BMC Endocrine Disorders

RESEARCH

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Assessment of self-efficacy, quality of life, and well-being of patients with diabetes mellitus in Alqunfudah, Saudi Arabia

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Abstract

Background Patients with diabetes mellitus (DM) often experience psychological challenges, such as feelings of loss of control, self-care stress, and fear of complications. This study aimed to assess the prevalence of uncontrolled DM, self-efficacy, quality of life (QoL), and well-being among patients with DM in Alqunfudah, Saudi Arabia, and to investigate the associations between these factors and diabetes control.

Methods A cross-sectional study employing an online questionnaire was conducted among adults with DM. The questionnaire assessed demographic characteristics, diabetes-related history, and glycemic control based on glycated hemoglobin A1c (HbA1c) level. Self-efficacy was evaluated using the validated Arabic version of the Self-Efficacy for Managing Chronic Disease 6-Item Scale, and the Arabic version of the World Health Organization Quality of Life Brief Version was utilized to assess QoL. Well-being was measured using the Arabic version of the World Health Organization-Five Well-being Index (WHO-5).

Results Four hundred patients with diabetes were included with a mean age of 49.3 ± 14.6 years, 40.8% were males, and 49.25% had uncontrolled DM. Compared to the controlled group, the uncontrolled group had a lower percentage of patients living in urban areas (16.8% vs. 25.6%, $p = 0.037$), a larger proportion of participants having DM for > 10 years (42.6% vs. 26.6%, $p < 0.001$), lower median (interquartile [IQR]) self-efficacy score [39.0 (30.0–46.0) vs. 47.0 (34.0–54.0), $p < 0.001$], lower physical QoL [75.0(60.7–85.7) vs. 67.8 (50.0–82.1), $p < 0.001$], and lower environmental QoL [(78.1(62.5–87.5) vs. 68.7(59.3–84.3), $p = 0.005$]. Predictors of glycemic control included the physical domain of QoL [adjusted odd ratio (aOR) = 1.02 (95% CI: 1.01–1.03), $p < 0.001$] duration of DM for 1–2 years [aOR = 2.53 (95% CI: 1.08–5.91), $p = 0.032$], 3–5 years [aOR = 3.76 (95% CI: 1.90–7.43), $p < 0.001$], and 6–10 years [aOR = 1.85 (95% CI: 1.04–3.32), $p = 0.036$], and urban residence [aOR = 1.88 (95% CI: 1.11–3.18), $p = 0.017$].

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Conclusions A large sector of patients with diabetes had uncontrolled blood sugar with greater affection of QoL and self-efficacy compared to the controlled group. Physical QoL, duration of DM, and residence were the key factors to be targeted for improved diabetes management.

Keywords Diabetes mellitus, Self-efficacy, Quality of life, Well-being, glycemic control, Self-efficacy for managing chronic disease 6-Item scale

Introduction

Diabetes mellitus (DM) is a major public health concern worldwide, with a growing prevalence that significantly impacts all aspects of a patient's life. There are different types of diabetes, including type 1, type 2, and gestational diabetes mellitus (GDM) [1]. According to the International Diabetes Federation (IDF), approximately 10.5% of the adults aged 20–79 worldwide have diabetes, with over half unaware of their condition. Alarmingly, the IDF estimates a 46% increase in diabetes prevalence by 2045 [2].

Saudi Arabia ranks seventh globally and the second in the Middle East for DM prevalence [3]. Household health surveys across country's 13 administrative regions reported an overall DM prevalence of 8.5% among individuals aged 15 years and above [4]. In 2021, IDF estimated that diabetes prevalence in Saudi Arabia was 17.7% among adults [2]. By 2024, the prevalence of DM surged to 36.1%, while prediabetes was also observed at a significant rate of 28.3% [5]. Not limited to adults, the affected youth is expected to increase dramatically over the next five years [6]. In 2021, the number of deaths caused by diabetes-related complications was around 32,000 [2]. A high prevalence of complications such as cerebrovascular disease, foot ulcers, myocardial infarctions, renal failure, retinopathy, and neuropathy have been observed among individuals with uncontrolled diabetes in Saudi Arabia. Furthermore, diabetes was identified as the leading cause of years lived with disability in the country [7, 8].

