Annals of Middle Eastern Medicine

ORIGINAL ARTICLE

Assessment of health-related quality of life among students with type 1 and type 2 diabetes at Taif University, Saudi Arabia: a cross-sectional study

Abdulmajeed M. Algethami[1], Muath A. Althomali[2*], Raghad A. Almutairi[2], Abdullah M. Alshanqiti[2], Ibrahim S. Aljuaid[2], Nedal M. Alqurashi[2], Rawan A. Almalki[2], Atheer J. Almalki[2], Shouq J. Almalki[2]

ABSTRACT

Background: Diabetes mellitus is a chronic metabolic disorder associated with persistent hyperglycemia and a significant physical, psychological, and social burden. University students with diabetes represent a unique and understudied population facing distinct challenges, including academic stress, lifestyle transitions, and the need for independent disease self-management. Assessing health-related quality of life (HRQoL) in this group is essential to identify modifiable factors and guide targeted interventions.

Methods: A cross-sectional study was conducted between 2 July 2024 and 28 January 2025 among students with type 1 and type 2 diabetes at Taif University, Taif, Saudi Arabia. Data were collected using a self-administered online questionnaire based on a modified version of the World Health Organization Quality of Life-BREF (WHOQOL-BREF) instrument, adapted to 30 items covering seven domains. Sociodemographic, clinical, and lifestyle characteristics were recorded. Statistical analyses were performed using IBM SPSS version 26.0, with significance set at $p < 0.05$.

Results: A total of 375 students were included (52.8% female; median age 22 years). The median total HRQoL score was 97 out of 150, indicating generally satisfactory quality of life. The physical health domain recorded the highest score (median 21/30), while the personal beliefs domain recorded the lowest (median 3/5). Lower HRQoL scores were significantly associated with the presence of comorbidities ($p = 0.019$), tobacco use ($p = 0.015$), and unhealthy dietary habits ($p < 0.001$). Students adhering to a healthy diet reported significantly higher scores across physical, psychological, independence, and social domains.

Conclusions: HRQoL among university students with diabetes at Taif University was generally satisfactory; however, the presence of comorbidities, tobacco use, and unhealthy dietary habits were significantly associated with poorer outcomes across multiple domains. Targeted interventions addressing diet, smoking cessation, and holistic disease management should be integrated into university health services to improve quality of life in this population. Future longitudinal studies incorporating objective clinical measures are recommended.

Introduction

Diabetes mellitus (DM) is a metabolic disease characterized by persistent hyperglycemia and disturbances in carbohydrate, lipid, and protein metabolism, which may result in abnormal glycogenolysis and gluconeogenesis leading to hyperglycemia [1]. There are several types of DM, including type 1 DM (T1DM), which results from autoimmune destruction of pancreatic beta cells, and type 2 DM (T2DM), which is associated with genetic predisposition and lifestyle-related factors

Correspondence to: Muath A. Althomali
*Department of Medicine, College of Medicine, Taif University, Taif, Saudi Arabia
Email: Dr.muath.a.althomali@gmail.com
Full list of author information is available at the end of the article.
Received: 19 March 2026 | **Revised (1):** 07 May 2026 | **Revised (2):** 19 May 2026 | **Accepted:** 25 May 2026

such as obesity, smoking, and physical inactivity [1,2]. Gestational DM occurs due to hormonal changes during pregnancy [3]. DM is among the most prevalent illnesses globally and affects individuals across all age groups [4]. According to the latest International Diabetes Federation estimates, approximately 537 million adults were living with diabetes in 2021, and this number is projected to rise to 643 million by 2030 and 783 million by 2045 [4]. DM has substantial effects on physical, psychological, and social well-being and remains one of the most common metabolic disorders worldwide [5].

Diabetes has both short-term and long-term effects on quality of life. Acute complications include diabetic ketoacidosis and hyperosmolar hyperglycemic state, while long-term complications include microvascular complications such as retinopathy, neuropathy, and nephropathy, and macrovascular complications such as cardiovascular disease and stroke [6]. In addition, the burden of disease management, including frequent medication use, insulin injections, and fear of hypoglycemia, may negatively affect patients' psychological well-being and HRQoL [7].

Health-related quality of life (HRQoL) is a multidimensional concept that reflects physical, psychological, and social aspects of health and is widely used to assess the impact of chronic diseases and their management on patients' well-being [8]. It is influenced by individual perceptions, beliefs, and experiences [9]. Improving HRQoL is an essential goal in diabetes management alongside reducing morbidity and mortality [10].

Despite the high prevalence of diabetes and its well-documented impact on quality of life, limited studies have examined HRQoL among university students with diabetes, particularly in Saudi Arabia. University students represent a unique population that faces specific challenges, including academic stress, transitional lifestyle changes, and the need for independent self-management of their chronic condition. These factors may significantly influence their quality of life outcomes, yet they remain inadequately explored in the existing literature. Most previous studies have focused on older adult populations or general patient groups, leaving a gap in understanding the specific needs and experiences of younger, university-based individuals with diabetes [11,12].

Therefore, the present study aimed to assess HRQoL among students with type 1 and type 2 diabetes at Taif University and to identify the sociodemographic, clinical, and lifestyle factors associated with HRQoL in this population.

Methods

Study design and setting

This cross-sectional study was conducted at Taif University, Taif, Saudi Arabia, between July 2024 and January 2026.

Study population and sampling

The study population consisted of university students diagnosed with type 1 or type 2 DM. Participants were recruited using a convenience sampling method. An invitation to participate was distributed electronically through official university communication channels and social media platforms. The minimum required sample size was calculated based on an estimated diabetes prevalence of 10% among the target population, with a 95% confidence level and a 5% margin of error, yielding a minimum of 139 participants [13].

Eligibility criteria

Students aged 18 years or older with a self-reported diagnosis of type 1 or type 2 DM were eligible to participate. Students younger than 18 years, those without a confirmed diabetes diagnosis, and individuals who did not provide informed consent were excluded from the study.

Study tool

Data were collected using a modified version of the World Health Organization Quality of Life-BREF (WHOQOL-BREF) questionnaire. The original WHOQOL-BREF is a validated 26-item instrument that assesses quality of life across four domains: physical health, psychological health, social relationships, and environment [9,12]. For the purpose of this study, the instrument was adapted and expanded to 30 items to include three additional domains relevant to the study population: overall quality of life and general health (2 items), independence level (7 items), and personal beliefs (1 item). The modified questionnaire therefore covered seven domains. Each item was rated on a 5-point Likert scale, with higher scores indicating better quality of life. The total score ranged from 30 to 150 points. Domain scores were calculated by summing the respective item scores. The internal consistency of the modified questionnaire was assessed using Cronbach's alpha, which was 0.87 for the total scale in the present sample, indicating good reliability.

