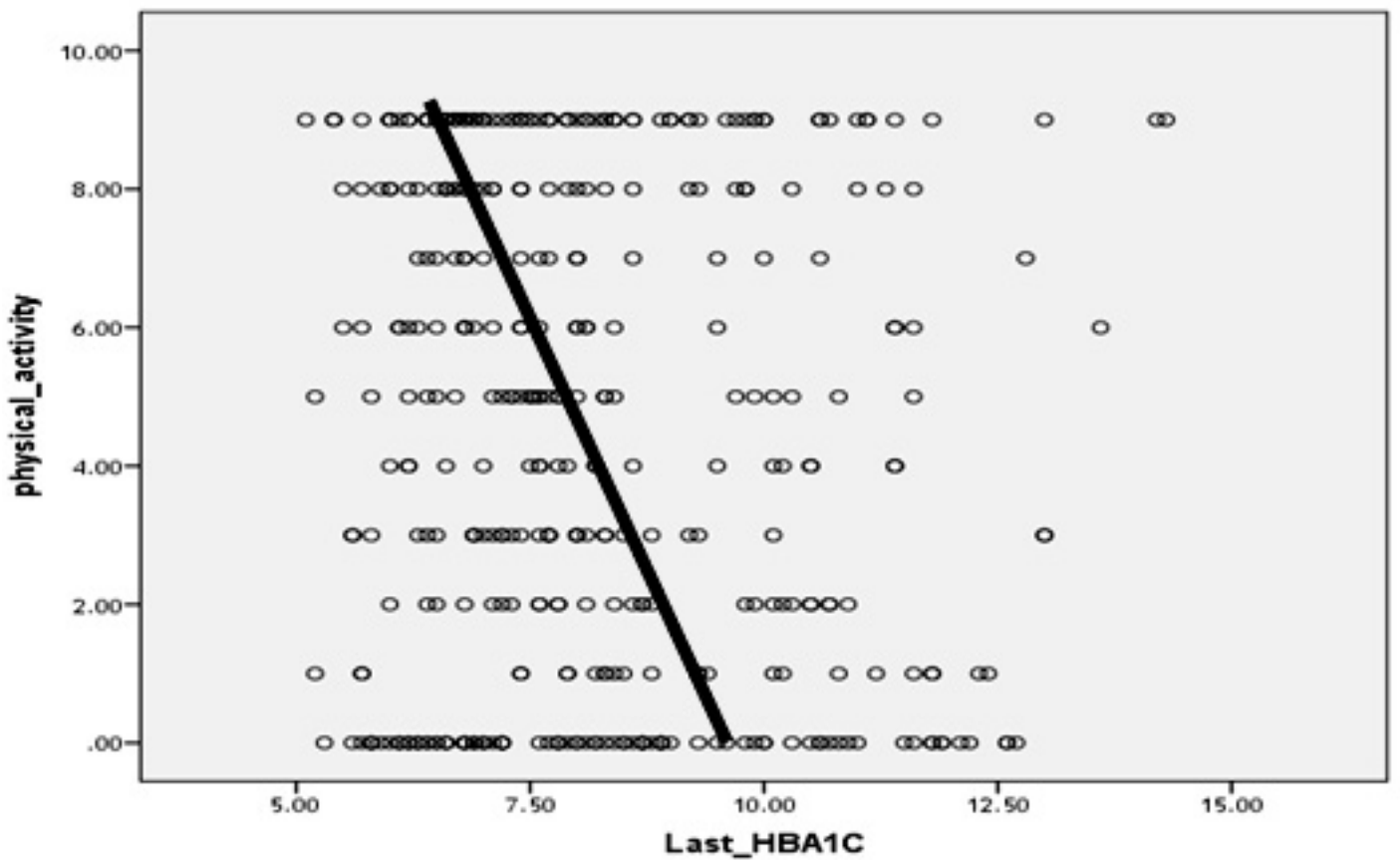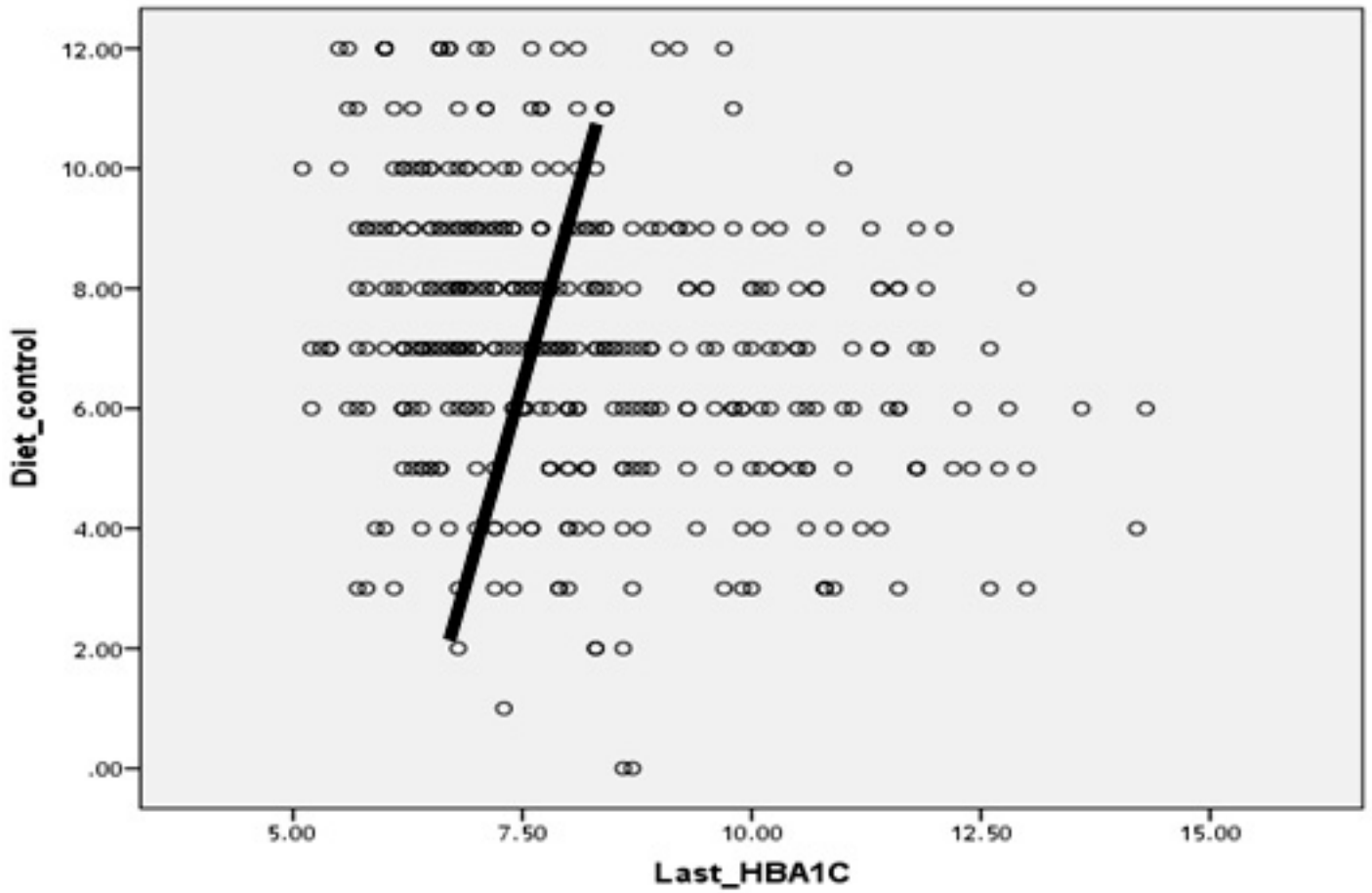