Quality of life (QoL) has become increasingly recognized as a vital component of managing chronic diseases, especially in the context of the DM epidemic. The World Health Organization (WHO) highlights its significance by defining QoL as the perception individuals have of their life circumstances within the context of cultural and value frameworks [9]. Among individuals with DM, several factors can significantly impact its management. These factors include complications arising from the disease, inadequate control of blood sugar levels, and psychological factors such as depression [10]. Research has highlighted strong associations between psychological changes and adverse health outcomes in diabetes patients [11]. Studies worldwide have employed diverse psychometric tools to evaluate mental well-being in this population, consistently revealing elevated levels of anxiety and depression. This underscores the importance of addressing mental health concerns alongside physical health in DM management. Understanding the complex interplay between DM and mental well-being is essential for devising effective interventions to enhance overall patient outcomes and QoL [12]. Moreover, patients with DM often experience psychological challenges, such as feelings of loss of control, self-care stress, and fear of complications. The demanding nature of DM management, coupled with internal and external stressors, further complicates glycemic control [13]. Self-efficacy is a psychological construct defined by Bandura as the self-perception of one's ability to perform goal-directed behaviors when confronted with impediments [14]. Self-efficacy emerges as a crucial determinant of health behaviour, influencing self-care practices and, consequently, glycemic control and QoL outcomes [15, 16, 17, 18]. There is a scarcity of literature assessing well-being and self-efficacy among patients with DM in Saudi Arabia. Existing studies often had small sample sizes or did not comprehensively assess QoL, well-being, and self-efficacy [19].

This study hypothesized that a significant proportion of patients with DM have uncontrolled diabetes and that lower levels of self-efficacy, QoL, and well-being are associated with poorer diabetes control. Given the high prevalence and severe health implications of DM in Saudi Arabia, this study aimed to assess the prevalence of uncontrolled DM. Moreover, the study aimed to compare self-efficacy, QoL, and well-being across patients with controlled and uncontrolled DM in Alqunfudah, Saudi Arabia, and explore their associations with diabetes control.

Subjects and methods

Study design and setting

An analytic cross-sectional study design was conducted using an online anonymous questionnaire Alqunfudah between November 1, 2023, and December 15, 2023.

Sample size, study population

To determine the minimum required sample size, G*Power software (version 3.1, Franz Faul, Universität Kiel, Germany) was used. Based on prior research by Jang et al., [20], which reported a correlation of 0.3 between hemoglobin A1c (HbA1c) and self-efficacy, with an alpha error of 5%, a null hypothesis of 0.5, and a power of 95%, the minimum sample size required was calculated to be 229 participants. To account for a non-response rate of 35%, the sample size was increased to 352. We rounded

it up to 400 to compensate for potentially incomplete or inconsistent data. The study recruited adult diabetic patients aged 18 years or older from the Alqunfudah region of Saudi Arabia, requiring them to have Internet access for participation. Exclusions were made for individuals with a history of mental illness, as well as diabetic patients who lacked recent HbA1C test results or did not provide uploaded HbA1c test results.

Sampling methods

We created the survey using Google Forms and shared it via commonly used social media platforms, including Instagram, Twitter, Telegram, and Messenger. Recruitment methods employed a combination of convenient and snowballing techniques to engage participants.

Study outcomes

This study aimed to assess the prevalence of uncontrolled diabetes among the Saudi population in Alqunfudah, Saudi Arabia. It also examined well-being, QoL, and self-efficacy among individuals with controlled and uncontrolled diabetes. Additionally, the study identified factors contributing to uncontrolled diabetes such as self-efficacy, well-being, and QoL.

Data collection tools

A self-administered questionnaire was developed for this study based on previously published papers [5, 6, 21], comprising four sections. *The first part* collected general characteristics of diabetic patients, including age, sex, marital status, residence, education, income (in Saudi Riyal), employment, health insurance, smoking habits, and the presence of documented comorbidities. Diabetes-related history was also assessed, such as the duration since diabetes diagnosis, type of diabetes, family history of diabetes, and HbA1c level. To accurately classify patients into controlled and uncontrolled diabetes groups, participants were required to submit their most recent HbA1c test results from the past three months. To ensure participant anonymity, participants were asked to mask all personal identifiers before submitting the HbA1c results. We included a field where participants were asked to specify the date of their last HbA1c test. Glycemic control was categorized based on guidelines from the less stringent HbA1c goals of the American Diabetes Association, with controlled diabetes defined as HbA1c < 64 mmol/mol < 8% and poorly controlled diabetes as HbA1c ≥ 64 mmol/mol (≥ 8%) [22]. *The second part* of the questionnaire assessed self-efficacy using the validated Arabic version of the Self-Efficacy for Managing Chronic Disease 6-Item Scale (SEM6S) [23]. This section consisted of six items rated on a 10-step Likert scale, ranging from 1 ("not at all confident") to 10 ("totally confident"). The maximum self-efficacy score achievable is 60. The overall scale score was determined by calculating the mean score of the six items. If more than two items were missing, the scale was not scored, following the guidelines. *The third part* aimed to measure the patient's well-being using the validated Arabic version of the World Health Organization-Five Well-being Index (WHO-5) [24]. This section included five positively framed items, and respondents rated their experiences on a 6-point Likert scale ranging from 0 ("at no time") to 5 ("all the time"). The raw scores, ranging from 0 to 25, were multiplied by 4 to transform them into a scale from 0 to 100. Lower scores indicated poorer well-being. A well-being score equal to or less than 50 suggested suboptimal mental health and the need for further exploration of potential symptoms of depression. A score of 28 or lower specifically indicated the presence of depressive symptoms, as highlighted by Bech et al. [25, 26]. *The fourth part* of the questionnaire utilized the validated Arabic version of the World Health Organization Quality of Life Brief Version (WHOQOL-BREF) to assess the QoL of patients with DM. The WHOQOL-BREF is a generic instrument applicable cross-cultural QoL assessment tool [27]. It consisted of 26 questions, including two questions about overall QoL and general health, and 24 questions assessing QoL in four domains: physical health, psychological, social relationships, and environment. Responses to each question were rated on a 5-point Likert scale from 1 to 5. Raw scores in each domain were transformed to a 4–20 score, and then linearly transformed to a 0–100 scale following guidelines by methods detailed in the WHOQOL-BREF manual. Higher scores indicated a better QoL [28].

