VIA MEDICA
RESEARCH PAPER
ISSN 2450–7458
e-ISSN 2450–8187

Basem Abbas Ahmed Al Ubaidi[1], Khatoon Jaffar Abdulla[2], Noora Ahmed Al Jenaidi[2], Hussain Abdulla Ali[2], Eman Merza Marhoon[2], Hajar Merza Matar[3], Hawra Ali Shakeeb[4]

[1]Consultant Family Physician (retired)

[2]Sheikh Sabah Health Center, Ministry of Health, Manama, Bahrain

[3]MISR University for Science and Technology, Giza, Egypt

[4]Department of Pathology, Salmaniya Medical Complex, Ministry of Health, Manama, Bahrain

Self-Care Management and Glycemic Control Among Patients with Type 2 Diabetes in Bahrain: A Cross-Sectional Study

ABSTRACT

Objective: This study aimed to evaluate the impact of self-care management on glycemic control in type 2 diabetes patients within primary care facilities in the Kingdom of Bahrain.

Materials and methods: It was a cross-sectional study that enrolled a cohort of 400 individuals diagnosed with type 2 diabetes. Data collection included the administration of the Diabetes Mellitus Self-Management Questionnaire (DSMQ). Statistical analysis was conducted using SPSS software version 24.0. The Chi-square test was employed to compare optimal scores in relation to diabetes self-care, while the Kruskal-Wallis test was utilized to assess the impact of patients' activities, as indicated by DSMQ items, on parameters reflecting HbA1c levels. Additionally, the Spearman rank correlation test was applied to examine the association between knowledge of DSMQ items and HbA1c levels. A statistical significance threshold was set at $p < 0.05$.

Results: The study involved participants with a mean age of 55.6 ± 9.3 years (mean ± standard deviation). Notably, there was a significant negative correlation between DSMQ-16 scores and HbA1c levels ($p = 0.026$). Similarly, a significant negative correlation was observed between dietary control and HbA1c levels ($p = 0.017$). Among the various socio-demographic variables examined, only the duration of diabetes exhibited a significant association with the overall self-care score for diabetes ($p = 0.045$).

Conclusions: The study underscores the paramount importance of dietary control in attaining favorable glycemic outcomes in individuals with diabetes. It emphasizes the crucial role of healthcare providers in delivering precise and comprehensive dietary guidance to all diabetes patients. (Clin Diabetol 2024; 13, 2: 116–123)

Keywords: Bahrain, cross-sectional study, Diabetes Self-Management Questionnaire (DSMQ), HbA1c, type 2 diabetes

Address for correspondence:
Dr. Khatoon Jaffar Abdulla
Consultant Family Physician, Sheikh Sabah Health Center,
Ministry of Health, Manama, Bahrain
e-mail: KAhmed2@health.gov.bh
Clinical Diabetology 2024, 13; 2: 116–123
DOI: 10.5603/cd.98550
Received: 15.12.2023 Accepted: 18.01.2024
Early publication date: 19.03.2024

Introduction

Type 2 diabetes (T2D) is the most prevalent and clinically significant metabolic disorder, which has recently become a global pandemic and is increasing the healthcare burden worldwide [1]. T2D prevalence has been highest in the countries experiencing rapid epidemiologic transitions, especially in Asia, the Middle East, and North Africa [2]. According to a previous study, the Arab countries with the highest incidence of T2D are the Kingdom of Saudi Arabia (31.6%), Oman (29%), Kuwait (25.4%), Bahrain (25%), and the United Arab Emirates (25%) [3].

According to the American Diabetes Association (ADA), one of the most important strategies for managing diabetes is glycemic control [4]. In clinical practice, optimal long-term control is difficult to achieve as the causes for poor glycemic control in patients with T2D are complex. Patient- and healthcare provider-related factors may both lead to poor glycemic control [5].

Self-care in diabetes has been termed an evolutionary process of increasing knowledge or awareness by learning to cope with the complex nature of diabetes in a social context [6]. According to the ADA Standards of Medical Care in Diabetes, to attain adequate glycemic control, patients must engage in dedicated self-care behaviors across multiple domains, including increase activity levels, change eating patterns, comply with medication regimens, perform self-monitoring of blood glucose, and monitor carbohydrate intake [6, 7]. To reduce diabetes-related morbidity and mortality, patients must follow self-care management [6]. In the Gulf countries, good glycemic control ranges between 11% and 41% and in Bahrain it was found that only 14.8% of patients attending diabetic clinic had good glycemic control [4, 8]. Traditional/cultural lifestyle restrictions in Gulf countries contribute to sedentary behavior which ultimately increases the prevalence of diabetes [4]. Previous research reported age, medication, self-efficacy, and self-care as predictors of glycemic control [9, 10], and very few studies have been conducted in Bahrain among patients with T2D to correlate self-care management with glycemic control. This study evaluated multiple domains of self-care by using Diabetes Mellitus Self-Management Questionnaire (DSMQ). Considering the high prevalence of diabetes and lack of diabetes self-care in Bahrain [3, 11], and with an aim to create awareness, the current study was designed to determine the effect of self-care management (SCM) on glycemic control in patients with T2D at primary care facilities in the Kingdom of Bahrain.