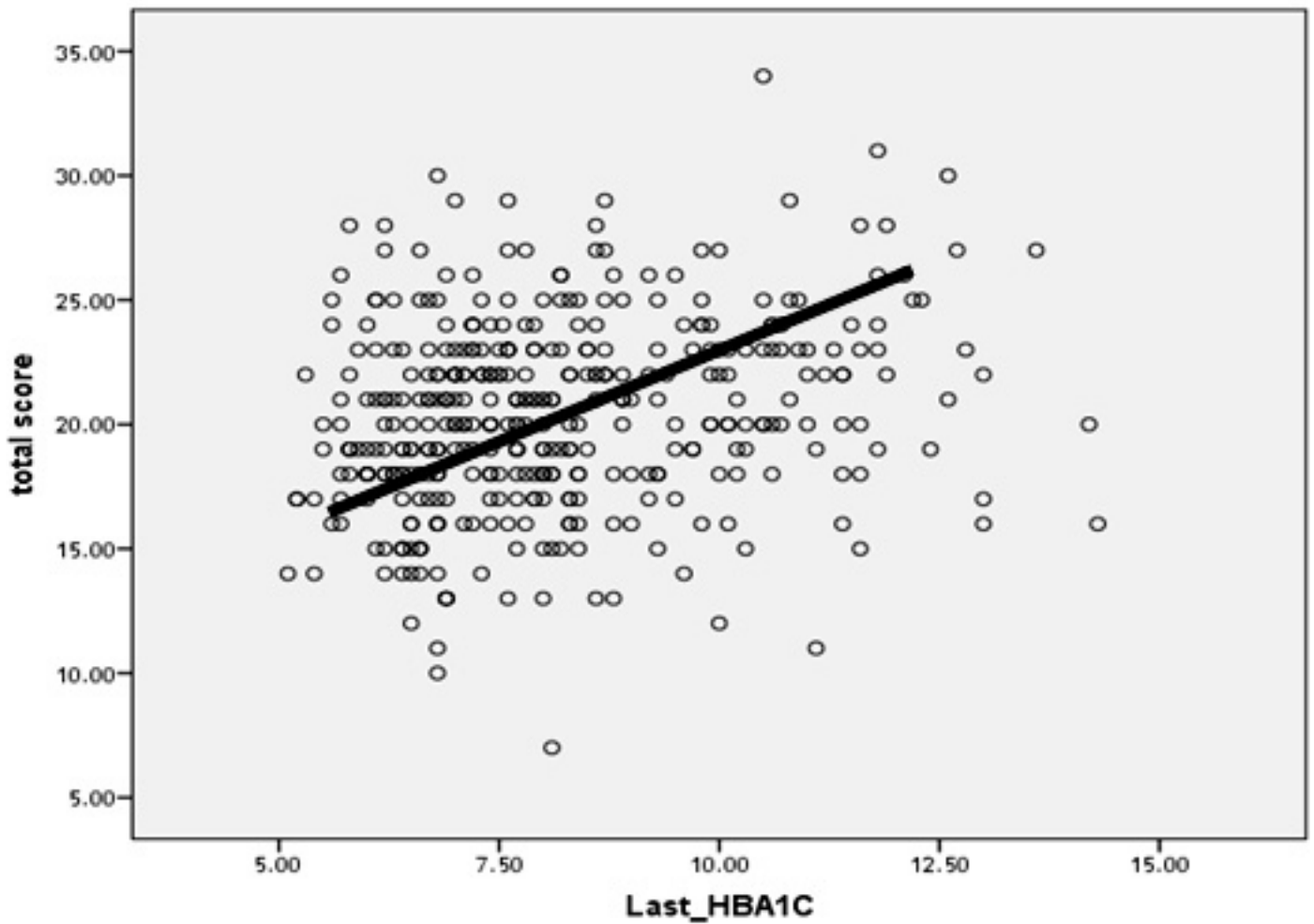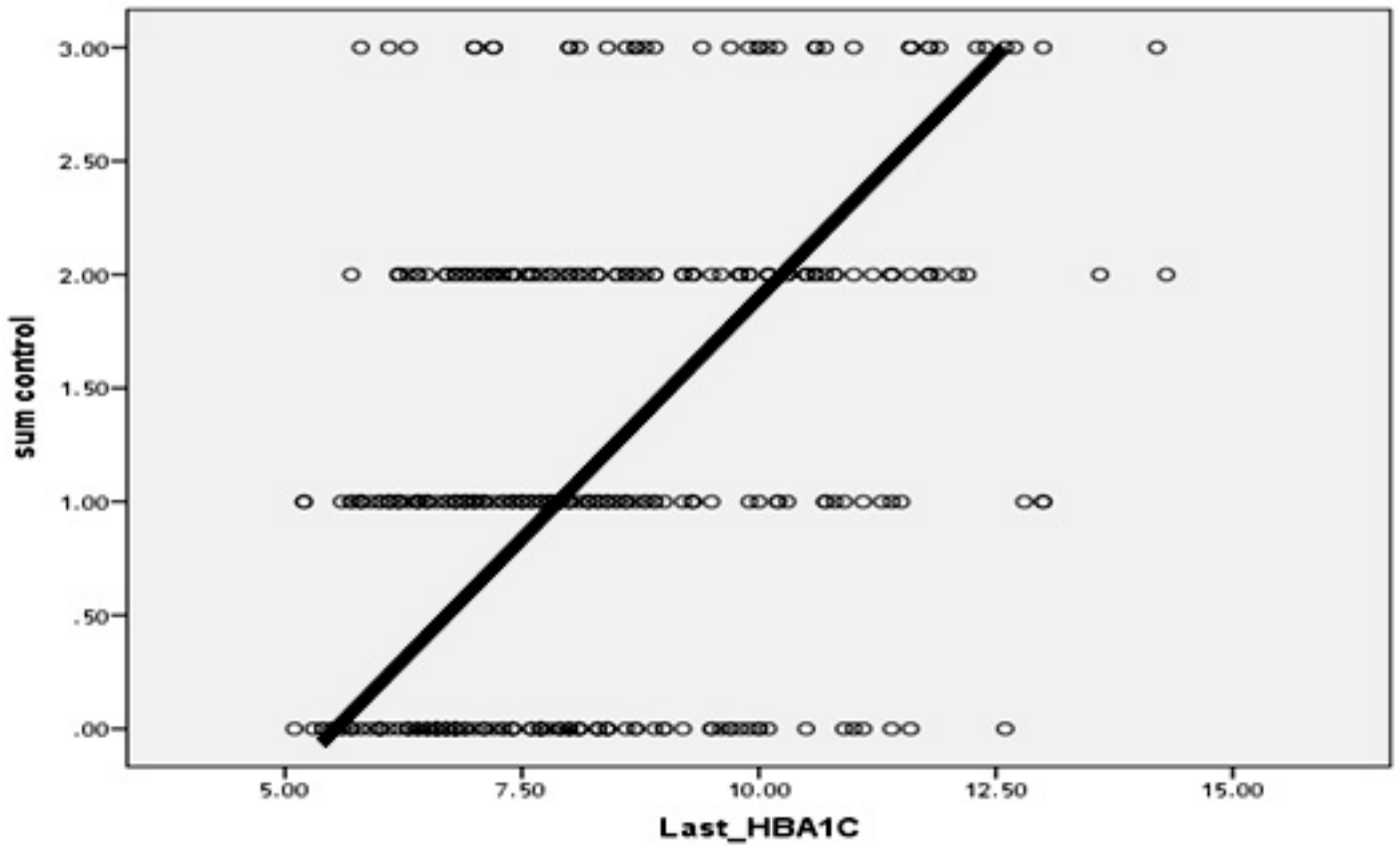
Table 5: relation of adequate score with other parameters

