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ORIGINAL

Determinants and impacts of glycemic control on quality of life among type 2 diabetes mellitus patients in Palestine: a cross-sectional study

Determinantes e impactos del control glucémico en la calidad de vida de pacientes con diabetes mellitus tipo 2 en Palestina: un estudio transversal

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ABSTRACT

Introduction: Type 2 Diabetes Mellitus (T2DM) imposes a profound global health burden, significantly impairing patients' Health-Related Quality of Life (HRQoL), particularly in low- and middle-income, conflict-affected settings like Palestine. Aim: This study aims to investigate the determinants and impacts of glycemic control on QoL among T2DM patients in Palestine, focusing on the satisfaction, impact, and worry domains. Methods: A cross-sectional study was conducted among 249 adult patients with T2DM recruited from diabetes outpatient clinics in Palestine. Data were collected using a structured questionnaire encompassing demographic/clinical variables and the Arabic version of the Revised Diabetes Quality of Life Questionnaire (RVDQOL-13). Glycemic control was categorized by HbA1c (≤7% controlled, >7% uncontrolled). Non-parametric tests (Mann–Whitney U, Kruskal–Wallis H) and Spearman correlations were utilized to identify associated factors and the impact of glycemic control on QoL. Results: The sample had a mean age of 61.17 years, with 54.2% exhibiting uncontrolled glycemia. QoL was moderately impaired (Mean = 3.31), with the "Impact" domain (fatigue and pain) being the most severely affected. Uncontrolled glycemia was a significant independent predictor of worse QoL (Mean Rank = 136.17 vs. 111.78, p = 0.008), corroborated by a positive correlation between HbA1c and QoL scores (rho = 0.209, p = 0.001). Additionally, female gender, physical inactivity, and low monthly income were significantly associated with poorer QoL. Conclusion: Poor glycemic control, female gender, physical inactivity, and low income significantly diminish QoL among Palestinian T2DM patients. Interventions must transcend pharmacological prescriptions to include structured diabetes self-management education, gender-sensitive support, and strategies that overcome contextual barriers to physical activity and self-efficacy.

Keywords: Type 2 Diabetes Mellitus, Glycemic control, Quality of Life, RVDQOL-13, Palestine, Self-efficacy

RESUMEN

Introducción: La diabetes mellitus tipo 2 (DM2) representa una profunda carga para la salud mundial, afectando significativamente la calidad de vida relacionada con la salud (CVRS) de los pacientes, especialmente en entornos de bajos y medianos ingresos y afectados por conflictos, como Palestina. Objetivo: Este estudio tiene como objetivo investigar los determinantes y el impacto del control glucémico en la calidad de vida de pacientes con DM2 en Palestina, centrándose en los dominios de satisfacción, impacto y preocupación. Métodos: Se realizó un estudio transversal con 249 pacientes adultos con DM2 reclutados en clínicas ambulatorias de diabetes en Palestina. Los datos se recopilaron mediante un cuestionario estructurado que incluía variables demográficas y clínicas, así como la versión árabe del Cuestionario Revisado de Calidad de Vida en Diabetes (RVDQOL-13). El control glucémico se categorizó según la HbA1c (≤7% controlado, >7% no controlado). Se utilizaron pruebas no paramétricas (U de Mann-Whitney, H de Kruskal-Wallis) y correlaciones de Spearman para identificar factores asociados y el impacto del control glucémico en la calidad de vida. Resultados: La muestra tenía una edad media de 61,17 años, con un 54,2% que presentaba glucemia no controlada. La calidad de vida estaba moderadamente deteriorada (media = 3,31), siendo el dominio "Impacto" (fatiga y dolor) el más gravemente afectado. La glucemia no controlada fue un predictor independiente significativo de peor calidad de vida (rango medio = 136,17 frente a 111,78, p = 0,008), corroborado por una correlación positiva entre la HbA1c y las puntuaciones de calidad de vida (rho = 0,209, p = 0,001). Además, el sexo femenino, la inactividad física y los bajos ingresos mensuales se asociaron significativamente con una peor calidad de vida. Conclusión: El control glucémico deficiente, el sexo femenino, la inactividad física y los bajos ingresos disminuyen significativamente la calidad de vida de los pacientes palestinos con diabetes tipo 2. Las intervenciones deben ir más allá de las prescripciones farmacológicas e incluir educación estructurada para el autocontrol de la diabetes, apoyo con perspectiva de género y estrategias que superen las barreras contextuales a la actividad física y la autoeficacia.