Materials and methods

Study design and population

The present cross-sectional study was conducted at a primary care center in the Kingdom of Bahrain (eight primary centers were included: Sheikh Sabah Health Center in Um Alhassam, Manama; Hamad Town Health Center in Hamad Town; Isa Town Health Center in Isa Town; Naim Health Center in Naim, Manama; Jidhafs Health Center in Jidhafs; Dair Health Center in Dair, Muharraq; Sitra Health Center in Sitra; North Muharraq Health Center in Muharraq) from February 2023 to May 2023. The research assistant screened the potential participant for eligibility using the following inclusion criteria: Adults aged between 25 and 70 years and diagnosed with T2D at least one year before the commencement of data collection. Adults who were newly diagnosed with T2D, known to have type 1 diabetes (T1D), and diagnosed with mental and/or physical disabilities were excluded from the study.

Ethical considerations

Ethical clearance was obtained from the Institutional Research and Ethics Committee in primary care under serial number 17-11-2022 before the commencement of the study. Prior to data collection, a researcher ensured that participants were fully informed about the purpose of the questionnaire, the research objectives, and how their data would be used. The participants clearly explained their voluntary participation and their right to withdraw at any time without consequences and to sign informed consent before participation.

The researcher guaranteed the anonymity of data collected, its storage, transmission, and disposing methods to protect participants' confidentiality. A channel was established for participants to provide feedback on any questionnaire inquiry or raise concerns about the research process. The researcher envisioned that the research would provide significant benefits to the health center or the broader community and ensured measures to minimize potential harm to participants, both physical and emotional.

Data collection

DSMQ was designed to assess self-care activities that can predict glycemic control [12]. Data was collected using DSMQ questionnaire. Sociodemographic information about the participants, such as age, sex, marital status, income, level of education, and duration of diabetes was collected.

Anthropometric measurements of the patients, such as weight in kilograms (kg), height in centimeters (cm), and body mass index (BMI) were recorded. The

weight was measured with the patient wearing light clothing and no shoes. Height was measured using a standard height board with the participant wearing no shoes. BMI was calculated as weight in kg divided by height in meters squared. BMI was categorized as normal (19–25 kg/m^2), overweight (26–30 kg/m^2), and obese (≥ 30 kg/m^2) [13].

Most recent laboratory results for HbA1c were noted. Glycemic status was categorized as 'good glycemic control' (HbA1c ≤ 7%), 'moderate glycemic control' (HbA1c 7.1–9.0%), and 'poor glycemic control' (HbA1c > 9.0%) [14].

Further, DSMQ was used which consisted of 16 questions and was freely available online. DSMQ has excellent psychometric properties [12]. The questionnaire presents itself as an effective tool that provides reliable and valid information on diabetes self-care and evaluates four well-defined specific self-care activities related to glycemic control.

The DSMQ-16 is a tool that evaluates patients' knowledge, attitudes, and behaviors pertaining to diabetes self-management. This tool consists of 16 items, employs a 4-point Likert scale for responses, with options ranging from 0 (no) to 3 (yes, definitely) [12–15].

In the current research, the Arabic version of the Diabetes Self-Management Questionnaire (A-DSMQ) was employed which was developed by Kaddech et al. in 2022 [16]. The DSMQ score was categorized as optimal and sub-optimal self-care of diabetes according to the DSMQ — user information and scoring guide. The questionnaire allows for a 'Sum Scale' score to be calculated and the estimation of four subscale scores [12]. Subscale scores were calculated by summing the scores of the four items in each subscale, with a range of 0–12. The subscales were labelled 'Glucose Management' (items 1, 4, 6, 10, 12), 'Dietary Control' (items 2, 5, 9, 13), 'Physical Activity' (items 8, 11, 15), and 'Health-Care Use' (items 3, 7, 14) based on their contents. Participants rated themselves on a scale ranging from 0 to 3, where 0: It does not apply to me; 1: It applies to me to some degree; 2: It applies to me to a considerable degree and 3: It applies to me very much. Some patients also responded to the options "blood sugar measurement is not required as a part of my treatment" and "diabetes medication/insulin is not required as a part of my treatment" [12].