Data collection

Data were collected between 2 July 2024 and 28 January 2025 using a self-administered online questionnaire developed on Google Forms. The questionnaire link was distributed to students through university email, student groups on social media, and announcements on the university's learning management system. The first page of the questionnaire contained the participant information sheet and electronic informed consent. Only those who provided consent could proceed to the questionnaire items. Sociodemographic characteristics (age, gender, marital status, nationality, academic year, specialization, and GPA), clinical characteristics (type of diabetes, duration of diagnosis, type of medication, and presence of comorbidities), and lifestyle factors (dietary habits, physical activity, smoking status, and consumption of coffee or energy drinks) were recorded. Body mass index (BMI) was calculated from self-reported height and weight.

Statistical analysis

Statistical analyses were performed using IBM SPSS Statistics for Windows, version 26.0 (IBM Corp., Armonk, NY, USA) [14]. Continuous variables were assessed for normality using the Shapiro-Wilk test and visual inspection of histograms. Normally distributed continuous data were expressed as mean and SD, while non-normally distributed data were expressed as median and interquartile range (IQR). Categorical variables were presented as frequencies and percentages. Group comparisons were conducted using the Mann-Whitney U test for two independent groups and the Kruskal-Wallis *H* test for more than two groups, as appropriate for non-parametric data. Associations between non-normally distributed continuous variables (e.g., age, BMI, and GPA) were assessed using Spearman's rank correlation coefficient (r). Statistical significance was set at $p < 0.05$. Valid percentages were reported to account for missing data.

Ethical approval

Ethical approval was obtained from the Institutional Research Ethics Committee of Taif University (Approval No. HAO-02-T-105). Electronic informed consent was obtained from all participants before data collection. The study was conducted in accordance with the Declaration of Helsinki.

Results

The study included 375 students from 2 July 2024 to 28 January 2025, with more than half being females (52.8%, $n = 198$). The median (IQR) age was 22 [4] years, and the median (IQR) BMI was 26.5 [7] kg/m². The majority of participants were single (84.8%, $n = 318$), and most were Saudi nationals (95.2%, $n = 357$). For the academic year, 31.5% were in their 3rd year, and 24.5% were in their 4th year. Medical & Health Sciences students (49.6%, $n = 182$) were the majority of the participants, followed by Engineering & Technology (17.7%, $n = 65$), with a median (IQR) GPA of 3.5 (0.7). Full details are provided in Table 1.

Clinical and lifestyle characteristics of diabetic students are illustrated in Figures 1–5. Among the participants, 59.7% ($n = 224$) had type 2 diabetes, while 40.3% ($n = 151$) had type 1 diabetes (Figure 1). About half (51.8%, $n = 187$) had been diagnosed within the last 5 years, while 25.8% ($n = 93$) had diabetes for more than 10 years (Figure 2). Regarding treatment, 44.5% (*n*

Table 1. *Sociodemographic characteristics of diabetic students at Taif University (n = 375).*

Factor	Category	Number	Percentage
Gender	Male	177	47.2
	Female	198	52.8
Age (years)	Mean ± SD	22.1 ± 2.4	
	Median (IQR)	22 (4)	
	Min-Max	17-30	
BMI* (kg/m²)	Mean ± SD	26.6 ± 6.1	
	Median (IQR)	26.5 (7)	
	Min-Max	15.6-64	
Marital status	Single	318	84.8
	Married	47	12.5
	Divorced	9	2.4
	Widowed	1	0.3
Nationality	Saudi	357	95.2
	Non-Saudi	18	4.8
Academic year	1st year	35	9.3
	2nd year	63	16.8
	3rd year	118	31.5
	4th year	92	24.5
	5th year	39	10.4
	6th year	28	7.5
Study specialization ($n = 367$)	Medical and Health Sciences	182	49.6
	Engineering and Technology	65	17.7
	Business and Social Sciences	42	11.4
	Natural and Applied Sciences	40	10.9
	Humanities and Education	38	10.4
GPA*	Mean ± SD	3.3 ± 0.5	
	Median (IQR)	3.5 (0.7)	
	Min–Max	1.6-4	

BMI = body mass index; GPA = grade point average.
*Continuous variable.