			Inadequate	Adequate	t/Mann Whitney / X²	P
Age of onset of DM			40.37±9.78	43.51±9.81	2.289	0.023*
Duration of DM			10.68±4.42	10.39±5.53	1.240	0.216
Last HBA1C			8.67±2.0	7.68±1.56	4.488	0.00++
Age	<30	N	4	4		
		%	2.1%	1.9%		
	30-40	N	23	19		
		%	12.2%	9.0%		
	41-50	N	56	48	4.49	0.21
		%	29.6%	22.7%		
	>50	N	106	140		
		%	56.1%	66.4%		
Gender	Female	N	84	103		
		%	44.4%	48.8%		
	Male	N	105	108	0.76	0.38
		%	55.6%	51.2%		
Education level	Illiterate	N	20	9		
		%	10.6%	4.2%		
	Primary	N	39	25		
		%	20.6%	11.8%		
	Secondary	N	47	48	22.93	0.00++
		%	24.9%	22.7%		
	College	N	60	106		
		%	31.7%	50.2%		
	Tertiary	N	23	23		
		%	12.2%	10.9%		
Marital Status	Divorced	N	17	15		
		%	9.0%	7.1%		
	Married	N	156	178		
		%	82.5%	84.4%	0.48	0.78
	Single	N	16	18		
		%	8.5%	8.5%		
PMH	Negative	N	56	48		
		%	29.6%	22.7%		
	Positive	N	133	163	3.31	0.19
		%	70.4%	77.3%		
Occupation	Employed	N	123	127		
		%	65.1%	50.2%		
	Unemployed	N	66	84		0.56
		%	34.9%	39.8%		
Nationality	Non-Qatari	N	110	116		
		%	58.2%	55.0%		
	Qatari	N	79	95	0.42	0.51
		%	41.8%	45.0%		