Statistical analysis

Sample size calculation

The sample size was calculated using the formula, $n = t^2 \times p(1-p)/m^2$. The resulting sample size was 384.16. Further, sample size was rounded up to 400. The sample size was established by the number of people diagnosed with T2DM, a 95% confidence interval (CI), a 5% tolerated error, and a design effect of 2.

SPSS software version 24.0 (IBM, Meadville, PA) was used to analyze the data. The DSMQ score was expressed as the mean with a standard deviation. The suboptimal score in each domain was expressed as a percentage. The Chi-square test was used to compare optimal diabetes self-care scores across socioeconomic variables. To compare optimal scores on self-care of diabetes between different socio-demographic variables, Chi-square test was computed. However, when the assumptions of Chi-square test failed in more than two-by-two table, appropriate rows were combined and assessed. Shapiro-Wilk test and Kruskal-Wallis test were used to determine the normality of data and the effect of the patient's DSMQ item activities on HbA1c parameters, respectively. Spearman rank correlation test was used to determine the relationship between assessments of knowledge about DSMQ items and HbA1c. In this study, a p-value less than or equal to 0.05 was considered statistically significant.

Results

This study included 400 patients (216 males and 184 females) with a mean ± SD age of 55.6 ± 9.3 years. About 47% of the patients were obese. As per WHO, ranges of BMI are classified as normal BMI (18.5 to 24.9), overweight (BMI ≥ 25 kg/m^2), obesity (BMI ≥ 30 kg/m^2) and severe obesity (BMI ≥ 40 kg/m^2) [17]. Most participants were educated up to the secondary school level (44.2%). In our study, the patient's HbA1c control level rates for good, moderate, and poor were 42.5%, 43.8%, and 13.8%, respectively. Most of the patients had moderate glycemic control (HbA1c) 7.7 ± 3.3 (mean ± SD). The duration of diabetes observed was 11.4 ± 8.0 (mean ± SD) years. Most of the patients (45.0%) had an income of less than 500 Bahraini Dinars (BD) (Tab. 1).

The majority of patients responded as, 'It applies to me (Score 0)' for the following questions: "I check my blood sugar levels with care and attention" (34%); "I keep all doctors' appointments recommended for my diabetes treatment" (88.7%); "I take my diabetes medication (e. g. insulin, tablets) as prescribed" (84.7%); "I strictly follow the dietary recommendations given by my doctor or diabetes specialist" (39.5%) (Suppl. Tab. 1).

Average DSMQ score on self-care for diabetes

The overall mean DSMQ score was 6.9 ± 1.4 points, which is higher than the sub-optimal score (> 6 points) [15]. The average scores on the subscale domains of glucose management, dietary control,

Table 1. Baseline Characteristic of the Study Subjects

Variable	Category	Frequency (%)
Age [years]	Mean ± SD	55.6 ± 9.3
Gender		
	Male	216 (54.0%)
	Female	184 (46.0%)
Marital Status		
	Single	28 (7.0%)
	Married	337 (84.2%)
	Divorced/Separated	13 (3.3%)
	Widow	22 (5.5%)
BMI	Mean ± SD	31.4 ± 6.2 kg/m^2
BMI		
	19–25	73 (18.3%)
	26–30	138 (34.4%)
	> 30	189 (47.3%)
Level of education		
	Not literate	11 (2.8%)
	Less than secondary	76 (19.0%)
	Secondary	177 (44.2%)
	College/University	122 (30.5%)
	Postgraduate	14 (3.5%)
HbA1c [%]	Mean ± SD	7.7 ± 3.3
HbA1c		
	Good control	170 (42.5%)
	Moderate control	175 (43.8%)
	Poor control	55 (13.8%)
Duration of diabetes [years]	Mean ± SD	11.4 ± 8.0
Duration of diabetes		
	≤ 10 years	235 (58.8%)
	>10 years	165 (41.2%)
Monthly income category		
	Less than 500 BD	180 (45.0%)
	500–1000 BD	172 (43.0%)
	> 1000 BD	48 (12.0%)

BD — Bahraini dinars; BMI — body mass index; HbA1c — glycated hemoglobin; SD — standard deviation

physical activity, and health care use, respectively, were 7.0 ± 2.0, 6.5 ± 2.0, 6.4 ± 2.7, and 7.8 ± 1.9. All domains scored higher than suboptimal level (> 6 points).