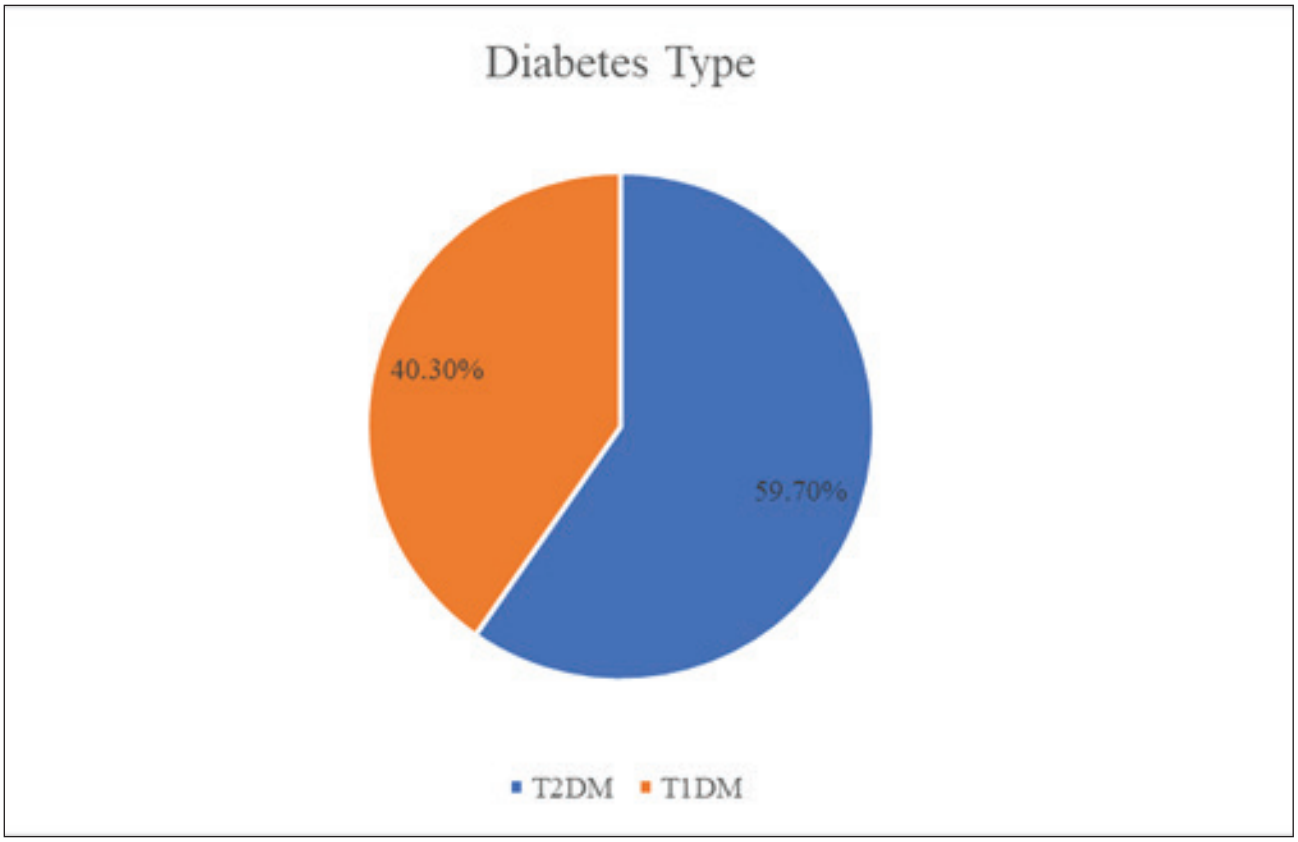

Figure 1. *Prevalence of Type 1 and Type 2 diabetes among study participants (N = 375).*

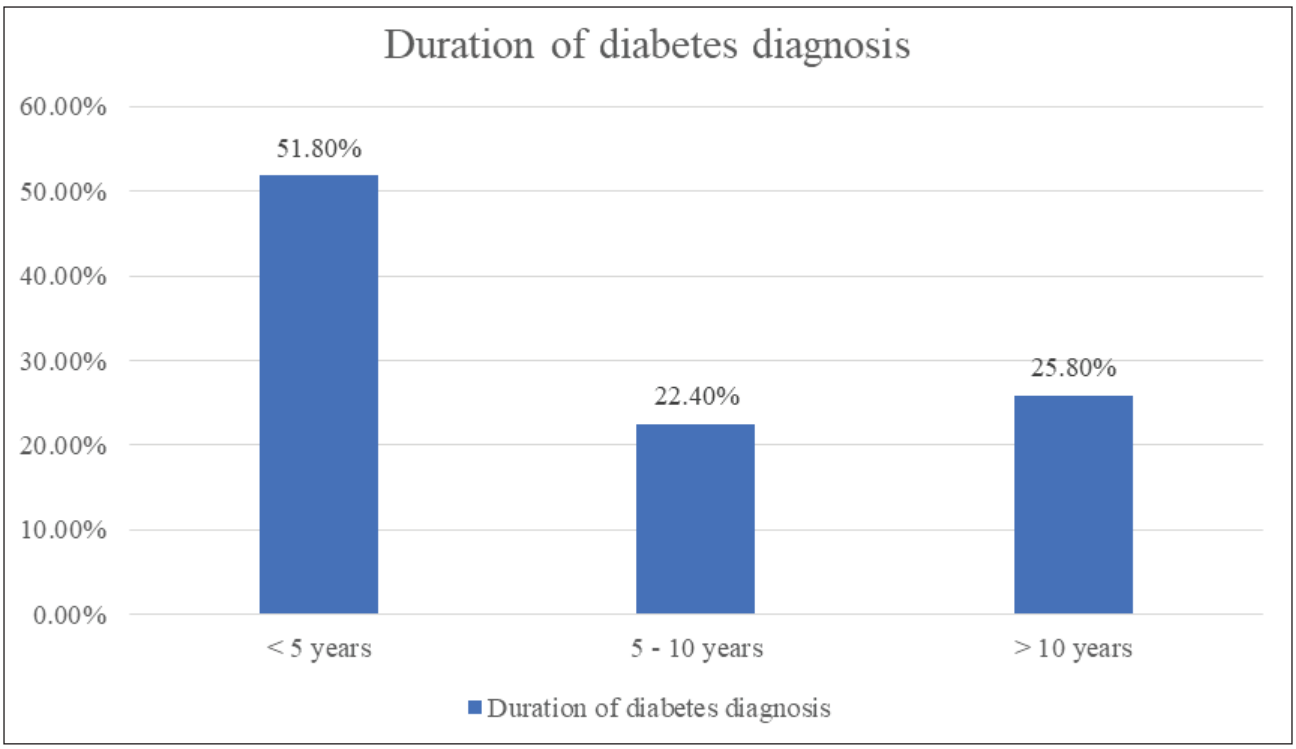

Figure 2. *Duration of diabetes diagnosis among Taif University students (n = 361).*

= 167) used insulin injections, while 40.5% (*n* = 152) used oral medication (Figure 3). Only 8% (*n* = 30) of participants reported having additional comorbidities, with cardiovascular conditions being the most common (Figure 4). Lifestyle habits showed that 86.7% (*n* = 325) of students consumed coffee or energy drinks, 32.3% (*n* = 121) used tobacco products, and 64% (*n* = 240) reported having an unhealthy diet. Regarding physical activity,