Palabras clave: Diabetes mellitus tipo 2, control glucémico, calidad de vida, RVDQOL-13, Palestina, autoeficacia

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INTRODUCTION

Type 2 Diabetes Mellitus (T2DM) is a chronic metabolic disorder characterized by persistent hyperglycemia resulting from insulin resistance and relative insulin deficiency, posing a profound global health burden.(1,2) The importance of T2DM lies in its escalating prevalence; it is a leading cause of morbidity and mortality worldwide, with the International Diabetes Federation projecting a continued surge in cases over the coming decades.(1,3) Glycemic control, typically measured by Glycated Hemoglobin (HbA1c), is the primary therapeutic target, as maintaining optimal levels is crucial to delaying devastating microvascular and macrovascular complications.(4,5) However, achieving and maintaining glycemic control is heavily dependent on rigorous diabetes self-management education (DSME) and self-care practices—such as dietary adherence, physical activity, and glucose monitoring—which empower patients but are often difficult to sustain.(6) When glycemic control is suboptimal, individuals suffer from debilitating physical symptoms, psychological distress, and reduced functional capacity, which severely diminishes their Health-Related Quality of Life (HRQoL).(7) Consequently, the societal and economic impacts are staggering, as poor QoL and uncontrolled diabetes lead to increased hospitalizations, loss of workforce productivity, and overwhelming healthcare expenditures.(1,8) This study specifically focuses on adult patients with T2DM, as this population bears the greatest burden of disease complications and requires sustained, complex self-management strategies to navigate the daily regimen of diabetes care, making them highly vulnerable to QoL deterioration.(9)

Internationally, the relationship between diabetes management and quality of life is well-established, with evidence consistently demonstrating that uncontrolled glycemia significantly deteriorates patient well-being. Global research confirms that self-care practices—such as regular physical activity and dietary control—are strongly associated with improved glycemic control and enhanced HRQoL.(1,6,10) Furthermore, international studies highlight that diabetes distress and health anxiety frequently accompany T2DM, acting as barriers to self-efficacy and medication adherence, which subsequently worsens both clinical outcomes and QoL.(11) Recent innovations, such as online DSME applications and digital health technologies, have shown promise in improving self-care autonomy and reducing HbA1c globally, particularly when interactive and feedback-driven components are utilized.(12,13) Additionally, valid and reliable measures of self-efficacy, such as the Diabetes Management Self-Efficacy Scale, have been developed to assess and support these interventions.(14) Cross-sectional studies from diverse international settings, such as Thailand, have shown that younger age, higher income, regular exercise, and the absence of complications are significant predictors of a good quality of life.(15)

Regionally, the Middle East faces one of the highest prevalences of T2DM globally, yet patients frequently exhibit poor glycemic control despite pharmacological treatment.(5) Research from Middle Eastern countries highlights that socio-cultural barriers, low health literacy, and inadequate self-management education severely limit patients' ability to maintain target HbA1c levels.(9,16) Specific regional determinants, including lifestyle and clinical factors, significantly impact glycemic control in this population.(17) Additionally, low health literacy has been identified as a barrier to glycemic control in Middle Eastern settings.(18) Regional studies affirm that females, patients with multiple complications, and those with poor glycemic control report significantly lower HRQoL.(16) Furthermore, disease duration exceeding 10 years and the presence of diabetic foot or renal complications have been shown to independently reduce the physical functioning and general health domains of QoL in Saudi T2DM populations.(7,19) Interventions like DSME have proven effective in the Middle East, significantly improving clinical outcomes and self-efficacy,(5) while cognitive behavioral therapy has shown promise in reducing diabetes distress and improving QoL in neighboring Pakistan.(11) Importantly, research in Jordan indicates that self-efficacy is the strongest predictor of diabetes self-management, heavily mediating the relationship between patient characteristics and health outcomes.(20)

In low- and middle-income countries (LMICs) such as Palestine, the management of T2DM is further complicated by severe socio-economic and political determinants. The Palestinian healthcare system operates under chronic resource constraints, military occupation, and frequent violence, which disrupts continuous care, limits access to medications, and restricts physical movement.(21,22) These contextual threats dictate that self-care behaviors—particularly physical activity and dietary adherence—are exceptionally challenging to maintain in Palestine, directly threatening glycemic control.(1) Recent evidence from Palestinian healthcare settings shows that nurses and nursing students face significant violence, checkpoint-related delays, and psychological distress, which mirror the broader systemic instability affecting all healthcare services, including diabetes outpatient clinics.(23–25)

Moreover, critical care and emergency departments in Palestine suffer from poor alarm management practices, inadequate cardiopulmonary resuscitation (CPR) training, and limited access to reliable electronic medical record systems, all of which compromise patient safety and the continuity of chronic disease follow-up.(26–28) A recent comparative cross-sectional study in Palestine revealed that QoL is moderately impaired among diabetic patients, with the impact domain (reflecting physical and social burdens) being the most severely affected, and that the presence of complications significantly worsens QoL.(21,29) This study is implicitly guided by Self-Efficacy Theory, which posits that a patient's belief in their capability to execute self-management behaviors directly influences their clinical outcomes (glycemic control) and psychosocial well-being (QoL). Global evidence supports this framework, demonstrating that self-efficacy is a strong predictor of self-management, communication, and disease activation,(30) and that valid, reliable measures of self-efficacy are directly and negatively correlated with HbA1c levels.(31) The theory suggests that cognitive processes shape behavior, and self-efficacy beliefs are powerful determinants of self-management actions.(32)