Pilot testing

Before data collection, data collectors were asked to conduct a pilot test of the questionnaire. The pilot study included 25 participants and aimed to assess the feasibility and clarity of the tool. The response rate was satisfactory (65%), and data from the pilot study were not included in the final dataset. The questions were found to be clear, and the time required to complete the questionnaire ranged from 14 to 18 min.

Data quality check

In our study, we used an online survey with mandatory questions that participants had to complete to submit the form. Any missing or incomplete data were excluded from the analysis. Additionally, each IP address was allowed to submit only one response.

Statistical analysis

Data entry and subsequent data analysis were performed using International Business Machines Corporation Statistical Package for the Social Sciences (IBM SPSS) for

Windows (Version 27.0). Figures were created using the ggplot2 package in R. Participant data that was incomplete or inconsistent was excluded from the analysis to ensure the quality of the data. Categorical data were presented as numbers and percentages. To identify associations between categorical variables, Pearson's Chi-square test (χ^2) for independence was used. Fisher's exact test was applied when expected cell frequencies were below 5. The Bonferroni test was used to compare column proportions. For quantitative or numerical data, normality assumptions were assessed using Shapiro's test and histogram. Descriptive statistics such as means, standard deviations, medians, and interquartile ranges (25-75%) were employed to describe quantitative variables. The independent Student's t-test was used for normally distributed data, while the Mann-Whitney U test was used for nonparametric data, to assess differences between quantitative variables. To explore the correlation QoL, well-being score, self-efficacy score, and HbA1c levels, Spearman's correlation coefficient was calculated to determine the strength and direction of associations. The correlation coefficient (r) ranges from − 1 to + 1. A value of + 1 indicates a perfect positive relationship, 0 indicates no correlation, and − 1 signifies a perfect negative relationship. The strength of the correlation was categorized as follows:

- A value between 0 and 0.3 indicates a weak positive correlation.
- A value between 0.3 and 0.5 signifies a moderate positive correlation.
- A value between 0.5 and 0.7 represents a strong positive correlation.
- A value between 0.7 and 1 indicates a very strong positive correlation.

Logistic regression analysis was performed to identify predictors of controlled diabetes among the patient population studied. The associations between variables were described using 95% confidence intervals (CI) and adjusted odds ratios (aOR). Variables that demonstrated significance in the bivariate analysis were incorporated into the final logistic regression model. All statistical tests were two-tailed, and p-values less than 0.05 were considered statistically significant.

Ethical considerations

Approval for this study was obtained from the King Khalid University Research Ethics Committee (IRB: ECM#2023–3105). The research adhered to international ethical guidelines, including the Helsinki Guidelines and their subsequent amendments. Before conducting the study, participants were provided with a clear understanding of the research objectives and goals. They were informed that their participation was voluntary, and their consent was obtained by answering a question at the beginning of the survey, indicating their agreement or disagreement to participate in the study. To ensure confidentiality, all responses were saved in a password-protected computer accessible only to the lead investigator and the lab test was anonymous.

Results

Among the 400 patients included, 49.25% had uncontrolled DM. The mean age of the patients was 49.3 ± 14.6 years, 40.8% were males, 68.3% were married, 42.8% had an income less than 5000 Saudi Riyal (1 USD = 3.75 Saudi Riyal), 32.8% had a university degree, 51.7% reported being unemployed, 95.5% were not health workers, and 69.0% did not have health insurance. Except for residence, no significant differences were observed between controlled and uncontrolled diabetic patients regarding these variables. Among the controlled diabetic group, 25.6% lived in urban areas, while 74.4% resided in rural areas. In contrast, the uncontrolled group had a lower percentage of patients living in urban areas (16.8%) and a higher percentage in rural areas (83.2%). This difference was statistically significant ($p = 0.037$). Table 1.