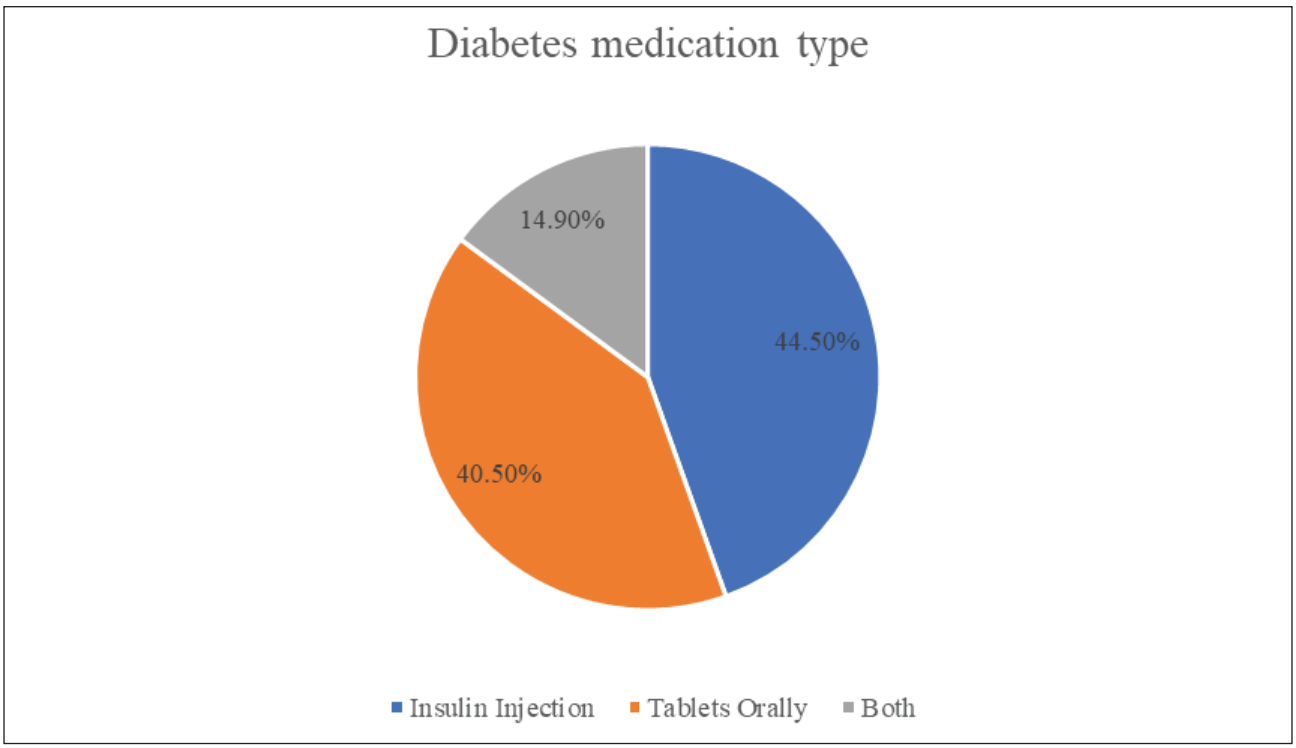

Figure 3. *Distribution of diabetes medication type among Taif University students (N = 375).*

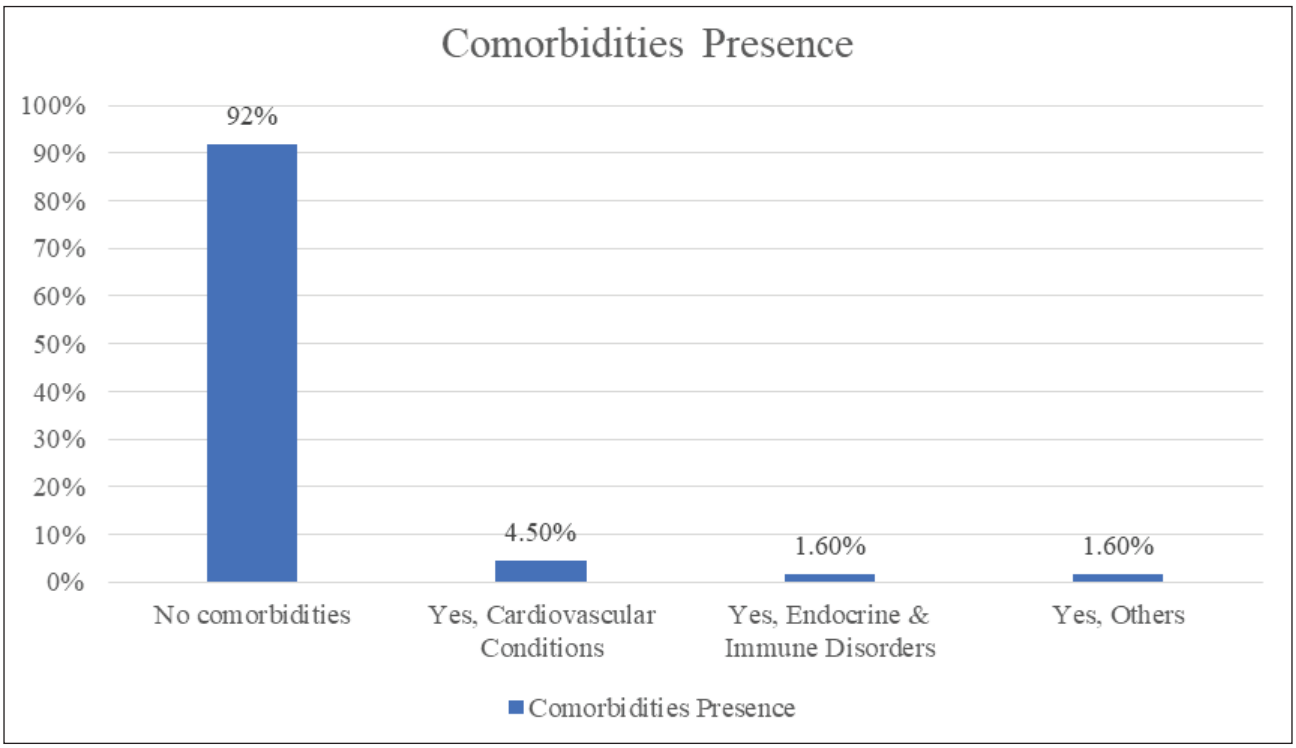

Figure 4. *Prevalence of comorbidities among diabetic students at Taif University (N = 375). Cardiovascular conditions: HTN, HF. Endocrine & Immune Disorders: Hypothyroidism, Immunodeficiency, Obesity, PCOS. Others: Asthma, IBS, Hypersensitivity, Migraine.*

half of the respondents (50.1%, n = 188) engaged in moderate activity, while 40.3% (n = 151) had low activity levels (Figure 5).

Overall and detailed quality of life scores across WHOQOL-BREF domains are presented in Table 2. The total QOL score among diabetic students indicated a good QOL with a median (IQR) score of 97 [15] out of 150. Participants reported a very good QOL in the physical health domain, with a median (IQR) of 21 [3] out of 30; the social relationships domain had a median of 13 [4] out of 20; and the psychological domain score had a median of 19 [4] out of 30. Additionally, a good