Distribution of score by the self-care of diabetes

The proportions of patients with optimal (> 6.0) and suboptimal (≤ 6.0) DSMQ score were 73.5% and 26.5%, respectively. Optimal and suboptimal scores for the glucose control domain were achieved by 60.4% and 39.6% of respondents, respectively. The optimal and sub-optimal scores for dietary control were achieved by 53.5% and 46.5%, respectively, and the physical activity scores were achieved by 54.5% and 45.5% of respondents, respectively. The optimal and sub-optimal scores for healthcare use were 85.7% and 14.3% in respondents, respectively.

Table 2 illustrates the correlation and comparison of DSMQ self-care activities with HbA1c levels. A significant negative correlation was noted between DSMQ-16 and HbA1c levels ($p = 0.026$), and for dietary control and HbA1c levels ($p = 0.017$). Cronbach's α coefficient for DSMQ-16 was 0.70 which is acceptable.

A significant negative correlation was observed between, "I strictly follow the dietary recommendations given by my doctor or diabetes specialist" and HbA1c levels ($p = 0.018$), and similarly for "My diabetes self-care is poor" and HbA1clevels ($p = 0.006$) (Suppl. Tab. 2).

Association between demographic profile and total score of self-care of diabetes

In the context of a study which examined the sub-optimal scores in diabetes self-care, an investigation was undertaken to assess potential associations with sociodemographic variables. Notably, the analysis revealed that males exhibited a lower score (53.5%) in contrast to females (28.8%). However, it is noteworthy that this observed disparity did not reach statistical significance ($p = 0.335$).

Moreover, an exploration of BMI categories uncovered varying rates of sub-optimal scores. Specifically, 19.2% of individuals within the 19–25 kg/m^2 category displayed sub-optimal scores, while 23.9% and 31.2% within the 26–30 and >30 kg/m^2 categories, respectively, exhibited similar sub-optimal scores. It is important to highlight that the proportional differences among these BMI categories did not attain statistical significance ($p = 0.098$).

For duration of diabetes, 30.2% of patients had a sub-optimal score for ≤ 10 years as compared to 21.2% of patients > 10 years which was statistically significant ($p = 0.045$). According to the Kruskal-Wallis test, there were no statistically significant differences between patient groups with 'good glycemic control' (HbA1c ≤ 7%), 'moderate glycemic control' (HbA1c 7.1–9.0%), and 'poor glycemic control' (HbA1c > 9.0%) in both the DSMQ sum scale scores and subscale scores (Tab. 3).

The DSMQ sum scale score was positively correlated with the duration of diabetes ($p = 0.009$). However, a negative correlation was noted for BMI ($p = 0.005$) and HbA1c levels ($p = 0.026$). For subscales, glucose management was positively correlated with the dura-

Table 2. Correlation and Comparison of DSMQ Self-Care Activities with HbA1c Levels

	Correlation		Comparison	
	Correlation coefficient	P-value	Mean (SD)	Cronbach alpha
DSMQ-16	–0.111	0.026*	6.9 (1.4)	0.70
Glucose management	–0.003	0.955	7.0 (2.0)	0.72
Dietary control	–0.120	0.017*	6.5 (2.0)	0.68
Physical activity	–0.098	0.051	6.4 (2.7)	0.68
Health-care use	–0.079	0.115	6.9 (1.9)	0.75

*Indicates statistical significance (note: Cronbach alpha is 0.7, which is considered respectable reliability)
DSMQ — Diabetes Self-Management Questionnaire; HbA1c — glycated hemoglobin; SD — standard deviation

Table 3. Comparison of the DSMQ Self-Care Activities in Patients with HbA1c Level

	HbA1c ≤ 7%	HbA1c 7.1–9.0%	HbA1c > 9.0%	P-value
DSMQ-16	7.08 (6.04, 8.13)	6.88 (6.04, 7.92)	6.67 (5.48, 7.71)	0.080^{K}
Glucose management	6.67 (5.69, 8.67)	7.33 (5.33, 8.67)	6.67 (6.00, 8.00)	0.863^{K}
Dietary control	6.67 (5.63, 8.33)	6.67 (5.00, 7.50)	5.83 (5.00, 8.33)	0.058^{K}
Physical activity	6.67 (4.44, 8.89)	6.67 (4.44, 7.78)	5.56 (4.44, 7.78)	0.148^{K}
Health-care use	7.78 (6.67, 10.00)	7.78 (6.67, 8.89)	7.78 (6.67, 8.89)	0.287^{K}

DSMQ — Diabetes Self-Management Questionnaire; HbA1c — glycated hemoglobin; K — Kruskal Wallis test