Looking at smoking habits, most patients were non-smokers (82.5%). Regarding comorbidities, the most prevalent comorbidity was hypertension (32.0%), followed by heart disease and thyroid diseases (4.5%). The controlled group had a slightly higher proportion of patients without any comorbidities except diabetes (58.1%) compared to the uncontrolled group (48.7%). Most patients had type 2 diabetes (67.0%) and had a positive family history of DM (74.3%). Regarding duration of DM, the controlled group had a higher proportion of patients in the 1–2 years (21.2% vs. 8.6%) and a lower proportion of patients having diabetes > 10 years (26.6% vs. 42.6%) compared to the uncontrolled group with a statistically significant difference ($p < 0.001$). Table 2.

The controlled group had a significantly higher median self-efficacy score of 47.0 (34.0–54.0) compared to the uncontrolled group 39.0 (30.0–46.0), $p < 0.001$. Moreover, in the controlled group, a higher proportion of patients (61.1%) fell into the high self-efficacy category,while in the uncontrolled group, more patients (56.9%) fell into the low self-efficacy category. These differences were statistically significant ($p < 0.001$). The overall median score of well-being was 68.0 (52–80), with no significant difference across the studied groups. When well-being is classified into "good well-being," "suboptimal mental health," and "probable depression.", the proportions of patients falling into these categories were similar between the controlled and uncontrolled groups. The controlled group generally had higher median scores across all domains of QoL compared to the uncontrolled group.

Table 1 General characteristics of patients with diabetes according to their glycemic control

Variables	Level	Total ($n=400$)	Controlled DM ($n=203$)	Uncontrolled ($n=197$)	p-value
Age (Years)		49.3 ± 14.6	49.3 ± 14.3	49.3 ± 14.9	(t)$p=0.962$
Sex	Male	163 (40.8)	90 (44.3)	73 (37.1)	(χ2)$p=0.155$
	Female	237 (59.2)	113 (55.7)	124 (62.9)	
Marital status	Married	273 (68.3)	144 (70.9)	129 (68.3)	(χ2)$p=0.253$
	Widow	49 (12.3)	20 (9.9)	29 (14.7)	
	Divorced	19 (4.8)	12 (5.9)	7 (3.6)	
	Single	59 (14.8)	27 (13.3)	32 (16.2)	
Residence	Urban	85 (21.2)	52 (25.6)	33 (16.8)	(χ2)$p=0.037$*
	Rural	315 (78.8)	151 (74.4)	164 (83.2)	
Income	Prefer not to say	5 (1.3)	4 (2.0)	1 (0.5)	(χ2)$p=0.344$
	Less than 5000 SAR	171 (42.8)	80 (39.4)	91 (46.2)	
	5000–15,000 SAR	142 (35.5)	72 (35.5)	70 (35.5)	
	15,000–20,000 SAR	70 (17.5)	41 (20.2)	29 (14.7)	
	> 20,000 SR	12 (3.0)	6 (3.0)	6 (3.0)	
Education level	Illiterate	67 (16.8)	31 (15.3)	36 (18.3)	(χ2)$p=0.674$
	Read and write	42 (10.5)	21 (10.3)	21 (10.7)	
	Primary/ Preparatory	63 (15.8)	34 (16.7)	29 (14.7)	
	Secondary	83 (20.8)	42 (20.7)	41 (20.8)	
	University	131 (32.8)	68 (33.5)	63 (32.0)	
	Postgraduate	14 (3.5)	7 (3.4)	7 (3.6)	
Employment	Governmental sector	90 (22.5)	53 (26.1)	37 (18.8)	(χ2)$p=0.255$
	Private sector	18 (4.5)	8 (3.9)	10 (5.1)	
	Retired	85 (21.3)	45 (22.2)	40 (20.3)	
	Not employed	207 (51.7)	97 (47.8)	110 (55.8)	
Health worker	No	382 (95.5)	193 (95.1)	189 (95.9)	(χ2)$p=0.811$
	Yes	18 (4.5)	10 (4.9)	8 (4.1)	
Health insurance	Governmental insurance	108 (27.0)	53 (26.1)	55 (27.9)	(χ2)$p=0.624$
	Private insurance	16 (4.0)	10 (4.9)	6 (3.0)	
	No insurance	276 (69.0)	140 (69.0)	136 (69.0)	

*Statistically significant ($p<0.05$). χ^2: Chi-square test. T: independent sample t-test. SAR: Saudi Riyal

The statistical analysis showed significant differences in the physical, psychological, and environmental domains between the two groups ($p<0.001$). However, there was no significant difference in the social relations domain ($p>0.05$). Table 3.