Table 5: relation of adequate score with other parameters (continued)

On Insulin	No	N	123	149		
		%	65.1%	70.6%		
	Yes	N	66	62	4.73	0.094
		%	34.9%	29.4%		
FH of DM II	No	N	42	55		
		%	22.2%	26.1%		
	Yes	N	147	156	1.95	0.37
		%	77.8%	73.9%		
Total		N	189	211		
		%	100.0%	100.0%		

Adequate cases significantly associated with later onset of DM and with lower HA1C also significantly associated with college education.

Error Bars: +/- 2 SD
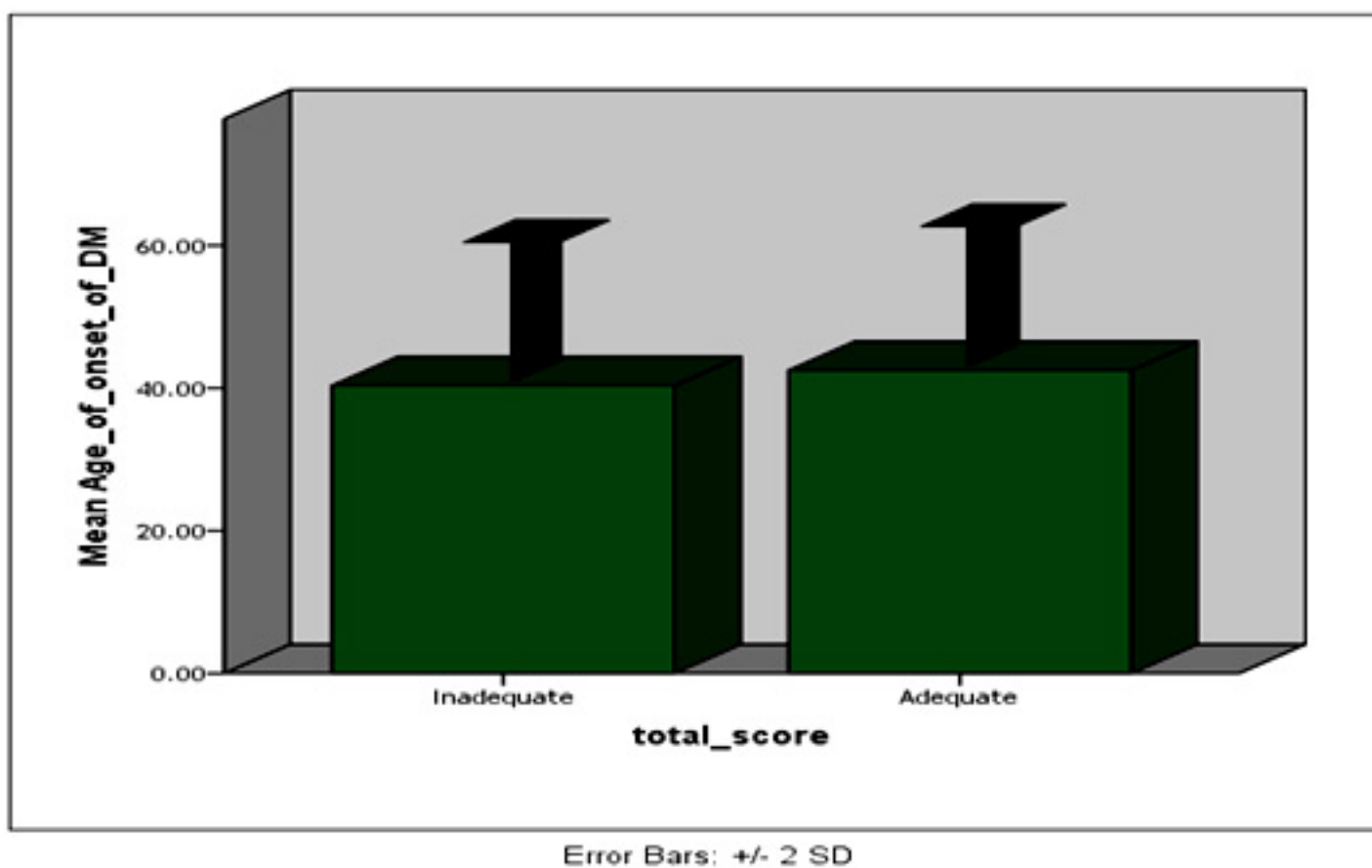
Discussion

In Qatar, there is limited information about the self-care practices of patients with diabetes mellitus. Thus, this study has tried to assess the self-care practices (glucose management, dietary control, physical activity, and health care use) and associated factors among patients with diabetes (PWD) in three health centers serving the central, northern, western regions of Qatar. To adequately evaluate diabetes self-management behaviors and glycemic control, a well validated tool (DSMQ) was used [23]

This tool with 16 self-care items has four subscales as follows: 1) Glucose Management (GM), consisting of five statements: 1, 4, 6, 10, 12, which are related to medication adherence and blood glucose monitoring; 2) Dietary Control (DC), consisting of four statements: 2, 5, 9, 13, which are related to diabetes-associated dietary management behaviors; 3) Physical Activity (PA) consisting of three statements: 8, 11, 15, which are related to exercise or activity for management of diabetes and 4) Health Care Use (HU) consisting of three statements: 3, 7, 14, which are related to adherence to diabetes-related physicians' appointments. The last item (item 16) requires the respondents to rate their overall diabetes self-care, hence its score is included only in the "sum scale" (23).

The scoring process of the DSMQ involves adding up the scores of all 16 items after reversing the scores of nine negatively keyed statements. Higher scores will represent more effective self-care. Finally, the DSMQ scores will be transformed to a scale ranging from 0 to 10, where a score of 10 will indicate the most effective self-care behavior.