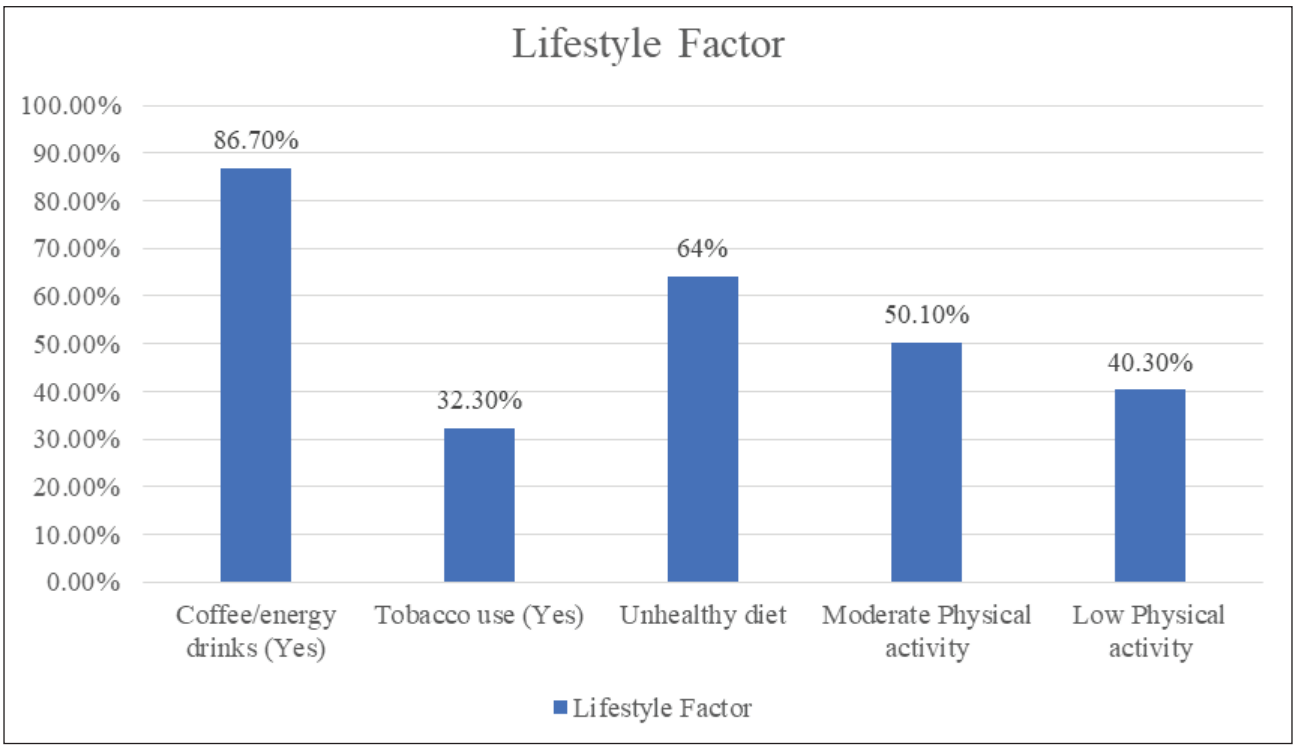

Figure 5. *Lifestyle characteristics among diabetic students at Taif University (N = 375).*

Table 2. *Overall and detailed scores across modified WHOQOL-BREF domains.*

Factor	Mean ± SD	Median (IQR)	Min–Max	Max score
Overall quality of life and general health	6.3 ± 1.8	6 (3)	2–10	10
Domain 1: Physical health	20.6 ± 3.0	21 (3)	11–30	30
Domain 2: Independence level	22.8 ± 4.0	23 (5)	10–35	35
Domain 3: Psychological	19.1 ± 3.5	19 (4)	6–30	30
Domain 4: Personal beliefs	3.0 ± 1.1	3 (2)	1–5	5
Domain 5: Environmental	11.9 ± 2.9	12 (4)	4–20	20
Domain 6: Social relationships	13.1 ± 2.6	13 (4)	6–20	20
Total scores	96.8 ± 14.1	97 (15)	42–142	150

QOL was reported in domains of overall QOL score, with a median (IQR) of 6 [3] out of 10; independence level score, with a median (IQR) of 23 [5] out of 35; personal belief domain score, with a median (IQR) of 3 [2] out of 5; and environmental domain score, with a median (IQR) of 12 [4] out of 20.

Tables 3 and 4 present the impact of sociodemographic and clinical factors on total QOL and domain scores. Diabetic students with other comorbidities had significantly lower total QOL scores ($p = 0.019$), with lower physical health scores (19.5 [IQR 3.5] *vs*. 21 [IQR 4], $p = 0.004$), lower independence level scores (21 [IQR 7.3] *vs*. 23 [IQR 6], $p = 0.011$), lower psychological scores (18 [IQR 7.3] *vs*. 19 [IQR 4.5], $p = 0.021$), and lower overall QOL scores (6 [IQR 3] *vs*. 6 [IQR 3], $p = 0.021$), compared to those without comorbidities.

Additionally, diabetic students who consumed coffee or energy drinks had higher total QOL scores ($p = 0.035$), with higher independence level scores (23 [IQR 6] *vs*. 22 [IQR 7], $p = 0.010$), higher social relationship scores (13 [IQR 3] *vs*. 12.2 [IQR 4.3], $p = 0.015$), and higher overall QOL scores (6 [IQR 3] *vs*. 6 [IQR 3], $p = 0.014$), compared to those who did not consume these beverages.

Likewise, tobacco users among diabetic students had significantly lower total scores ($p = 0.015$), with lower physical health scores (20 [IQR 4] *vs*. 21 [IQR 4], $p = 0.043$), lower independence level scores (22 [IQR 5] vs. 23 [IQR 5], $p = 0.035$), and lower social relationship scores (13 [IQR 4] *vs*. 13.5 [IQR 3], $p = 0.032$) than non-smokers.

Furthermore, students following a healthy diet reported significantly higher total scores ($p < 0.001$), with higher overall QoL scores (7 [IQR 2] *vs*. 6 [IQR 2], $p = 0.006$), higher physical health scores (22 [IQR 3] *vs*. 20 [IQR 4], $p < 0.01$), higher independence level scores (25 [IQR 6] *vs*. 22 [IQR 5], $p < 0.01$), higher psychological scores (20 [IQR 4] *vs*. 19 [IQR 4], $p = 0.003$), and higher social relationship scores (14 [IQR 3] *vs*. 13 [IQR 4], $p < 0.01$) than those with an unhealthy diet.

Table 3. *Impact of sociodemographic and clinical factors on total quality of life scores.*

Factor	Category	Total questionnaire scores Median (IQR)	*P* value
Gender	Male	95 (17)	0.149
	Female	98 (18.3)	
Age (years)	Correlation coefficient	–0.019	0.710
Marital status	Single	97 (18)	0.978
	Married/Divorced/Widowed	96 (19.5)	
Nationality	Saudi	97 (17.5)	0.107
	Non-Saudi	89 (22.5)	
Academic year	1st year/2nd year	94.7 (19)	0.173
	3rd year/4th year	97 (18)	
	5th year/6th year	99 (18)	
GPA*	Correlation coefficient	0.056	0.281
BMI* (kg/m²)	Correlation coefficient	0.079	0.130
Diabetes type	Type 1	97 (18)	0.526
	Type 2	96 (18)	
Diabetes diagnosis duration (years)	<5	97 (20)	0.703
	5-10	96 (12.5)	
	>10	97 (20)	
Type of medicine used	Tablets orally	95.5 (18.8)	0.334
	Insulin injection	97 (18)	
	Both	96 (18.8)	
Diagnosed with other comorbidities	Yes	92 (24.5)	**0.019**
	No	97 (17.5)	
Drinking coffee or energy drinks	Yes	97 (17.5)	**0.035**
	No	93.5 (19.8)	
Using any tobacco products	Yes	94 (17)	**0.015**
	No	97.5 (18)	
Diet type	Healthy	102 (21)	**<0.001**
	Unhealthy	95 (15.8)	
Physical activity	High	94.5 (28.8)	0.261
	Moderate	98 (21)	
	Low	95 (15)	

BMI, body mass index; GPA, grade point average.
Bold values indicate statistical significance at $p < 0.05$.

