Advanced International Journal for Research (AIJFR)
E-ISSN: 3048-7641 ● Website: www.aijfr.com ● Email: editor@aijfr.com

Health related quality of life and its determinants among adults with type 2 diabetes mellitus: An exploratory study

Keya Patel[1], Prof. Rinu Mathew[2]

[1] M.Sc. Nursing Student, Shrey Institute of Nursing and Allied Sciences, Ahmedabad - 380013, Gujarat, India.
[2] Principal, Shrey Institute of Nursing and Allied Sciences, Ahmedabad - 380013, Gujarat, India.

Abstract

Background
This study aimed to evaluate the health related quality of life (HRQoL) and its determinants among adults with type 2 diabetes mellitus admitted in selected hospitals of Ahmedabad city with a view to develop informational booklet.

Materials and Methods
A quantitative, non-experimental descriptive research design was adopted for the study. The study was conducted in selected hospitals of Ahmedabad city. A total of 100 type 2 diabetes mellitus patient were selected using non probability purposive sampling technique. Data were collected using a five-point Likert's rating scale and structured questionnaire. Content validity was established through expert opinion, and reliability of the tool was assessed using Cronbach's alpha method. Data analysis was done using descriptive statistics (frequencies, percentages, and mean ± standard deviation) and inferential statistics (Karl Pearson and Chi-square test).

Results
The findings revealed that the majority of adults with type 2 diabetes mellitus exhibited low to high levels of health related quality of life, with none of the participants showing very low health related quality of life. The mean score was found to be 62.99 with a mean percentage of 44.99, indicating a low to moderate level of health related quality of life. The standard deviation was 24.13, reflecting variations in health related quality of life among the participants. Health-related quality of life was significantly associated with co-morbidity (χ^2 = 17.202, p = 0.028) and monthly family income (χ^2 = 19.411, p = 0.004). Furthermore, HRQoL was significantly negatively correlated with present diabetes complications, poor medication adherence, financial difficulty, lack of health insurance, inability to afford healthy food, reduced work capacity, poor family support, and diabetes-related anxiety and depression.

Conclusion
HRQoL among diabetic adults in Ahmedabad is heavily influenced by socio-economic factors, clinical complications, and psychological distress. To address a notable deficit in existing literature and clinical

counselling, raising patient awareness regarding coping strategies is crucial. Consequently, an informational booklet on self-regulation was developed to actively support patients in optimizing and managing their daily quality of life.

Keywords: Health related quality of life, Determinants, Adults, Type 2 Diabetes Mellitus, Hospitals

1. Introduction

"Life is not over because you have diabetes. Make the most of what you have, be grateful."
- Dale Evans

Diabetes mellitus (DM) is rising at a rapid rate worldwide **(Saeedi et al., 2019)**. As a chronic, incurable metabolic disease, diabetes affects a person's life in all ways. Studies thus far have focused on the impact of diabetes on the physical, mental and social health of persons affected by the quality of life (QoL). Diabetes mellitus is a metabolic disorder marked by high blood glucose levels due to gradual but progressive deterioration of the pancreatic beta-cell function. With time, a decrease in insulin levels and insulin resistance leads to chronic hyperglycemia **(American Diabetes Association, 2024)**. There are three types of hyperglycemia: type 1, type 2, and gestational diabetes. More than 95% of people with diabetes suffer from type 2 diabetes. As per the WHO statistics, between 2000 and 2019, there was a 3% increase in age-standardized mortality rates from diabetes. Also, another 4,60,000 kidney-related deaths were due to diabetes, and high blood glucose caused around 20% of cardiovascular deaths. **(World Health Organization: Diabetes, 2023)**

Recent studies have shown that the development of Type 2 DM is influenced by the 'Built Environments' (BE). BE is defined as the environments that are modified by humans including homes, schools, workplaces, highways, urban sprawls, accessibility to amenities, leisure and pollution **(Glanz et al., 2016)**. They influence the lifestyle and habits of their inhabitants including opportunities for physical activity, food, rest, relaxation and sleep.