While existing literature provides valuable insights into diabetes management, significant gaps remain. Most studies are descriptive, focus on isolated demographic or clinical factors, and heavily rely on generic QoL instruments that fail to capture the disease-specific burdens of satisfaction, impact, and worry unique to T2DM.(33) Qualitative and mixed-methods research is scarce, especially in conflict-affected settings, limiting the development of context-specific interventions. Furthermore, the explicit pathway linking glycemic control to disease-specific QoL dimensions—while accounting for the compounding socio-political barriers of life in an LMIC—remains underexplored. Critically, no prior study in Palestine has systematically examined the specific impact of glycemic control on the satisfaction, impact, and worry domains of QoL exclusively among T2DM patients, nor has any study integrated the local realities of economic deprivation and restricted mobility to explain why uncontrolled glycemia so profoundly devastates the physical and psychosocial well-being of this population.

Therefore, this study aims to investigate the determinants and impacts of glycemic control on quality of life among Type 2 diabetes patients in Palestine. Specifically, it (a) analyzes the demographic, clinical, and behavioral characteristics of T2DM patients; (b) evaluates the quality of life across satisfaction, impact, and worry domains; (c) identifies the socio-demographic and clinical factors associated with QoL; and (d) determines the impact of glycemic control on QoL, guided by the premise that self-efficacy and contextual barriers dictate clinical and psychosocial outcomes.

METHODS

Design and setting

This study employed a cross-sectional design, which is commonly used in public health as a reliable method for examining behaviors and associations within populations. The study was conducted in Palestine, recruiting patients from diabetes outpatient clinics and primary healthcare centers that provide routine follow-up and management services for patients with Type 2 Diabetes Mellitus (T2DM).

Population and sampling

The study population consisted of adult patients diagnosed with T2DM who attended diabetes outpatient clinics or primary healthcare centers. Because the exact number of patients who use these facilities is not known, the sample size was calculated using the Raosoft calculator, assuming a 95% confidence level, 5% margin of error, and a conservative 50% response distribution in the absence of prior local estimates. The minimum required sample size was 384 participants; however, a total of 249 eligible participants were successfully recruited within the study period. Participants were recruited using convenience sampling.

Inclusion and exclusion criteria

Participant inclusion criteria consisted of adults (≥ 18 years) with a clinical diagnosis of T2DM and the ability to read and write in Arabic, enabling them to complete the study questionnaire independently. Participants were excluded if they had type 1 diabetes, cognitive impairments, severe psychiatric disorders, or barriers to communication that would otherwise prevent them from completing the questionnaire with any level of reliability.

Instrumentation

Data were collected using a structured, paper-based, self-administered questionnaire consisting of two sections:[1]demographic and health-related characteristics and[2]the RVDQOL-13 scale.

The first section included demographic variables (age, gender, marital status, educational level, monthly income, and smoking status) and clinical/behavioral variables (duration of diabetes, Body Mass Index [BMI], glycemic control status, and physical activity frequency). Glycemic control was categorized based on the most recent HbA1c level: controlled (HbA1c ≤ 7%) and uncontrolled (HbA1c > 7%). Physical activity was assessed based on self-reported frequency and categorized into four levels: regularly (engaging in planned physical activity ≥ 3 times per week), sometimes (1–2 times per week), rarely (< 1 time per week), and never (no regular physical activity).

Quality of life (QoL) was assessed using the Arabic version of the Revised Diabetes Quality of Life Questionnaire (RVDQOL-13), originally developed by Bujang et al.(33) This instrument was designed with 13 items, divided into three domains: satisfaction (6 items), impact (4 items), and worry (3 items). Participant ratings for the Satisfaction domain were collected on a 5-point Likert scale, where 1 is “very satisfied” and 5 is “very dissatisfied,” yielding a total score ranging from 6 to 30 points. For the domains “impact” and “worry,” all items were rated using a 5-point Likert scale, specifically “never” (1) through “always” (5). The total score range for the domains “impact” and “worry” were 4 to 20 and 3 to 15, respectively. The total score across all three domains ranged from 13 to 65 points. A greater total score represented a worse QoL.