Moreover, students with Saudi nationality had higher social relationship scores (13 [IQR 3.5] *vs*. 11.5 [IQR 1.5], $p = 0.003$) than non-Saudi students, and students in the 1st to 4th academic year had higher personal beliefs scores (3 [IQR 2] *vs*. 3 [IQR 1], $p = 0.047$) than students in the 5th to 6th academic year. Students with higher GPAs had lower independence level scores (r = 0.119, $p = 0.021$), and those with higher BMI values had lower social relationship scores (r = 0.146, $p = 0.005$).

Finally, students who used tablet or injection medicine had lower psychological scores (18.5 [IQR 5] *vs*. 19 [IQR 4] *vs*. 20 [IQR 5], $p = 0.030$) than those who used both types of medicine.

Discussion

This study assessed HRQoL among university students with type 1 and type 2 diabetes at Taif University and identified factors associated with HRQoL in this population. The overall HRQoL among participants was generally satisfactory, with a median total score of 97 out of 150. However, several factors were significantly associated with lower HRQoL, including the presence of comorbidities, tobacco use, and unhealthy dietary habits. In contrast, healthier lifestyle behaviors, such as consuming a healthy diet and abstaining from tobacco, were associated with better HRQoL outcomes across multiple domains.

The findings of this study are consistent with previous research demonstrating that DM negatively affects HRQoL across multiple domains. Several studies have reported that individuals with diabetes experience reduced quality of life compared with the general population, particularly in the presence of complications and poor glycemic control [5,6,10]. Fowler [6] emphasized that microvascular and macrovascular complications are major determinants of poor quality of life in diabetic patients. In our study, students with comorbidities had significantly lower HRQoL scores across physical, psychological, and independence domains (p = 0.004-0.021), which directly supports Fowler's findings regarding the impact of complications on patient well-

Table 4. *Impact of sociodemographic, clinical, and lifestyle factors on WHOQOL domain scores.*

Factor	Category	Domains scores Median (IQR)						
		Overall QOL	1	2	3	4	5	6
Gender	Male	6 (3)	21 (4)	23 (5)	19 (4)	3 (2)	12 (4)	13 (4)
	Female	7 (3)	21 (4)	23 (5)	19 (4.3)	3 (2)	12 (4)	14 (3)
P value		0.136	0.451	0.595	0.287	0.681	0.639	0.074
Age (years)	*R*	–0.019	**0.015**	–0.031	–0.005	0.061	–0.006	–0.027
P value		0.711	0.769	0.547	0.926	0.240	0.907	0.598
Marital status	Single	6 (3)	21 (3.3)	23 (6)	19 (4)	3 (2)	12 (4)	13 (4)
	Married/ Divorced/ Widowed	6 (3)	21 (4.5)	22 (7)	19 (4)	3 (2)	12 (4)	13 (4)
P value		0.346	0.451	0.992	0.486	0.451	0.971	0.878
Nationality	Saudi	6 (3)	21 (3.5)	23 (6)	19 (4)	3 (2)	12 (4)	13 (3.5)
	Non–Saudi	6 (1.5)	21 (4.5)	22 (8.3)	18.5 (5.3)	3 (2)	12 (4.3)	11.5 (1.5)
P Value		0.218	0.429	0.165	0.958	0.735	0.438	**0.003**
Academic year	1st year/2nd year	6 (3)	21 (4.3)	23 (5)	18 (4)	3 (2)	12 (4)	13 (3.3)
	3rd year/4th year	6 (3)	21 (4)	23 (6)	19 (5)	3 (2)	12 (4)	13.5 (3)
	5th year/6th year	7 (3)	20 (4)	24 (5)	19 (4)	3 (1)	12 (3)	13 (3)
P value		0.270	0.074	0.105	0.550	**0.047**	0.194	0.184
GPA*	r	**0.021**	**0.015**	0.119	**0.017**	–0.042	–0.018	**0.037**
P value		0.680	0.769	**0.021**	0.745	0.418	0.734	0.474
BMI* (kg/m²)	r	**0.049**	**0.010**	**0.048**	–0.043	0.068	0.075	0.146
P value		0.343	0.841	0.354	0.411	0.190	0.150	**0.005**
Diabetes type	Type 2	6 (3)	21 (4)	23 (6)	19 (4)	3 (2)	12 (4)	13 (4)
	Type 1	6 (3)	21 (3.3)	23 (6)	19 (5)	3 (2)	12 (4)	13 (4)
P value		0.430	0.625	0.959	0.566	0.238	0.200	0.321
Diabetes diagnosis duration? (years)	<5	6 (3)	21 (4)	23 (6)	19 (5)	3 (2)	12 (4)	13 (4)
	5- 10	6 (2)	20 (4)	23 (4)	19 (4)	3 (2)	12 (3)	13 (3)
	>10	7 (2)	21 (4)	23 (4)	19 (5)	3 (2)	12 (3)	13 (3)
P value		0.665	0.358	0.854	0.448	0.988	0.522	0.914
Type of medicine used	Tablets orally	6 (3)	21 (4)	23 (5.8)	18.5 (5)	3 (2)	12 (3)	13 (4)
	Insulin injection	6 (3)	21 (4)	23 (5)	19 (4)	3 (2)	13 (4)	13 (3)
	Both	7 (2)	21 (4)	23 (4)	20 (5)	3 (2)	12 (4)	13.5 (4)
P value		0.560	0.477	0.461	**0.030**	0.786	0.928	0.607
Diagnosed with other comorbidities?	Yes	6 (3)	19.5 (3.5)	21 (7.3)	18 (7.3)	3 (2)	11.5 (2.5)	13 (5.3)
	No	6 (3)	21 (4)	23 (6)	19 (4.5)	3 (2)	12 (4)	13 (4)
P value		**0.021**	**0.004**	**0.011**	**0.021**	0.411	0.082	0.418
Drinking coffee or energy drinks	Yes	6 (3)	21 (3)	23 (6)	19 (4.5)	3 (2)	12 (4)	13 (3)
	No	6 (3)	22 (5)	22 (7)	18 (5)	3 (2)	11 (3.8)	12.2 (4.3)
P value		**0.014**	0.370	**0.010**	0.339	0.367	0.103	**0.015**
Using any tobacco products	Yes	6 (4)	20 (4)	22 (5)	19 (4.5)	3 (2)	12 (3)	13 (4)
	No	6 (3)	21 (4)	23 (5)	19 (5)	3 (2)	12 (4)	13.5 (3)
P value		0.080	**0.043**	**0.035**	0.105	0.082	0.174	**0.032**
Diet type	Healthy	7 (2)	22 (3)	25 (6)	20 (4)	3 (2)	12 (4)	14 (3)
	Unhealthy	6 (2)	20 (4)	22 (5)	19 (4)	3 (2)	12 (3)	13 (4)
P value		**0.006**	**<0.01**	**<0.01**	**0.003**	0.254	0.145	**<0.01**
Physical activity	High	6 (4)	22 (4.5)	22 (8.5)	18.5 (6.8)	3 (2)	11 (5.8)	14 (5.8)
	Moderate	7 (3)	21 (4)	24 (6)	20 (4.8)	3 (2)	12 (4)	13.5 (4)
	Low	6 (2)	21 (4)	22 (5)	19 (4)	3 (2)	12 (3)	13 (4)
P value		0.219	0.164	0.183	0.328	0.402	0.306	0.397