Table 4. Correlation of DSMQ Scales and Patient Characteristics

	Correlation Coefficient (P-value)				
	DSMQ sum scale	Glucose management	Dietary control	Physical activity	Health-care use
Age	0.026 (0.625)	–0.004 (0.945)	0.115 (**0.031***)	–0.010 (0.851)	–0.098 (0.067)
Gender	0.062 (0.212)	–0.037 (0.455)	0.030 (0.547)	0.202 (< 0.001*)	0.004 (0.934)
BMI	–0.140 (**0.005***)	0.036 (0.467)	–0.218 (< 0.001*)	–0.183 (< 0.001*)	0.020 (0.686)
Duration of diabetes	0.131 (0.009*)	0.141 (0.005*)	0.095 (0.057)	0.068 (0.172)	–0.066 (0.189)
HbA1c level	–0.111 (0.026*)	–0.003 (0.955)	–0.120 (0.017*)	–0.98 (0.051)	–0.079 (0.115)

*Indicates statistical significance
BMI — body mass index; DSMQ — Diabetes Self-Management Questionnaire; HbA1c — glycated hemoglobin

tion of diabetes ($p = 0.005$). Dietary control was positively correlated with age ($p = 0.031$) and negatively correlated with BMI ($p < 0.001$). Physical activity was positively correlated with gender ($p < 0.001$) and negatively correlated with BMI ($p < 0.001$) (Tab. 4).

Discussion

The burden of T2D in Bahrain is steadily increasing due to population growth, urbanization, lack of physical activity and unhealthy diet [18, 19]. Considering the main goal of diabetes management is glycemic control [20], this study estimated the effect of self-care management on glycemic control in patients with T2D at primary care in the Kingdom of Bahrain.

A total of 400 patients with T2D were included in this study, and the mean age of the participants was found to be 55.6 years. This finding aligned with Alawainati et al. [21] who conducted the study on Bahraini population. Research consistently indicates that the prevalence of T2D rises with advancing age [22]. The study population consisted of approximately equal percentages of males (54%) and females (46%). These findings are consistent with Midhet et al. [23] (male: 48.1%; female: 51.9%) but a meta-analysis on prevalence of DM in Saudi conducted by Jarrar et al. [24] reported contrasting findings on gender distribution.

Most participants were married (84.2%), obese (47.3%), and completed their education up to secondary level (44.2%). These findings agree with Saad et al. [13] where most of the participants were married (93.5%), obese (43.1%), and studied up to secondary level (32.5%). The reason for this could be that diabe-

tes affects older people more than young people, thus most patients were married. Obesity could be due to unhealthy eating habits [18, 22, 25]. Lower education levels may be associated with higher diabetes incidence, as individuals with lower education may not be aware of the signs and symptoms of diabetes.

In the current study, 42.5% of participants had good control, and 13.8% had poor control of HbA1c levels. The previous study conducted by Al Ubaidi et al. [26], among Bahraini population reported that 57.91% patients had controlled HbA1c levels, which is similar to the findings of the current study. In contrast, a study by D'Souza et al. [10] reported that 32% of participants had moderate glycemic control and 65% of participants had poor glycemic control. The diverging results of these studies may be due to the behavior of patients regarding self-care management.

The present study reported higher score than the suboptimal level (> 6 points) for all the domains. A maximum sub-optimal score was noted for dietary control followed by physical activity and glucose management. Similar findings were reported by Bukhsh et al. [27], where majority of the study participants had poor knowledge regarding diet and physical activity. In contrast, study by Totesora et al. [28] reported least sub-optimal score for dietary control and maximum was found in glucose management, followed by physical activity. The analysis showed that there was a significant negative correlation between DSMQ-16 ($p = 0.026$), dietary control ($p = 0.017$) and HbA1c levels. Similarly, a study conducted by Alodhayani et al. [29] reported a weak negative correlation between dietary control, physical activity and HbA1c levels. This may be attributed to the unhealthy diet consumption in Eastern Mediterranean region [9, 30]. The negative correlations found between dietary control and HbA1c levels, as well as between physical activity and HbA1c levels demonstrate the clinical significance of lifestyle factors in diabetes care. A decline in dietary control and physical activity is related with an increase in HbA1c levels, signifying poorer long-term blood sugar control.

Patients with diabetes for more than ten years were more likely to have poor self-care scores than those with diabetes for less than ten years. Similarly, Ko et al. [31], reported that a longer duration of diabetes resulted in a lower adherence to self-care activities and poorer glycemic control. The relationship between diabetes duration and diabetes self-management was weak and inversely proportional, which means that as diabetes duration increases, diabetes self-management and control decrease and thus become less effective [32].