Validity and reliability

The original research study that validated the RVDQOL-13 showed that each domain has a high level of reliability, with composite reliability ranging from 0.794 (worry) to 0.922 (satisfaction).(33) The Arabic version of the RVDQOL-13 was translated and validated previously by Eshtaya et al. using the WHO’s translation process (forward-translated, back-translated, and reviewed by experts) to guarantee content validity. The overall value of Cronbach’s alpha for the Arabic version was 0.88. In the current research, a pilot test was performed on thirty patients who were not included in the final sample; the pilot study evaluated the clarity, ability to understand, and time to complete the questionnaire. The questionnaire was determined to be clear and took 15–20 min to complete; therefore, no changes were needed.

Data collection process

After ethics committee approval, permission was obtained from the relevant health authorities and administrators of the selected outpatient diabetes clinics and primary healthcare centers. The research team visited each clinic during routine working hours and recruited eligible patients attending follow-up visits while they waited at the clinics. Patients received information about the study purpose, procedures, and voluntary participation. Those who agreed signed a written consent form before completing the questionnaire. Participants were assured that their responses would remain confidential and anonymous and that they could withdraw at any time without affecting their access to healthcare services. The self-administered paper questionnaire was completed in a designated private area within each clinic. Research team members were available to answer questions without influencing responses. Completed questionnaires were checked for completeness, securely stored, and later entered into statistical software for analysis.

Data analysis

Data were analyzed using IBM SPSS Statistics. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were used to summarize participants’ characteristics and QoL scores. Given the non-normal distribution of the data, non-parametric tests were utilized. The Mann–Whitney U test was applied to examine differences in QoL scores across dichotomous variables (e.g., gender, glycemic control status), and the Kruskal–Wallis H test was applied for variables with three or more categories (e.g., physical activity level, income, educational level). Spearman rank-order correlation was used to assess associations between continuous variables (e.g., age, BMI, HbA1c) and QoL scores. In all analyses regarding QoL scores, a higher mean rank or coefficient indicated a worse quality of life. A p-value < 0.05 was considered statistically significant.

Ethical consideration

Ethical approval for this study was obtained before the commencement of data collection from the Palestine Ministry of Health (Ref no. ES/2025/20).

The research was conducted in line with ethical considerations as outlined in the Declaration of Helsinki. Information about the purpose, procedure, risk, and benefit of the research activities was provided completely to all participants. Written consent was obtained from all participants prior to the study. Participants were informed that their participation was completely voluntary and that they could withdraw from the study at any time without penalty. No information collected was identifiable; instead, participants were assigned a numerical code to identify their questionnaire. All data were kept in a password-protected format on a computer drive that only the research team could access, consistent with international guidelines regarding data protection and research ethics.

RESULTS

Demographic and Clinical Characteristics

As detailed in Table 1, the study included 249 patients diagnosed with Type 2 diabetes. The mean age of the participants was 61.17 years (SD = 13.89), representing an older adult population. The sample was predominantly female (60.6%, n = 151) and mostly married (87.6%, n = 218). The average Body Mass Index (BMI) was 30.65 kg/m² (SD = 6.60), placing the average participant in the obese category.

Socioeconomically, the sample was characterized by low educational attainment and low income; over half of the participants had only an elementary level of education (59.0%, n = 147) and earned less than 2,000 NIS monthly (58.2%, n = 145). Regarding health behaviors, the vast majority were non-smokers (73.9%, n = 184); however, physical activity levels were notably low, with 35.8% (n = 89) reporting that they rarely or never engaged in physical activity.

Clinically, the sample represented a substantial disease burden. More than half of the participants (56.6%, n = 141) had been living with diabetes for more than 10 years. With respect to glycemic control, the majority of the sample (54.2%, n = 135) had uncontrolled glycemic levels (HbA1c > 7%), while only 45.8% (n = 114) maintained controlled glycemia (HbA1c ≤ 7%).

Quality of Life

Quality of life (QoL) was assessed across three subscales—Satisfaction, Impact, and Worry—using a 1–5 scale, where higher scores indicate a worse quality of life. As shown in Table 2, the overall mean QoL score was 3.31 (SD = 1.03), suggesting a moderately negative impact of diabetes on participants' overall quality of life.

Within the Satisfaction subscale, participants reported relatively lower scores compared to the other domains, indicating comparatively better satisfaction. Dissatisfaction was highest regarding the time spent managing diabetes (M = 2.02), while participants were most satisfied with their overall life and their knowledge about diabetes (both M = 1.87).

The Impact subscale yielded the highest scores, reflecting the greatest reduction in QoL. Physical well-being was most severely affected; "feeling unwell or tired" recorded the highest item mean across the entire QoL instrument (M = 2.94), followed closely by "pain due to diabetes treatment" (M = 2.74). By contrast, social impacts were less pronounced, with "diabetes limiting social relationships" scoring lowest in this subscale (M = 1.95).