The prime and initial intervention is lifestyle changes **(Marín-Peñalver et al., 2016)**. A combination of lifestyle changes such as diet and exercise; and pharmacological treatment such as oral hypoglycemic agents and/or injectable agents are necessary to achieve good metabolic control in chronic diabetic cases. Physical activity and structured exercise serve as primary non-pharmacological interventions. Regular physical exertion increases cellular insulin sensitivity, enhances glycemic control, stabilizes lipid profiles, regulates blood pressure and body weight, optimizes cardiovascular function, and improves psychological well-being. When pharmacological intervention is required, Metformin is universally established as the first-line oral hypoglycemic agent, provided no contraindications exist. It can be paired with second-line alternative oral agents or injectable therapies, primarily insulin, to achieve target glycated hemoglobin (HbA1c) levels **(Davies et al., 2022).** A sleep for at least 7 hours per night is advisable for maintaining energy levels and well-being **(Cappuccio et al., 2010)**.

The World Health Organization (WHO) defines quality of life (QoL) as "an individual's perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards, and concerns" **(The WHOQOL Group, 1995)**. Complementing this broader conceptualization, the Centers for Disease Control and Prevention (CDC) conceptualizes health-related quality of life (HRQoL) as an individual's or group's perceived physical and mental health over

time, serving as a critical indicator for long-term health surveillance **(Centers for Disease Control and Prevention [CDC], 2021).**

It is the personal perception of the patient, pointing to the comfort areas that are influenced by his/her health status. It contains patient-oriented and patient-reported outcome measures that evaluate his/her physical function and psychological status. The psychological symptoms of hyperglycemic stress such as denial, anger, anxiety, depression, desolation, isolation, shock, guilt, and frustration make the self-management of blood sugar more difficult, which affects the patient's HRQoL **(Hernandez-Segura, N., et. al., 2022).**

MATERIALS AND METHODS:

A quantitative, non-experimental, descriptive survey design was adopted for this study, which was undertaken over a period of two months from December 2025 to January 2026. The objectives of the study were to assess the health related quality of life and its determinants as well as identify the association between health related quality of life and its determinants among adults with type 2 diabetes mellitus with demographic variables. The target population included type 2 diabetes mellitus admitted in selected hospitals of Ahmedabad city. A sample size of 100 patients was determined based on similar prior studies, alongside considerations of Hospital feasibility and time constraints. The participants were selected using a non-probability purposive sampling technique. Ethical approval was obtained and written consent was taken from all participants prior to data collection. Content validity was established through expert opinion, and reliability of the tool was assessed using Cronbach's alpha method.

Data were collected using a five-point Likert's rating scale to assess the health related quality of life (HRQoL) and a structured questionnaire to identify its determinants among adults with type 2 diabetes mellitus.

Scoring and Categorization: The HRQoL scale comprised of 28 statements scored from 1 to 5 (strongly disagree to strongly agree) for positive items, and reversed for negative items to maintain directional consistency. Consequently, individual cumulative scores could range from a minimum of 28 to a maximum of 140. To interpret the overall status of the respondents, these total scores were stratified into four tiers: scores between 28 and 56 indicated a Very Low HRQoL, ranges from 57 to 84 represented a Low HRQoL, scores spanning 85 to 112 denoted a High HRQoL, and values from 113 to 140 signified a Very High HRQoL.

Descriptive statistics, including frequencies, percentages, and mean ± standard deviation, were used to summarize demographic data, HRQoL and its determinants scores. Inferential statistics, specifically the Chi-square test, were utilized to examine the associations between demographic variables and the participants' health related quality of life and its determinants of type 2 diabetes mellitus.

RESULTS

The findings are presented under the following sections: demographic variables of the participants, assessment of health related quality of life (HRQoL) among adults with type 2 diabetes mellitus and its determinants, evaluation of association between health related quality of life with demographic variables of type 2 diabetes mellitus among adults with type 2 diabetes mellitus admitted in selected hospitals in Ahmedabad city.