A weak negative correlation was found between HbA1c and psychological QoL (r = -0.25). Similarly, HbA1c showed a weak inverse relationship with overall well-being (r = -0.11). Furthermore, a negative correlation was observed between HbA1c and physical QoL (r = -0.28). Additionally, there was a weak negative correlation between HbA1c and self-efficacy (r = -0.26). All correlations were significant $P<0.05$. Figure 1.

Multivariable analysis identified the physical domain of QoL (aOR = 1.02 (95% CI: 1.01–1.03), $p<0.001$) as a significant predictor of glycemic control, with higher scores associated with better glycemic control. Duration since diabetes diagnosis was also a strong determinant, with patients having diabetes for 1–2 years (aOR = 2.53 (95% CI: 1.08–5.91), $p=0.032$), 3–5 years (aOR = 3.76 (95% CI: 1.90–7.43), $p<0.001$), and 6–10 years (aOR = 1.85 (95% CI: 1.04–3.32), $p=0.036$) showing significantly higher odds of controlled glycemia. Urban residence (aOR = 1.88 (95% CI: 1.11–3.18), $p=0.017$) was also associated with better glycemic control. However, diabetes duration exceeding 10 years ($p=0.063$), well-being score ($p=0.095$), and high self-efficacy ($p=0.187$) were not statistically significant predictors (Table 4).

Discussion

The present study sought to assess prevalence of uncontrolled DM and level of self-efficacy, QoL, and well-being among patients with controlled and uncontrolled DM in Alqunfudah, Saudi Arabia. Moreover, we addressed predictors of poor glycemic control. Notably, our study revealed high prevalence of uncontrolled DM with lower self-efficacy and QoL among the patients with uncontrolled DM. Additionally, nearly one-fifths had low well-being with no significant difference observed between controlled and uncontrolled diabetic patients. Furthermore, factors such as physical QoL, urban residence, and duration since diabetes diagnosis emerged as significant factors influencing glycemic control, emphasizing the

Table 2 Health-related profile of patients with diabetes according to their glycemic control

Variable	Level	Total ($n=400$)	Controlled DM ($n=203$)	Uncontrolled DM ($n=197$)	*p*-value
Smoking	Non-smoker	330 (82.5)	167 (83.2)	163 (82.8)	(χ2)$p=0.917$
	Smoker	33 (8.3)	18 (8.9)	15 (7.6)	
	Ex-smoker	37 (9.2)	18 (8.9)	19 (9.6)	
Comorbidities	None except diabetes	214 (53.5)	118 (58.1)	96 (48.7)	(FE)$p=0.199$
	Hypertension	128 (32.0)	58 (28.6)	70 (35.5)	
	Heart disease	8 (2.0)	2 (1.0)	6 (3.0)	
	Thyroid diseases	18 (4.5)	8 (3.9)	10 (5.1)	
	Allergic diseases	10 (2.5)	7 (3.4)	3 (1.5)	
	Others	22 (5.5)	10 (4.9)	12 (6.1)	
Type of diabetes	Don't know	64 (16.0)	30 (14.8)	34 (17.3)	(χ2)$p=0.810$
	Type 1	68 (17.0)	35 (17.2)	33 (16.8)	
	Type2	268 (67.0)	138 (68.0)	130 (66.0)	
Duration since diabetes diagnosis	Less than 1 year	31 (7.8)	19 (9.4)[a]	12 (6.1)[a]	(χ2)$p<0.001$*
	1–2 years	60 (15.0)	43 (21.2)[a]	17 (8.6)[b]	
	3–5 years	81 (20.3)	43 (21.2)[a]	38 (19.3)[a]	
	6–10 years	90 (22.5)	44 (21.7)[a]	46 (23.4)[a]	
	More than 10 years	138 (34.5)	54 (26.6)[a]	84 (42.6)[b]	
Family history of diabetes	No	103 (25.8)	49 (24.1)	54 (27.4)	(χ2)$p=0.394$
	Yes	297 (74.3)	154 (75.9)	143 (72.6)	

*Statistically significant ($p<0.05$). χ^2: Chi-square test. FE: Fisher Exact test; Each subscript letter denotes a subset of categories whose column proportions do not differ/differ significantly from each other at the 0.05 level using the Bonferroni test

Table 3 Self-efficacy, well-being, and quality of life among patients with diabetes according to their glycemic control