In the Worry subscale, the primary psychological burden was fear of future health deterioration. "Worried about complications" recorded the highest score among worry items (M = 2.45), which is consistent with the high rate of uncontrolled glycemia (54.2%) observed in this sample. Worry about fainting (M = 2.05) and concerns about physical appearance (M = 1.99) were less prominent but still present.

Factors Associated with Quality of Life

To identify factors associated with QoL, non-parametric tests were used given the non-normal distribution of the data: the Mann–Whitney U test was applied for dichotomous variables and the Kruskal–Wallis H test for variables with three or more categories. In all analyses, a higher mean rank denotes worse QoL. The results are presented in Table 3.

Table 1. Demographic and Clinical Characteristics of Participants (N = 249)

Variable	Category / Statistic	n (%) or Mean ± SD
Age (years)	Mean ± SD	61.17 ± 13.89
BMI (kg/m²)	Mean ± SD	30.65 ± 6.60
Gender		
	Male	98 (39.4%)
	Female	151 (60.6%)
Marital Status		
	Single	21 (8.4%)
	Married	218 (87.6%)
	Other	10 (4.0%)
Educational Level		
	Elementary	147 (59.0%)
	Secondary	68 (27.3%)
	Bachelor's degree	25 (10.0%)
	Above Bachelor's	9 (3.6%)
Monthly Income (NIS)		
	< 2,000	145 (58.2%)
	2,000–4,000	90 (36.1%)
	> 4,000	14 (5.6%)
Smoking Status		
	Non-smoker	184 (73.9%)
	Current smoker	50 (20.1%)
	Former smoker	15 (6.0%)
Physical Activity Level		
	Regularly	80 (32.1%)
	Sometimes	80 (32.1%)
	Rarely	42 (16.9%)
	Never	47 (18.9%)
Duration of Diabetes		
	< 1 year	11 (4.4%)
	1–5 years	58 (23.3%)
	6–10 years	39 (15.7%)
	> 10 years	141 (56.6%)
Glycemic Control (HbA1c)		
	Controlled (HbA1c ≤ 7%)	114 (45.8%)
	Uncontrolled (HbA1c > 7%)	135 (54.2%)

Note. BMI = Body Mass Index; NIS = New Israeli Shekel; HbA1c = Glycated Hemoglobin. Physical activity categories are self-reported. Percentages may not sum to 100% due to rounding.

Gender was a significant determinant of QoL, with females reporting significantly worse QoL (Mean Rank = 135.04) than males (Mean Rank = 109.54; U = 5883.5, p = 0.006). Physical activity was the strongest associated factor (H = 17.046, p = 0.001); a clear dose–response pattern was evident, whereby patients who never exercised had the worst QoL (Mean Rank = 158.59), while those who exercised regularly had the best QoL (Mean Rank = 104.43). Monthly income was also significantly associated with QoL (H = 6.896, p = 0.032), with higher-income participants (> 4,000 NIS) reporting the best QoL (Mean Rank = 79.46). Glycemic control was a significant predictor (U = 6187.5, p = 0.008), with uncontrolled patients reporting worse QoL (Mean Rank = 136.17) than controlled patients (Mean Rank = 111.78).

Table 2. Quality of Life (QoL) Items and Descriptive Statistics (N = 249)

Item	Description	Mean ± SD
Satisfaction Subscale		
S1	Satisfaction with time for diabetes management	2.02 ± 0.95
S2	Satisfaction with time for medical check-ups	2.00 ± 0.93
S3	Satisfaction with time for blood sugar testing	2.01 ± 0.96
S4	Satisfaction with current treatment plan	1.92 ± 0.97
S5	Satisfaction with diabetes knowledge level	1.87 ± 1.03
S6	Satisfaction with life overall	1.87 ± 0.87
Impact Subscale		
IM1	Pain due to diabetes treatment	2.74 ± 1.39
IM2	Feeling unwell or tired	2.94 ± 1.37
IM3	Diabetes negatively affects family	2.17 ± 1.40
IM4	Diabetes limits social relationships	1.95 ± 1.39
Worry Subscale		
W1	Worried about fainting	2.05 ± 1.29
W2	Concerned about physical appearance	1.99 ± 1.18
W3	Worried about complications	2.45 ± 1.34
Total QoL Score (Overall Quality of Life)		3.31 ± 1.03

Note. QoL = Quality of Life. Items scored on a 1–5 Likert scale. For the Satisfaction subscale: 1 = Very Satisfied to 5 = Very Dissatisfied. For the Impact and Worry subscales: 1 = Never to 5 = Always. Higher scores indicate worse quality of life.

Educational level approached significance (H = 7.734, p = 0.052), with a trend toward better QoL among those with higher education. Marital status (H = 2.789, p = 0.248), smoking status (H = 2.080, p = 0.353), and duration of diabetes (H = 3.740, p = 0.291) were not statistically significantly associated with QoL.