A High score of DSMQ reflects the autonomy of the patient of actively participating in his/her diabetes self-management (DSM) and we have correlated the result by current glucose readings from patient records (HbA1c). DSMQ is a preferable tool when analyzing behavioral problems related to reduced glycemic control. We found that most studies in the Middle East, Gulf area focused on sociodemographic factors in DM. In our study we focused on the diabetes profile of the patient and self-management behaviors. In the studies we identified many similarities when it came to patient gender distribution, nationality, marital status, occupation, education, living situation, co-morbidities, and family history. To elaborate on that we found that most of our diabetic patients were married, employed, had at least one comorbidity, and lived with family. Moreover, what our study mainly emphasized and complemented with other studies is the level of education of the patients. In this study 61.5% diabetic patients were found to be more than 50 years of age and around a quarter 26% were between 41 to 50 years old, Compared to Similar study done in Egypt showed that 66% of diabetic patients were less than 60 years of age and 44% were more than 60 years of age (32). The present study showed that 3% (PWD) use no diabetic medications, the majority use oral medications (47.6% had 1-2 medication and 47.6% had 3-4 medication) and 32.0% were on insulin respectively compared to study carried out in United States revealed that three-quarters of the patients received hypoglycemic agents (oral or insulin) (31,32).

Diabetes self-Management is crucial for diabetic care and reflects the tasks performed by the patient to manage his disease. To manage DM effectively, patients must have the ability to define their goal, make decisions related to their medications, fitting their lifestyle and values (20,21,29,33,34) education was strongly correlated with DSM in this study where we found that college educated patients comprised the majority in the studies; there was a statistically significant difference between college education and DSM, additionally it revealed that longer duration of the disease results in poor out comes. Similarly, as A study done in Egypt nearly one quarter (26%) of illiterates were not adhered to dietary management of diabetes and also revealed that shorter disease duration had a positive impact on DSM (32).