BMI, body mass index; GPA, grade point average.
Bold values indicate statistical significance at $p < 0.05$.

being. Similarly, the foundational work by Rubin and Peyrot [5] established that the psychological burden of diabetes—including fear of hypoglycemia and the demands of daily disease management—negatively affects HRQoL. Our results confirm this, as students using insulin alone or tablets alone reported lower psychological domain scores ($p = 0.030$) compared to those on combination therapy, suggesting that treatment complexity may influence psychological well-being.

Jing et al. [10] conducted a systematic review demonstrating that self-management behaviors and adherence to treatment play critical roles in determining quality of life outcomes. Our findings align with this review, as students who adhered to healthy dietary habits had significantly higher HRQoL scores across physical health ($p < 0.01$), independence ($p < 0.01$), psychological ($p = 0.003$), and social domains ($p < 0.01$), highlighting the importance of positive self-care behaviors. In the Saudi context, Alshayban and Joseph [11] conducted a cross-sectional study in the Eastern Province and reported that lifestyle factors and disease burden significantly influence HRQoL among diabetic patients. Our study extends these findings to a younger, university-based population in the Western region (Taif), demonstrating that similar associations exist even among students in the earlier stages of their disease.

Wändell [16] reviewed HRQoL in primary care across Nordic countries and found that diabetic patients with comorbidities consistently report lower scores across physical and psychological domains. Our findings mirror this observation precisely, as students with comorbidities scored significantly lower in physical health (19.5 *vs*. 21, $p = 0.004$) and psychological domains (18 *vs*. 19, $p = 0.021$). Solli et al. [17] specifically examined the impact of diabetes-related complications using the EQ-5D instrument and found that complications were strongly associated with reduced HRQoL. Our study confirms this association using a different instrument (WHOQOL-BREF), showing that students with comorbidities had lower scores not only in physical health but also in independence level (21 *vs*. 23, $p = 0.011$), providing a more comprehensive picture of the functional impact of complications.

Regarding specific lifestyle factors, Clair et al. [18] demonstrated that smoking cessation and weight change are associated with cardiovascular disease outcomes among adults with and without diabetes. Our study supports this finding, as tobacco users had significantly lower physical health scores (20 *vs*. 21, $p = 0.043$) and lower independence scores (22 *vs*. 23, $p = 0.035$), suggesting that smoking cessation should be a priority in HRQoL improvement strategies for young diabetic populations. Einarson et al. [19] conducted a systematic review showing the high prevalence of cardiovascular disease in type 2 diabetes and its association with adverse health outcomes. The link between unhealthy dietary habits and reduced HRQoL across all measured domains in our study suggests that dietary interventions could mitigate the cardiovascular risk factors that ultimately impair quality of life. The study by Gonzalez et al. [15] highlighted the role of psychosocial factors in medication adherence and self-management. Our finding that students on monotherapy had lower psychological scores ($p = 0.030$) may reflect differences in disease acceptance, self-efficacy, or psychosocial support that warrant further investigation. Chatterjee et al. [20] emphasized holistic, patient-centered approaches to diabetes management. Our study reinforces this perspective by demonstrating that factors beyond glycemic control—such as diet, smoking, and social support—are strongly associated with HRQoL in a young diabetic population. Finally, Alharbi et al. [21] found that lifestyle modification significantly improves quality of life among diabetic patients in Saudi Arabia, particularly when interventions are culturally tailored. Our findings extend this evidence by identifying the specific domains most affected by lifestyle factors in university students, providing a basis for designing targeted, campus-based interventions.

Several mechanisms may explain the observed associations. Diabetes requires continuous self-management, including medication adherence, dietary regulation, physical activity, and monitoring of blood glucose levels, which can impose a substantial psychological burden [15]. The presence of comorbidities may further increase this burden, as students must manage multiple health conditions simultaneously while balancing academic demands. In addition, unhealthy lifestyle behaviors such as smoking and poor diet may worsen glycemic control and increase the risk of complications, thereby negatively affecting HRQoL [20]. The finding that coffee and energy drink consumption was associated with higher HRQoL scores in some domains was unexpected and may be confounded by other lifestyle factors or social behaviors not captured in this study. It is also possible that students who consume these beverages have higher levels of social engagement, which could positively influence social relationship scores.

The findings of this study have several clinical and public health implications. First, the significant impact of comorbidities on HRQoL underscores the importance of comprehensive diabetes care that addresses not only glycemic control but also the prevention and management of coexisting conditions. Second, the strong association between healthy dietary habits and better HRQoL suggests that nutritional interventions could be an effective strategy for improving quality of life in this population. Universities represent a critical setting for implementing health promotion strategies, as they can provide access to education, counseling, and support services tailored to students with chronic conditions [21]. Specifically, university health centers could offer dietary counseling, smoking cessation programs, and physical activity initiatives designed to meet the unique needs of students with diabetes. Furthermore, integrating HRQoL assessments into routine diabetes care for young adults could help healthcare providers identify individuals at risk of poor outcomes and tailor interventions accordingly.

Strengths and limitations

This study has several strengths. First, it addresses a relatively under-researched population, namely

university students with diabetes, and provides valuable insights into the factors influencing HRQoL in this group. Second, the use of a modified and validated WHOQOL-BREF instrument enhances the reliability and comparability of the findings. Third, the inclusion of multiple sociodemographic, clinical, and lifestyle variables allowed for a comprehensive analysis of factors associated with HRQoL across several domains. Fourth, the study was conducted in a real-world university setting, which increases the practical relevance of the findings for student health services.

Several limitations should be acknowledged when interpreting the results of this study. First, the cross-sectional design limits the ability to establish causal relationships between the identified factors and HRQoL. Longitudinal studies are needed to confirm the directionality of these associations. Second, the use of self-reported data may introduce recall and reporting bias, particularly for variables such as dietary habits, physical activity, and tobacco use. Third, the convenience sampling method and the single-university setting may limit the generalizability of the findings to other populations and institutions in Saudi Arabia or internationally. Fourth, the relatively small number of students with comorbidities (n = 30) may have limited the statistical power to detect additional significant associations. Finally, the study did not include clinical measures such as HbA1c levels, which could have provided objective data on glycemic control and its relationship with HRQoL.