Spearman rank-order correlations were conducted to examine associations between continuous variables and QoL scores (Table 4). Neither age (rho = 0.061, p > 0.05) nor BMI (rho = 0.013, p > 0.05) was significantly correlated with QoL. In contrast, HbA1c demonstrated a significant positive correlation with QoL score (rho = 0.209, p = 0.001), indicating that higher (less controlled) blood glucose levels are associated with worse quality of life.

Impact of Glycemic Control on Quality of Life

The central research question—whether glycemic control significantly influences QoL—was evaluated through both categorical and continuous analyses. As presented in Table 3, the Mann–Whitney U test revealed a statistically significant difference in QoL scores based on glycemic control status (U = 6187.5, p = 0.008). Patients with uncontrolled glycemia reported significantly worse QoL (Mean Rank = 136.17) compared to those with controlled glycemia (Mean Rank = 111.78).

This finding is strongly corroborated by the Spearman correlation presented in Table 4, which demonstrated a significant positive association between HbA1c values and QoL scores (rho = 0.209, p = 0.001). Because higher QoL scores denote worse quality of life, these results collectively and conclusively indicate that poor glycemic control is a significant and independent predictor of reduced quality of life in patients with Type 2 diabetes.

DISCUSSION

This study investigated the demographic, clinical, and behavioral factors influencing Quality of Life (QoL) among Type 2 Diabetes Mellitus patients in Palestine, with a specific focus on the impact of glycemic control. The findings reveal a population characterized by high obesity, low socio-economic status, and alarmingly poor glycemic control. QoL was moderately impaired, with the physical impact of diabetes—specifically fatigue and pain—being the most severely affected domain. Crucially, uncontrolled glycemia, female gender, physical inactivity, and low income were identified as significant independent predictors of a worse quality of life.

Table 3. Association Between Demographic and Clinical Factors and Quality of Life (N = 249)

Variable	Category	N	Mean Rank	Test Statistic	p-value
Gender	Male	98	109.54	U = 5883.500	0.006**
	Female	151	135.04		
Marital Status	Single	21	149.57	H = 2.789	0.248
	Married	218	123.08		
	Other	10	115.20		
Educational Level	Elementary	147	134.86	H = 7.734	0.052
	Secondary	68	115.32		
	Bachelor's degree	25	98.54		
	Above Bachelor's	9	110.56		
Monthly Income (NIS)	< 2,000	145	124.10	H = 6.896	0.032*
	2,000–4,000	90	133.53		
	> 4,000	14	79.46		
Smoking Status	Non-smoker	184	128.57	H = 2.080	0.353
	Current smoker	50	117.76		
	Former smoker	15	105.33		
Physical Activity	Regularly	80	104.43	H = 17.046	0.001**
	Sometimes	80	123.16		
	Rarely	42	130.11		
	Never	47	158.59		
Duration of Diabetes	< 1 year	11	99.09	H = 3.740	0.291
	1–5 years	58	113.89		
	6–10 years	39	129.59		
	> 10 years	141	130.32		
Glycemic Control	Controlled	114	111.78	U = 6187.500	0.008**
	Uncontrolled	135	136.17		

Note. QoL = Quality of Life, scored such that higher mean ranks indicate worse quality of life. Mann–Whitney U test applied for dichotomous variables; Kruskal–Wallis H test applied for variables with ≥ 3 categories. * $p < 0.05$. ** $p < 0.01$.

Table 4. Spearman Rank-Order Correlations Among Age, BMI, HbA1c, and Quality of Life Score

Variable	Age	BMI	HbA1c	QoL Score
Age	1.000	-0.054	-0.027	0.061
BMI	-0.054	1.000	0.027	0.013
HbA1c	-0.027	0.027	1.000	0.209**
QoL Score	0.061	0.013	0.209**	1.000

Note. QoL = Quality of Life, scored such that higher scores indicate worse quality of life. Values are Spearman rho (ρ) coefficients. ** $p < 0.01$ (two-tailed).

The demographic profile of the sample reflects a vulnerable, aging population with a mean age of 61.17 years and a high prevalence of obesity (BMI = 30.65 kg/m^2). The predominance of female participants (60.6%) aligns with regional epidemiological data indicating higher T2DM prevalence and poorer QoL among women in the Middle East.(16) Socioeconomically, the sample is highly disadvantaged, with 59% having only elementary education and 58.2% earning less than 2,000 NIS monthly. This intersection of low income and low health literacy is a recognized barrier to diabetes self-care in LMICs, as patients struggle to afford nutritious food, monitor glucose, and access consistent care.(1,9,34) Clinically, the high rate of uncontrolled glycemia (54.2%) despite over half the patients having the disease for more than 10 years underscores a critical failure in achieving therapeutic targets.