Variables		Total ($n=400$)	Controlled ($n=203$)	Uncontrolled ($n=197$)	*p*-value
Self-efficacy	Median (Q1-Q3)	42.0 (30.2–52.0)	47 (34–54)	39 (30–46)	(W)$p<0.001$*
Self-efficacy classification	High self-efficacy n(%)	209 (52.3)	124 (61.1)	85 (43.1)	(χ2)$p<0.001$*
	Low self-efficacy n(%)	191 (47.8)	79 (38.9)	112 (56.9)	
Well-being	Median (Q1-Q3)	68 (52–80)	72 (52–80)	68 (52–80)	(W)$p=0.175$
Well-being classification	Good well-being n(%)	314 (78.5)	164 (80.8)	150 (76.1)	(χ2)$p=0.439$
	Suboptimal mental health n(%)	71 (17.8)	31 (15.3)	40 (20.3)	
	Probable depression n(%)	15 (3.8)	8 (3.9)	7 (3.6)	
Quality of life Median (Q1-Q3)	Physical domain	71.4(53.3–82.1)	75(60.7–85.7)	67.8 (50-82.1)	(W)$p<0.001$*
	Psychological domain	70.8(54.1–79.1)	75 (58.3–83.3)	62.5(50-79.1)	(W)$p<0.001$*
	Social relations domain	75.0(58.3–83.3)	75 (66.6–85.4)	75 (85.3–83.3)	(W)$p=0.168$
	Environmental domain	71.8(59.3–84.3)	78.1(62.5–87.5)	68.7(59.3–84.3)	(W)$p=0.005$*

*Statistically significant ($p<0.05$). W: Mann-Whitney U test. χ^2: Chi-square test

importance of contextual factors in diabetes management strategies.

In this survey, nearly half of the participants were found to have uncontrolled DM. Similarly, Al-Rasheedi et al. [29] reported that more than three-fourths of the studied diabetic Saudi patients had uncontrolled DM. Moreover, Alsuliman et al. [30] conducted a meta-analysis to assess the pooled proportion of diabetes management in Saudi Arabia. This meta-analysis, which included studies conducted from 2006 to 2018, found that 77.7% of patients had inadequate glycemic control. In the current study, we applied a higher threshold to categorize patients as having controlled or uncontrolled diabetes, which may have contributed to the lower observed prevalence of uncontrolled DM. This high prevalence of uncontrolled DM findings underscores the critical importance of effective and novel diabetes management approaches like community engagement [31] and community-based interventions to effectively manage DM and reduce its complications [32].

The concept of self-efficacy, as defined by Bandura [10], underscores the pivotal role of individuals' belief in their capacity to accomplish tasks in managing DM effectively. Our study observed a significant difference in self-efficacy scores between diabetic patients with controlled and uncontrolled glycemic levels in bivariate analysis, however, in multivariable analysis this association was not retained. We speculate that the insignificant effect of self-efficacy in the developed logistic model can be due to the indirect effect of self-efficacy on mediators like treatment adherence or lifestyle modifications. Furthermore, a threshold effect may exist, where only a certain