The results inferred from our study showed that, 77% compliant with their diabetes medication (e.g., insulin, tablets) as prescribed, this result was higher from study result of Malaysia (54 %) and Nigeria (54 %) (28,30,33). Additionally, 71.8% said they keep all doctors' appointments recommended for their diabetes treatment This study revealed HbA1c mean is inadequate 8.37 for corresponding patients' age, having said that the majority were on oral medications, and only 32% were on insulin could raise the suspension of therapeutic inertia along with other psychosocial barriers, considering that most of the patients in the study had reported that they keep all doctor's appointments, This suggests shedding the light in our context specifically on physician inertia, continuity of care , or patients refusal of insulin therapy which delays insulin application for a long period of time, "Psychologic Insulin resistance (PIR)" (33,34). All this need to be explored with other studies. Results reflected the degree of poor insight of diabetic patients regarding their diabetes self-care. When they asked if they considered their diabetes self-care as poor, only 24.8% said it applied to them very much although actual score of DSM inadequacy was 47%. Additionally, only 26.3% did regular physical activity to achieve optimal blood sugar levels, only 15% choose to eat the food that makes it easy to achieve optimal blood sugar levels and only 11.3% strictly follow the dietary recommendations given by my doctor or diabetes specialist. The study found a low rate of referral for dietitian concluding that applicability of nutritional counseling remains a challenge in medical practice, same as exercise counseling [3]. Only 19% record their blood sugar levels regularly. Additionally, the results of this study revealed a strong negative correlation between self-care activities score and HbA1c levels. This finding is in line with our hypothesis, as patients with higher DSMQ scores were expected to perform better self-care behavior and thus had better glycemic control, that poor glycemic control is associated with poor self-care practices of the patient (12,13,14).

In the present study, linear regression analysis revealed that GM, which includes medication intake and regular self-monitoring of blood glucose level, was the most significant predictor for low HbA1c levels, followed by Diet and HU , whereas Physical activity was observed to be the least predictor for low HbA1c levels. Our study concluded that Total score was 29.01±7.38; Glucose management mean score was 9.29 and diet control (mean score 7.16) got the highest scores followed by the utility of health care (mean score 6.2)1and the lowest score was for physical activity (mean score 4.47) . Our patients total adequate control was 52.8% and around 47.2% showed inadequate control.

Diet plays an important role in controlling the blood glucose levels and disease progression. Diet was observed as a significant predictor for glycemic control in patient with diabetes Many interventional studies had shown the beneficial outcome of dietary educational programs on patients' glycemic control (4,6,7,12). Health care professionals should instead provide patient-tailored recommendations, considering their affordability, personal and cultural preferences (15,16,17).

Inadequate practice of exercise was evident from the low median scores of patients' PA. It was observed in our study that patients with good glycemic control scored significantly higher for PA as compared to patients with poor glycemic control.

Besides the self-care practices, patients' demographic factors could also influence the glycemic control, such as duration of disease. Diabetes is a progressive disease and one of the possibilities could be that euglycemic therapy is not being suitably intensified in those patients.

Strengths and Limitations of the study:
The Strengths of the study were Use of a high reliable standardized questionnaire, and since there is no similar study conducted in the area, it can contribute a lot as baseline information for future studies. Limitations, Limitation of related literatures to compare and discuss some of the findings and because the study design were cross-sectional method, the direction of causal relationship between variables can't always be determined

Conclusion

The results of this cross-sectional study of the diabetes self-management behavior among patients with diabetes in Qatar at Three primary health care centers covering the three regions in Qatar (central , western and northern) demonstrates that the status of diabetes self-management may be classified as average at this time, as reflected in the mean DSMQ score of 29.01±7.38 and adequate was 52.8% . Adequate cases significantly associated with later onset of DM and with lower HA1C also significantly associated with college education. HA1C was significantly negative correlated with Glucose management, Physical activity, positive correlated with Diet control, disease Control and total score. These findings demonstrate a need for improvement in diabetes self-management in Qatar. There is clearly a need for further research into strategies to provide diabetes self-management education and support, particularly among those who, have a lower educational status and are not following physical activity regimens with poor access to health care. The findings can serve to help clinicians have a better understanding on the extent to which different self-efficacy parameters have an influence on self-management behaviors in Qatari community, which will in turn lead to better glycemic control and thus improving HbA1c levels.

Declaration of interests
The authors report no conflicts of interest.

Data availability statement:
All data related to the article are available upon request.

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