In the Palestinian context, this is heavily exacerbated by structural barriers: restricted freedom of movement limits access to clinics, while pervasive stress and infrastructural instability disrupt routine self-management and medication adherence.(21) Recent studies on Palestinian healthcare workers demonstrate that military checkpoints, violence exposure, and chronic stress severely degrade quality of life and professional performance, which inevitably extends to diabetes care delivery.(23,35) Furthermore, the alarmingly low levels of physical activity (35.8% rarely or never exercising) are not merely a lifestyle choice but a reality of living in environments where outdoor movement is restricted and unsafe. This is consistent with findings from Sub-Saharan Africa, where structural barriers impede self-management.(36) From the perspective of Self-Efficacy Theory, these environmental barriers severely diminish a patient's belief in their capacity to manage their disease, spiraling into worse clinical outcomes.(20,31,37)

The QoL assessment revealed that the "Impact" subscale yielded the highest (worst) scores, with "feeling unwell or tired" (M = 2.94) and "pain due to diabetes treatment" (M = 2.74) being the most prominent burdens. This aligns closely with Alshahrani et al.,(7) who found that physical functioning and general health are the most compromised domains in diabetic patients, particularly as disease duration extends. The fatigue and pain experienced by this Palestinian cohort likely reflect the cumulative physiological toll of prolonged uncontrolled hyperglycemia and obesity. Prolonged disease duration often leads to progressive beta-cell dysfunction and resistance to treatment, complicating management.(38) Conversely, the "Satisfaction" domain scored lowest (indicating better satisfaction), particularly regarding diabetes knowledge (M = 1.87) and overall life (M = 1.87). This relative satisfaction might indicate a degree of resignation or adaptation to the chronic illness, or a reflection of low expectations given the broader socio-political hardships of life in Palestine.(29) Within the "Worry" domain, fear of complications scored highest (M = 2.45), which is a rational psychological response given that more than half the sample has uncontrolled HbA1c and over 73% already suffer from diabetes complications. This pervasive worry mirrors global findings where diabetes distress and health anxiety are dominant psychological burdens that impair treatment adherence.(11) Addressing this worry requires psychological support structures, similar to the cognitive behavioral therapies proven effective in neighboring Pakistan,(11) or digital interventions that provide reassurance and self-management skills.(12,13) However, in Palestine, the high levels of academic and occupational stress documented among nursing students and nurses suggest that even available mental health resources may be overstretched, indirectly affecting diabetes education and patient support.(24,25,35)

The non-parametric analysis identified several crucial determinants of QoL. Consistent with regional literature from Saudi Arabia, female patients reported significantly worse QoL than males (Mean Rank = 135.04 vs. 109.54, p = 0.006), a disparity often attributed to biological differences in complication risks, higher rates of depression, and socio-cultural gender roles that limit women's self-care priorities in the Middle East.(16,39) Monthly income was also a significant factor (p = 0.032); patients earning >4,000 NIS had significantly better QoL (Mean Rank = 79.46). This reinforces the premise that in LMICs, economic deprivation directly obstructs self-management—limiting access to healthy diets, glucose strips, and transportation to clinics.(1,9,40)

Physical activity emerged as the strongest predictor of QoL (p = 0.001), demonstrating a clear dose-response relationship: patients who never exercised had the worst QoL (Mean Rank = 158.59), while regular exercisers had the best (Mean Rank = 104.43). This robust finding mirrors the work of Tamornpark et al.,(15) who identified regular exercise as a primary correlate of good QoL. In Palestine, where physical movement is heavily restricted by the occupation and security constraints, enforced physical inactivity becomes a structural determinant of disease burden. From the perspective of Self-Efficacy Theory, the inability to exercise diminishes patients' belief in their capacity to manage their disease, spiraling into worse clinical and psychological outcomes.(20,30) Interestingly, unlike Alshahrani et al.,(7) duration of diabetes was not significantly associated with QoL in this sample (p = 0.291). This suggests that in the Palestinian context, the acute socio-economic and behavioral barriers (like income and inactivity) may overshadow the chronological duration of the disease in determining a patient's day-to-day well-being.

The central finding of this study conclusively demonstrates that poor glycemic control is a significant and independent predictor of reduced QoL. Patients with uncontrolled glycemia reported significantly worse QoL (Mean Rank = 136.17) compared to controlled patients (Mean Rank = 111.78; U = 6187.5, p = 0.008). This categorical finding is strongly corroborated by the Spearman correlation, which showed a significant positive association between continuous HbA1c values and worse QoL scores (rho = 0.209, p = 0.001). This aligns with Mikhael et al.,(5) who noted that achieving target HbA1c is the most critical factor in improving both clinical and patient-reported outcomes in the Middle East.