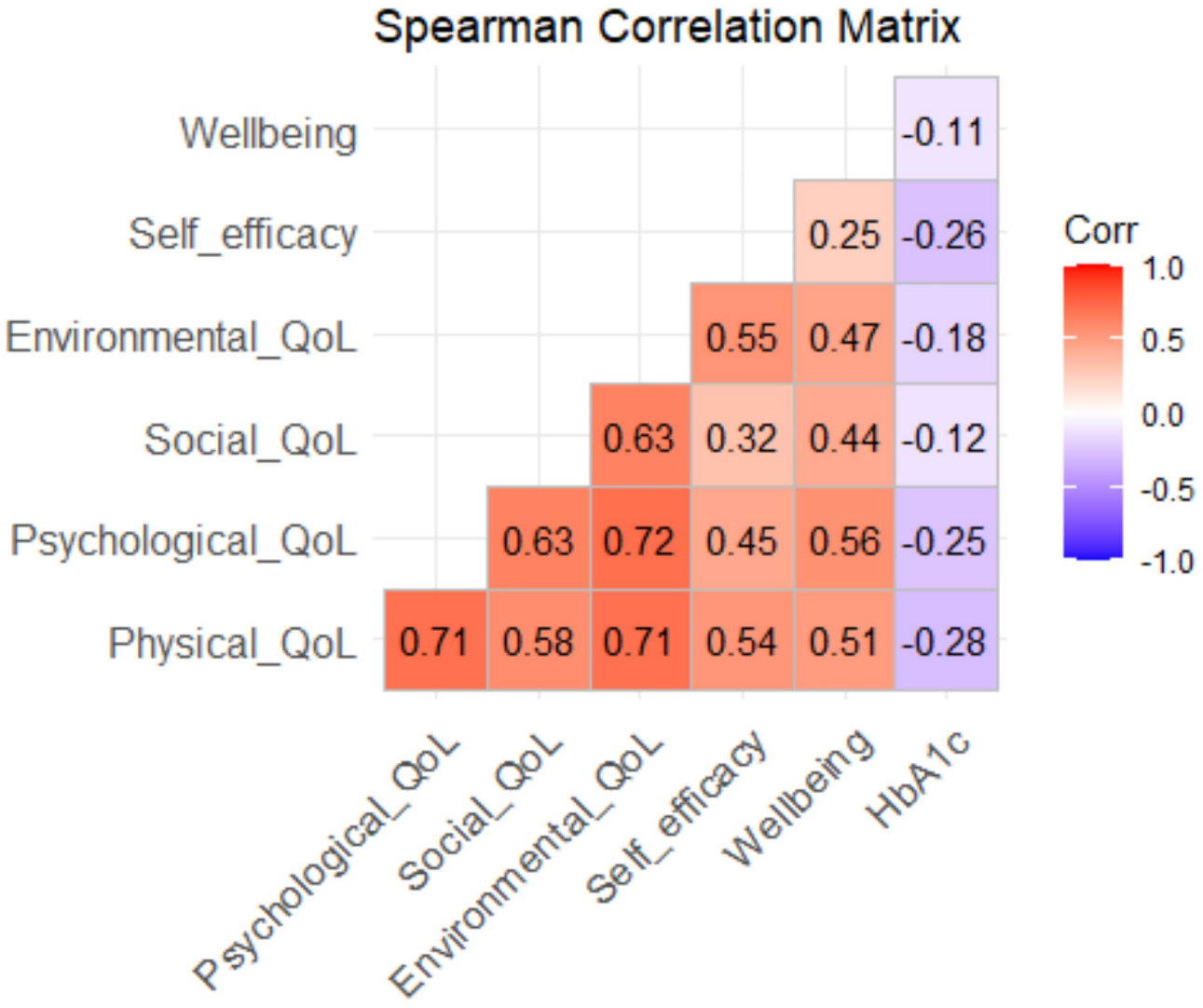

Fig. 1 Correlation between HbA1C, quality of life, well-being, and self-efficacy

Table 4 Predictors of controlled glycemia among patients with diabetes mellitus

Predictors	aOR	95% CI		*P* value
		Lower	Upper	
Urban residence	1.88	1.11	3.18	**0.017***
Duration of DM (1–2 years)	2.53	1.08	5.91	**0.032***
Duration of DM (3–5 years)	3.76	1.90	7.43	**< 0.001***
Duration of DM (6–10 years)	1.85	1.04	3.32	**0.036***
Duration of DM (> 10 years)	1.71	0.97	3.03	0.063
Physical domain of QOL score	1.02	1.01	1.01	**< 0.001***
Well-being score	0.98	0.97	1.00	0.095
High self-efficacy	1.38	0.85	2.24	0.187
Constant	0.13			**< 0.001***

*Statistically significant ($p < 0.05$). QOL: Quality of life, aOR: Adjusted odds ratio, CI: Confidence interval-reference categories are low self-efficacy, poor well-being, and rural residence

level of self-efficacy can meaningfully influence glycemic management. This finding is consistent with Sarkar et al. [33], which similarly demonstrated a positive association between glycemic control and self-efficacy among diabetic patients. Moreover, Huayanay-Espinoza et al. [16] reported lower median self-efficacy scores among patients with DM, who were less likely to feel empowered to achieve goals related to their disease. This suggests that individuals who can effectively manage their blood glucose levels are more likely to feel confident in their ability to control their condition.

Examining well-being among diabetic patients revealed that 17.8% have a suboptimal mental condition and 3.8% have probable depression based on the WHO-5 wellbeing index. This finding aligns with previous research and highlights the importance of prioritizing mental health in diabetes management. A systematic review by Nouwen et al. [34] concluded that individuals with diabetes

had a significantly increased risk of developing depression compared to those without diabetes. In contrast to self-efficacy, our study did not find significant differences in well-being between controlled and uncontrolled diabetic patients. While DM can impact mental health and overall well-being, the relationship between glycemic control and well-being is complex and multifactorial. Similarly, many studies did not find a significant association between well-being scores and HbA1C, suggesting that factors other than glycemic control, such as social support, coping mechanisms, and comorbidities, may play significant roles in determining well-being outcomes [35, 36].

Regarding QoL, controlled diabetic patients generally have higher median scores across physical, psychological, and environmental domains of QoL compared to uncontrolled patients. Specifically, the physical domain was identified as a significant predictor of diabetes control, indicating that a one-unit increase in the physical QoL score was associated with a 2% higher likelihood of achieving glycemic control. Acute exercise sessions and regular physical activity can affect insulin function. They enhance muscle glucose uptake by up to fivefold. Furthermore, following exercise, glucose uptake remains elevated for approximately two hours [37, 38]. Similarly, other studies found that low QoL among diabetic patients was associated with poor metabolic outcomes [16, 29]. Maintaining glycemic control is associated with a reduced risk of diabetes-related complications, which exhibit a positive impact on various aspects of QoL [5].