Our study has few limitations that merit consideration. First, the use of a convenience sampling method may limit the generalizability of our findings, as those who volunteered may not fully represent the diversity of the entire Bahraini population with T2D. Second, the omission of comprehensive covariate adjustment in our analysis, including variables such as age, gender, duration of diabetes, BMI, educational level, and income, restricts our ability to fully account for potential confounding effects. Third, the cross-sectional design prohibits the establishment of causal relationships, and the reliance on self-reported data, particularly in the assessment of self-care management, introduces the potential for recall and social desirability biases. Fourth, the analysis of nominal variables, such as gender, using traditional correlation methods presents challenges due to linearity assumptions, and while biserial correlation would be ideal, software constraints limited its implementation. Lastly, while our study focuses on the Bahraini population, variations in socioeconomic status, cultural diversity, and healthcare access may limit the generalizability of our findings across all segments of the population. These limitations underscore the need for cautious interpretation and highlight avenues for future research with more comprehensive datasets and study designs.

Despite these limitations, this study has several advantages, including a large sample size, assessing multiple domains of self-care and their correlation with glycemic control, providing a comprehensive understanding of the factors influencing diabetes management in the primary care setting. The reliability analysis of the DSMQ scale demonstrated respectable internal consistency, adding rigor to the study's measurements.

Further research should consider longitudinal designs to investigate the dynamics of self-care behaviors and their effect on glycemic control over time. The impact of cultural and social factors on self-care behaviors in Bahrain, considering the diverse population can also be examined. Efforts should be directed towards investigating strategies for the seamless integration of self-care support within the healthcare system, with the aim of enhancing patient outcomes. Additionally, there is a need to explore the influence of healthcare provider training on diabetes management, as such investigations hold promise for advancing our comprehension of effective strategies in this domain, ultimately leading to improved diabetes care.

Conclusions

DSMQ-16 serves as a robust instrument for the evaluation of diabetes self-management behaviors.

DSMQ along with demographic data and relevant variables provided an effective measurement of self-care management. This instrument provides valuable insights for guiding interventions aimed at improving diabetes care.

Our findings confirmed that self-care activity adherence had a significant influence on glycemic control. Diabetes duration and non-adherence to diabetes self-care management behaviors were linked to poor glycemic control. The findings also highlight the need to improve patient and healthcare provider involvement in self-care management practice, as well as patient empowerment. Developing programs on self-care management in T2D is noteworthy; therefore, more research is needed on factors associated with T2D patients' self-care management practices.

Article information

Supplementary material

The Supplementary materials for this article can be found at https://journals.viamedica.pl/clinical_diabetology/article/view/98550

Ethics statement

Ethical clearance was obtained from the Institutional Research and Ethics Committee in primary care under serial number 17-11-2022 before the commencement of the study. Prior to data collection, a researcher ensured that participants were fully informed about the purpose of the questionnaire, the research objectives, and how their data would be used. The participants clearly explained their voluntary participation and their right to withdraw at any time without consequences and to sign informed consent before participation.

Author contributions

Basem Abbas Ahmed Al Ubaidi, Khatoon Jaffar Abdulla contributed to the study design, data collection and implementation of the research. Noora Ahmed Al Jenaidi, Hussain Abdulla Ali and Eman Merza Marhoon contributed to data analysis and interpretation. Hajar Merza Matar and Hawra Ali Shakeeb aided in interpreting the results and worked on the manuscript. All the authors discussed the results, revised the articled and approved the final version of manuscript for submission.

Acknowledgments

We would like to express our profound gratitude to the diabetic nurses in the health centers involved in our research:
Ms. Zahra Atya – Sheikh Sabah Health Center
Ms. Sara Ali – Hamad Town Health Center
Ms. Afaf Isa Nawar and Mr. Mahmood Mohammed Ameen – Isa Town Health Center
Ms. Mariam Khalil – Naim Health Center
Ms. Eman Abdulnabi – Jidhafs Health Center
Ms. Nadia Jaber and Ms. Huda Own – Dair Health Center
Ms. Eman Ramadhan – Sitra Health Center
Ms. Khairia – North Muharraq Health Center
for their contribution to complete our research.

Funding

None.

Conflict of interest

The authors declare no conflict of interest.