Future recommendations

Future research should focus on longitudinal studies to better understand the causal relationships between lifestyle factors, disease management, and HRQoL among university students with diabetes. Additionally, intervention-based studies are needed to evaluate the effectiveness of strategies such as dietary counseling, smoking cessation programs, and physical activity interventions in improving HRQoL in this population. Expanding research to include multiple universities across Saudi Arabia would enhance the generalizability of findings and allow for comparisons across different regions and institutional contexts. Furthermore, future studies should incorporate objective clinical measures, such as HbA1c and lipid profiles, to examine the relationship between metabolic control and HRQoL more precisely.

Conclusion

In conclusion, this study demonstrates that while HRQoL among university students with diabetes at Taif University is generally satisfactory, the presence of comorbidities, tobacco use, and unhealthy dietary habits are significantly associated with poorer quality of life outcomes across multiple domains. These findings highlight the importance of holistic diabetes management that extends beyond glycemic control to address the broader physical, psychological, and social dimensions of health. University health services have a unique opportunity to implement targeted interventions that promote healthy lifestyles among students with diabetes, ultimately improving their quality of life and long-term health outcomes.

List of Abbreviations

BMI	Body mass index
DM	Diabetes mellitus
GPA	Grade Point Average
HRQoL	Health-Related Quality of Life
HTN	Hypertension
HF	Heart failure
IBS	Irritable bowel syndrome
IQR	Interquartile Range
PCOS	Polycystic Ovary Syndrome
QOL	Quality of life
SD	Standard deviation
T1DM	Type 1 Diabetes Mellitus
T2DM	Type 2 Diabetes Mellitus
WHOQOL-BREF	World Health Organization Quality of Life-BREF

Conflict of interest

The authors declare that they have no conflict of interest regarding the publication of this article.

Consent to participate

Electronic informed consent was obtained from all participants prior to their participation in the study.

Ethical approval

Approved by the Research Ethics Committee of Taif University, Taif, Saudi Arabia. Approval No.: HAO-02-T-105. Date of approval: 04/06/2024.

Authors contribution

All authors have read and approved the final manuscript. The authors confirm that they meet the authorship criteria and that the manuscript represents honest and original work.

Author details

Abdulmajeed M. Algethami[1], Muath A. Althomali[2], Raghad A. Almutairi[2], Abdullah M. Alshanqiti[2], Ibrahim S. Aljuaid[2], Nedal M. Alqurashi[2], Rawan A. Almalki[2], Atheer J. Almalki[2], Shouq J. Almalki[2]

1. College of Medicine, Taif University, Taif, Saudi Arabia
2. Medical Student, College of Medicine, Taif University, Taif, Saudi Arabia

Supplementary content (if any) is available online.

References

1. Association AD. Classification and diagnosis of diabetes: standards of medical care in diabetes-2024. Diabetes Care. 2024;47 Suppl 1(Suppl 1):S16–33.
2. Defronzo RA, Ferrannini E, Groop L, Henry RR, Herman WH, Holst JJ, et al. Type 2 diabetes mellitus. Nat Rev Dis Primers. 2015;1(1):15019. https://doi.org/10.1038/nrdp.2015.19
3. World Health Organization. Diabetes. Geneva: WHO; 2025.
4. International Diabetes Federation. IDF Diabetes Atlas. 11th ed. Brussels: IDF; 2025.
5. Rubin RR, Peyrot M. Quality of life and diabetes. Diabetes Metab Res Rev. 1999;15(3):205–18.

6. Fowler MJ. Microvascular and macrovascular complications of diabetes. Clin Diabetes. 2008;26(2):77–82. https://doi.org/10.2337/diaclin.26.2.77
7. Testa MA, Simonson DC. Assessment of quality-of-life outcomes. N Engl J Med. 1996;334(13):835–40. https://doi.org/10.1056/NEJM199603283341306
8. The Whoqol Group. Development of the World Health Organization WHOQOL-BREF quality of life assessment. Psychol Med. 1998;28(3):551–48. https://doi.org/10.1017/S0033291798006667
9. Glasgow RE, Ruggiero L, Eakin EG, Dryfoos J, Chobanian L. Quality of life and associated characteristics in a large national sample of adults with diabetes. Diabetes Care. 1997;20(4):562–7. https://doi.org/10.2337/diacare.20.4.562
10. Jing X, Chen J, Dong Y, Han D, Zhao H, Wang X, et al. Related factors of quality of life among people with type 2 diabetes: a systematic review and meta-analysis. Health Qual Life Outcomes. 2018;16:189. https://doi.org/10.1186/s12955-018-1021-9
11. 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):227573. https://doi.org/10.1371/journal.pone.0227573
12. World Health Organization. WHOQOL-BREF: Introduction, administration, scoring and generic version of the assessment. Geneva: WHO; 1996.
13. Cochran WG. Sampling techniques. 3rd ed. New York: John Wiley & Sons; 1977.
14. Corp IB. IBM SPSS Statistics for Windows. Armonk: IBM Corp.; 2019.
15. Gonzalez JS, Tanenbaum ML, Commissariat PV. Psychosocial factors in medication adherence and diabetes self-management. Curr Diab Rep. 2016;16(12):130.
16. Wändell PE. Quality of life of patients with diabetes mellitus. An overview of research in primary health care in the Nordic countries. Scand J Prim Health Care. 2005;23(2):68–74. https://doi.org/10.1080/02813430510015296
17. Solli O, Stavem K, Kristiansen I. Health-related quality of life in diabetes: the associations of complications with EQ-5D scores. Health Qual Life Outcomes. 2010;8(1):18. https://doi.org/10.1186/1477-7525-8-18
18. Clair C, Rigotti NA, Porneala B, Fox CS, D'Agostino RB, Pencina MJ, et al. Association of smoking cessation and weight change with cardiovascular disease among adults with and without diabetes. JAMA. 2013;309(10):1014–21. https://doi.org/10.1001/jama.2013.1644
19. Einarson TR, Acs A, Ludwig C, Panton UH. Prevalence of cardiovascular disease in type 2 diabetes: a systematic literature review of scientific evidence from across the world in 2007-2017. Cardiovasc Diabetol. 2018;17(1):83. https://doi.org/10.1186/s12933-018-0728-6
20. Chatterjee S, Khunti K, Davies MJ. Type 2 diabetes. Lancet. 2017;389(10085):2239-51. https://doi.org/10.1016/S0140-6736(17)30058-2
21. Alharbi TJ, Tourkmani AM, Alharbi NS, Alotaibi YK, Alharbi MF, Almutairi M. The impact of lifestyle modification on quality of life among patients with diabetes in Saudi Arabia. J Fam Med Prim Care. 2021;10(2):928–34.