Furthermore, our study identified urban residence as significant predictor of good glycemic control. Urban residence is often associated with better access to healthcare resources, including diabetes education, specialized clinics, and support services, which can facilitate improved glycemic control [39]. Additionally, we identified a significant association between the duration of DM and glycemic control. A similar finding was reported in Saudi Arabia [40], United States of America [41], Ethiopia [42], and Mexico [43]. Finally, the current work found that poor glycemic control was significantly predicted by increasing disease duration. This may be attributed to a decline in insulin secretion or an increase in insulin resistance among these patients [44]. With the short duration of the disease, early interventions and education programs prove crucial in establishing self-management behaviors and achieving glycemic targets [45].

Implication of this research

This reported high prevalence of uncontrolled DM emphasizes the need for targeted and comprehensive DM management strategies in Alqunfudah, Saudi Arabia. The study findings highlight the significant differences of self-efficacy and QoL across patients with controlled and uncontrolled diabetes. The study also highlights the importance of addressing mental health problems, as many diabetic patients exhibit suboptimal well-being and probable depression, suggesting the integration of mental health support into diabetes care. Additionally, the study identified physical QoL, urban residence, and disease duration as key determinants influencing glycemic control, suggesting that improving healthcare access in rural areas, improvement of physical QoL, and promoting early interventions may lead to better glycemic control.

Strengths and limitations

The study demonstrates several strengths that enhance the robustness of its findings. To our knowledge, this is the first study in Saudia Arabia that assessed QoL, well-being, and self-efficacy among diabetic patients. Moreover, the study used validated measurement tools, including the Arabic versions of established scales for assessing self-efficacy, well-being, and WHO-QoL. However, the study also has several limitations that need to be considered. Firstly, we deepened the online distribution of the questionnaire through non-random sampling methods through social media platforms. This may introduce selection bias, as it may exclude individuals who do not use or have access to these platforms. However, estimates by the Saudi Communications, Space, and Technology Commission (CST) revealed that 100% of the Saudi population uses the Internet which would reduce the selection bias. Second, the study was conducted in the Alqunfudah region, we did not include other regions in Saudi Arabia, which would limit the generalizability of the findings to the broader population of patients. Third, as we used a cross-sectional design, the study cannot establish any causal relationships between the studied variables and glycemic control. Finally, we did not perform subgroup analysis by diabetes type. The small sample size for type 1 diabetes limits the power of such comparisons. Future studies with larger sample sizes may benefit from considering type of DM as a potential modifier of outcomes.

Conclusions

This study found that nearly half of the participants had uncontrolled DM. The controlled diabetic patients exhibited significantly higher self-efficacy and QoL scores. Among diabetic patients, a considerable proportion had suboptimal well-being and probable depression with no significant differences between controlled and uncontrolled diabetic patients. Physical QoL, residence, and duration of DM were the main predictors of DM control. These findings underscore the importance of holistic approaches to DM care that prioritize not only glycemic control but also self-efficacy, QoL, and well-being. Patient-centered interventions and community

engagement would address individual needs, enhance self-efficacy, provide psychosocial support, and optimize access to healthcare resources for diabetic patients in Alqunfudah, Saudi Arabia. Additional research is necessary to investigate factors affecting diabetes management and to create targeted interventions that meet the diverse needs of diabetic populations.

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12902-025-01894-4.

Supplementary Material 1

Acknowledgements
The author extends their appreciation to the Deanship of Research and Graduates studies at King Khalid University for funding this work through small under grant number group research RGP1/180/45.

Author contributions
All authors contributed to data analysis, drafting, or revising the article, gave final approval of the version to be published, agreed to the submitted journal, and agreed to be accountable for all aspects of the work.Conceptualization, S.A.A, R.M.G and F.H.A.; methodology, A.Kh.A and R.M.G.; software, F.A.A.; validation, A.S.A. formal analysis, A.I.A and R.M.G; investigation B.M.A.; resources, S.M.A.; data curation, A.S.A.; writing—original draft preparation, O.A.A. and R.M.G; writing—review and editing, A.A.Al. and R.M.G; visualization, M.A.Al and R.M.G.; supervision, R.M.G.

Funding
This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Data availability
Data is availble upon request by emailing the corresponding author.

Declarations

Ethics approval and consent to participate
Ethical Approval number: for this study was obtained from the King Khalid University Research Ethics Committee (IRB: ECM#2023-3105).

Competing interests
The authors declare no competing interests.

Consent to participate
Not Applicable.

Clinical trial number
Not Applicable.

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Received: 30 October 2024 / Accepted: 4 March 2025
Published online: 07 April 2025

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