REFERENCES

1. Reed J, Bain S, Kanamarlapudi V. A Review of Current Trends with Type 2 Diabetes Epidemiology, Aetiology, Pathogenesis, Treatments and Future Perspectives. Diabetes Metab Syndr Obes. 2021; 14: 3567–3602, doi: 10.2147/DMSO.S319895, indexed in Pubmed: 34413662.
2. Khan MA, Hashim MJ, King JK, et al. Epidemiology of Type 2 Diabetes - Global Burden of Disease and Forecasted Trends. J Epidemiol Glob Health. 2020; 10(1): 107–111, doi: 10.2991/jegh.k.191028.001, indexed in Pubmed: 32175717.
3. Meo SA, Usmani AM, Qalbani E. Prevalence of type 2 diabetes in the Arab world: impact of GDP and energy consumption. Eur Rev Med Pharmacol Sci. 2017; 21(6): 1303–1312, indexed in Pubmed: 28387897.
4. Al-Rasheedi AA. Glycemic Control among Patients with Type 2 Diabetes Mellitus in Countries of Arabic Gulf. Int J Health Sci (Qassim). 2015; 9(3): 345–350, indexed in Pubmed: 26609299.
5. Kamuhabwa AR, Charles E. Predictors of poor glycemic control in type 2 diabetic patients attending public hospitals in Dar es Salaam. Drug Healthc Patient Saf. 2014; 6: 155–165, doi: 10.2147/DHPS.S68786, indexed in Pubmed: 25368533.
6. Shrivastava SR, Shrivastava PS, Ramasamy J. Role of self-care in management of diabetes mellitus. J Diabetes Metab Disord. 2013; 12(1): 14, doi: 10.1186/2251-6581-12-14, indexed in Pubmed: 23497559.
7. Beckerle C, Lavin M. Association of Self-Efficacy and Self-Care With Glycemic Control in Diabetes. Diabetes Spectrum. 2013; 26(3): 172–178, doi: 10.2337/diaspect.26.3.172.
8. Alromaihi D, Bastawrous M, Bastawrous D. Factors affecting glycaemic control among patients with type 2 diabetes in Bahrain. Bahrain Medical Bull. 2019; 41(3): 146–149.
9. Babazadeh T, Lotfi Y, Ranjbaran S. Predictors of self-care behaviors and glycemic control among patients with type 2 diabetes mellitus. Front Public Health. 2022; 10: 1031655, doi: 10.3389/fpubh.2022.1031655, indexed in Pubmed: 36711399.
10. D'Souza MS, Karkada SN, Parahoo K, et al. Self-efficacy and self-care behaviours among adults with type 2 diabetes. Appl Nurs Res. 2017; 36: 25–32, doi: 10.1016/j.apnr.2017.05.004, indexed in Pubmed: 28720235.
11. Al-Jawaldeh A, Abbass MMS. Unhealthy Dietary Habits and Obesity: The Major Risk Factors Beyond Non-Communicable Diseases in the Eastern Mediterranean Region. Front Nutr. 2022; 9: 817808, doi: 10.3389/fnut.2022.817808, indexed in Pubmed: 35369054.
12. Schmitt A, Gahr A, Hermanns N, et al. The Diabetes Self-Management Questionnaire (DSMQ): development and evaluation of an instrument to assess diabetes self-care activities associated with glycaemic control. Health Qual Life Outcomes. 2013; 11: 138, doi: 10.1186/1477-7525-11-138, indexed in Pubmed: 23937988.