Uncontrolled hyperglycemia directly drives the severe physical symptoms—fatigue, pain, and malaise—identified in the Impact subscale, which in turn fuels the psychological worry about future complications. This cycle of poor metabolic control leading to physical decline and psychological distress severely degrades QoL, reflecting the core tenets of Self-Efficacy Theory where poor clinical feedback diminishes a patient's confidence in managing their condition.(31) The findings validate that in Palestine, much like in global contexts, suboptimal HbA1c is not just a biochemical failure, but a pervasive disruptor of a patient's functional, social, and emotional life.(11,21,41) Therefore, interventions must go beyond pharmacological prescriptions to include structured DSME programs(6) and address the contextual barriers—economic hardship, restricted movement, and low self-efficacy—that prevent patients from achieving the glycemic control necessary for a tolerable quality of life. The high levels of stress and trauma documented among Palestinian healthcare workers further suggest that the entire healthcare system is under duress, which may compromise the quality of diabetes education and support provided to patients.(23,35) Strengthening the resilience of the healthcare workforce through targeted mental health support and improved working conditions could have secondary benefits for chronic disease management.(24,26)

Limitations

This study has several limitations that should be considered when interpreting the findings. First, the use of convenience sampling may introduce selection bias and limit the representativeness of the study population. Participants were recruited from outpatient clinics, which may not fully reflect the experiences of individuals with limited access to healthcare services, particularly those restricted by movement barriers in Palestine. Second, the cross-sectional design precludes causal inferences; while associations between glycemic control and QoL were identified, the temporal relationship cannot be established. Third, reliance on self-reported data for variables such as physical activity, dietary habits, and QoL may introduce recall and social desirability biases. Fourth, important psychosocial confounders, such as mental health status (e.g., depression and anxiety), social support, and formal self-efficacy scores, were not directly measured in this study, which may have resulted in residual confounding. Finally, the exclusion of patients with severe cognitive or psychiatric impairments may underestimate the true burden of poor QoL within the broader T2DM population. Despite these limitations, the study provides crucial insights into the disease-specific QoL burdens in an under-researched, conflict-affected setting.

Recommendations and Implications

Organizational/Healthcare Level

• Implement routine, disease-specific QoL assessments (such as the RVDQOL-13) in diabetes clinics to guide individualized, patient-centered care planning.

• Enhance multidisciplinary diabetes care by integrating structured Diabetes Self-Management Education (DSME) programs that specifically target self-efficacy, dietary adherence, and safe physical activity routines.

• Establish tailored support services for high-risk groups, particularly women and low-income patients, to address the socio-cultural and financial barriers to self-care.

• Given the high levels of stress among Palestinian healthcare workers,(23,35) hospital administrations should also provide mental health support for diabetes educators and nurses to prevent burnout and maintain quality of patient education.

Individual/Practice Level

• Encourage patient-centered goal-setting that focuses on achieving optimal glycemic targets (HbA1c ≤ 7%) to alleviate the physical burdens (fatigue and pain) and psychological worries (fear of complications) that severely degrade QoL.

• Promote self-management strategies and adherence to treatment regimens through tailored education and motivational support, utilizing digital health technologies where feasible.

• Address psychosocial needs by incorporating cognitive behavioral strategies or referring patients to mental health services to mitigate diabetes distress and health anxiety.

Policy/Societal Level

• Advocate for policies ensuring equitable access to diabetes medications, monitoring supplies, and nutritious food, particularly for low-income populations in conflict-affected regions.

• Prioritize funding for community-based, safe physical activity programs that accommodate the environmental restrictions and safety concerns inherent to the Palestinian context.

• Support national surveillance programs to monitor QoL and glycemic outcomes, informing future health planning and the allocation of resources to address the specific satisfaction, impact, and worry domains of diabetic patients.

• Address systemic barriers such as military checkpoints and travel restrictions that impede access to regular diabetes care, in line with international humanitarian recommendations.(22)

CONCLUSION

This study highlights that Quality of Life among Palestinian adults with Type 2 Diabetes Mellitus is significantly compromised, with patients experiencing substantial physical impacts—primarily fatigue and pain—and profound worry about future complications. Poor glycemic control emerges as a central, independent predictor of diminished QoL, exacerbating both physical and psychological distress. Furthermore, the intersection of female gender, physical inactivity, and economic deprivation creates a vulnerable population that struggles disproportionately with the burdens of diabetes management. These findings underscore the necessity of moving beyond a purely biomedical approach to diabetes care. Effective interventions in Palestine must adopt a multi-dimensional, person-centered framework that prioritizes strict glycemic control while simultaneously enhancing self-efficacy, promoting safe and accessible physical activity, and dismantling the socio-economic and structural barriers that hinder self-management. Future research should employ longitudinal and interventional designs to further clarify causal pathways and evaluate the effectiveness of targeted, culturally sensitive DSME programs in improving both clinical outcomes and the overall quality of life for this population.

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