13. Saad AMJ, Younes ZMH, Ahmed H, et al. Self-efficacy, self-care and glycemic control in Saudi Arabian patients with type 2 diabetes mellitus: A cross-sectional survey. Diabetes Res Clin Pract. 2018; 137: 28–36, doi: 10.1016/j.diabres.2017.12.014, indexed in Pubmed: 29278711.
14. Inaba M, Okuno S, Kumeda Y, et al. Osaka CKD Expert Research Group. Glycated albumin is a better glycemic indicator than glycated hemoglobin values in hemodialysis patients with diabetes: effect of anemia and erythropoietin injection. J Am Soc Nephrol. 2007; 18(3): 896–903, doi: 10.1681/ASN.2006070772, indexed in Pubmed: 17267743.
15. Schmitt A, Gahr A, Hermanns N, et al. The Diabetes Self-Management Questionnaire (DSMQ): development and evaluation of an instrument to assess diabetes self-care activities associated with glycaemic control. Health Qual Life Outcomes. 2013; 11(1): 138, doi: 10.1186/1477-7525-11-138, indexed in Pubmed: 23937988.
16. Kaddech N, Guelmami N, Bonsaksen T, et al. Adaptation and Psychometric Evidence of the ARABIC Version of the Diabetes Self-Management Questionnaire (A-DSMQ). Healthcare (Basel). 2022; 10(5): 951, doi: 10.3390/healthcare10050951, indexed in Pubmed: 35628088.
17. Chooi YuC, Ding C, Magkos F. The epidemiology of obesity. Metabolism. 2019; 92: 6–10, doi: 10.1016/j.metabol.2018.09.005, indexed in Pubmed: 30253139.
18. Alshayban D, Joseph R. Health-related quality of life among patients with type 2 diabetes mellitus in Eastern Province, Saudi Arabia: A cross-sectional study. PLoS One. 2020; 15(1): e0227573, doi: 10.1371/journal.pone.0227573, indexed in Pubmed: 31923232.
19. Aloia AA, Jassim G. The epidemiologic profile of diabetes mellitus among attendees of outpatient clinics at Bahrain Defense Force Hospital: A cross-sectional study. J Glob Diabetes Clin Metab. 2017; 2(1): 1–5, doi: 10.26226/morressier.59d51849d462b80296ca3193.
20. Gao J, Wang J, Zheng P, et al. Effects of self-care, self-efficacy, social support on glycemic control in adults with type 2 diabetes. BMC Fam Pract. 2013; 14: 66, doi: 10.1186/1471-2296-14-66, indexed in Pubmed: 23705978.
21. Alawainati MA, Ayoob ZA, Naser HS. Characteristics, glycemic control and outcomes of adults with type-2 diabetes mellitus attending specialized clinics in primary healthcare centers in Bahrain-A cross-sectional study. J Family Med Prim Care. 2023; 12(11): 2576–2583, doi: 10.4103/jfmpc.jfmpc_829_23, indexed in Pubmed: 38186767.
22. Barrot-de la Puente J, Mata-Cases M, Franch-Nadal J, et al. Older type 2 diabetic patients are more likely to achieve glycaemic and cardiovascular risk factors targets than younger patients: analysis of a primary care database. Int J Clin Pract. 2015; 69(12): 1486–1495, doi: 10.1111/ijcp.12741, indexed in Pubmed: 26422335.
23. Midhet FM, Al-Mohaimeed AA, Sharaf FK. Lifestyle related risk factors of type 2 diabetes mellitus in Saudi Arabia. Saudi Med J. 2010; 31(7): 768–774, indexed in Pubmed: 20635010.
24. Jarrar M, Abusalah MA, Albaker W, et al. Prevalence of Type 2 Diabetes Mellitus in the General Population of Saudi Arabia, 2000-2020: A Systematic Review and Meta-Analysis of Observational Studies. Saudi J Med Med Sci. 2023; 11(1): 1–10, doi: 10.4103/sjmms.sjmms_394_22, indexed in Pubmed: 36909010.
25. Malik S, Basit R, Naz S, et al. Adherence to Lifestyle Advice and Treatments in Pakistani Patients with Type 2 Diabetes Mellitus. Journal of Diabetes Mellitus. 2016; 06(01): 49–57, doi: 10.4236/jdm.2016.61006.
26. Al Ubaidi B, Hasan B, Shubbar K. Participatory diabetes care in primary care: evaluating self-care behaviors and patient involvement in Bahrain. Int Medical J. 2023; 30(10): 9161–9177.
27. Bukhsh A, Khan TM, Sarfraz Nawaz M, et al. Association of diabetes knowledge with glycemic control and self-care practices among Pakistani people with type 2 diabetes mellitus. Diabetes Metab Syndr Obes. 2019; 12: 1409–1417, doi: 10.2147/DMSO.S209711, indexed in Pubmed: 31616171.
28. Totesora D, Ramos-Rivera MI, Villegas-Florencio MQ, et al. Association of Diabetes-related Emotional Distress with Diabetes Self-care and Glycemic Control among Adult Filipinos with Type 2 Diabetes Mellitus at a Tertiary Hospital in Manila, Philippines. J ASEAN Fed Endocr Soc. 2019; 34(2): 189–196, doi: 10.15605/jafes.034.02.10, indexed in Pubmed: 33442155.
29. Alodhayani A, Almutairi KM, Vinluan JM, et al. Association between self-care management practices and glycemic control of patients with type 2 diabetes mellitus in Saud Arabia: A cross-sectional study. Saudi J Biol Sci. 2021; 28(4): 2460–2465, doi: 10.1016/j.sjbs.2021.01.047, indexed in Pubmed: 33911959.
30. Sami W, Ansari T, Butt NS, et al. Effect of diet on type 2 diabetes mellitus: A review. Int J Health Sci (Qassim). 2017; 11(2): 65–71, indexed in Pubmed: 28539866.
31. Ko SH, Park SA, Cho JH, et al. Influence of the duration of diabetes on the outcome of a diabetes self-management education program. Diabetes Metab J. 2012; 36(3): 222–229, doi: 10.4093/dmj.2012.36.3.222, indexed in Pubmed: 22737662.
32. Adwan MA, Najjar YW. The relationship between demographic variables and diabetes self-management in diabetic patients in Amman city/Jordan. Glob J Health Sci. 2013; 5(2): 213–220, doi: 10.5539/gjhs.v5n2p213, indexed in Pubmed: 23445711.