Analysis and interpretation of the demographic variables of the samples

Table 1: Frequency and Percentage Distribution of Adults with Type 2 Diabetes Mellitus According to Demographic Variables

[n=100]

Sr. No.	Demographic Variables	Categories	frequency (f)	Percentage (%)
1	Age (in years)	30–40	38	38.0
		41–50	18	18.0
		51–60	18	18.0
		>60	26	26.0
2	Gender	Male	57	57.0
		Female	43	43.0
		Other	0	0
3	Level of Education	Illiterate	9	9.0
		Primary school	22	22.0
		Secondary school	12	12.0
		Higher secondary	15	15.0
		Graduate & above	42	42.0
4	Religion	Hindu	54	54.0
		Muslim	27	27.0
		Christian	19	19.0
		Others	0	0
5	Marital Status	Single	1	1.0
		Married	65	65.0
		Widowed	17	17.0
		Divorced	10	10.0
		Separated	7	7.0
6	Number of Children	1	29	29.0
		2	36	36.0
		3	25	25.0
		More than 3	10	10.0
7	Occupation	Office-based work	33	33.0
		Agricultural/Farming	5	5.0
		Construction/Manual labour	15	15.0
		Domestic/Household	23	23.0
		Self-employed/Business	24	24.0
8	Physical Activity Pattern	None	31	31.0
		Aerobics	21	21.0
		Strength training	9	9.0

Sr. No.	Demographic Variables	Categories	frequency (f)	Percentage (%)
		Household chores	39	39.0
9	Alcohol Consumption	Used to drink, stopped	12	12.0
		Frequently	3	3.0
		Sometimes	4	4.0
		Do not drink	81	81.0
10	Smoking Habit	Used to smoke, stopped	2	2.0
		Frequently	24	24.0
		Sometimes	11	11.0
		Do not smoke	63	63.0
11	Duration of Diabetes	1–5 years	45	45.0
		6–10 years	33	33.0
		11–15 years	9	9.0
		>15 years	13	13.0
12	Dietary Pattern	Vegetarian	69	69.0
		Non-vegetarian	31	31.0
		Vegan	0	0
13	Co-morbidity	Hypertension	35	35.0
		Thyroid	10	10.0
		Kidney disease	13	13.0
		Others	3	3.0
		No any	39	39.0
14	Type of Therapy	Oral medication	52	52.0
		Injectable (Insulin)	33	33.0
		Diet & lifestyle only	15	15.0
15	Monthly Family Income (₹)	≤10,000	4	4.0
		10,001–20,000	40	40.0
		21,001–40,000	49	49.0
		>40,000	7	7.0

Table 1 reveals that among the 100 participants, the majority were male (57.0%), married (65.0%), and aged 30–40 years (38.0%). Economically and educationally, most participants were graduates or above (42.0%) and reported a monthly family income between ₹21,001–40,000 (49.0%). In terms of health habits and lifestyle, the majority were vegetarians (69.0%), non-smokers (63.0%), and non-drinkers (81.0%). While 39.0% primarily engaged in household chores for physical activity, a substantial 31.0% reported no physical activity at all. Clinically, nearly half of the sample had been diagnosed with diabetes for 1–5 years (45.0%) and were primarily managing their condition through oral medications (52.0%). Although 39.0% reported no co-morbidities, hypertension was the most prevalent co-morbid condition among the remaining participants, affecting 35.0% of the sample.

Analysis and interpretation of the data related to health-related quality of life among adults with type 2 diabetes mellitus

Table 2: Frequency and percentage distribution of health-related quality of life among adults with type 2 diabetes mellitus

[n=100]

Sr. No.	Health-related quality of life	Score	Frequency (f)	Percentage (%)
1.	Very Low Health Related Quality of Life	28-35	0	0
2.	Low Health Related Quality of Life	36-70	57	57.0
3.	High Health Related Quality of Life	71-100	29	29.0
4.	Very High Health Related Quality of Life	106-140	14	14.0
Total			**100**	**100%**

Table 2 demonstrates that most of the participants, 57 (57.0%), experienced low HRQoL, followed by 29 (29.0%) who demonstrated high HRQoL. A smaller proportion of 14 (14.0%) reported very high HRQoL, while none of the participants (0.0%) fell into the very low HRQoL category. Overall, the results indicate that the majority of adults with type 2 diabetes mellitus had Low to High health-related quality of life.

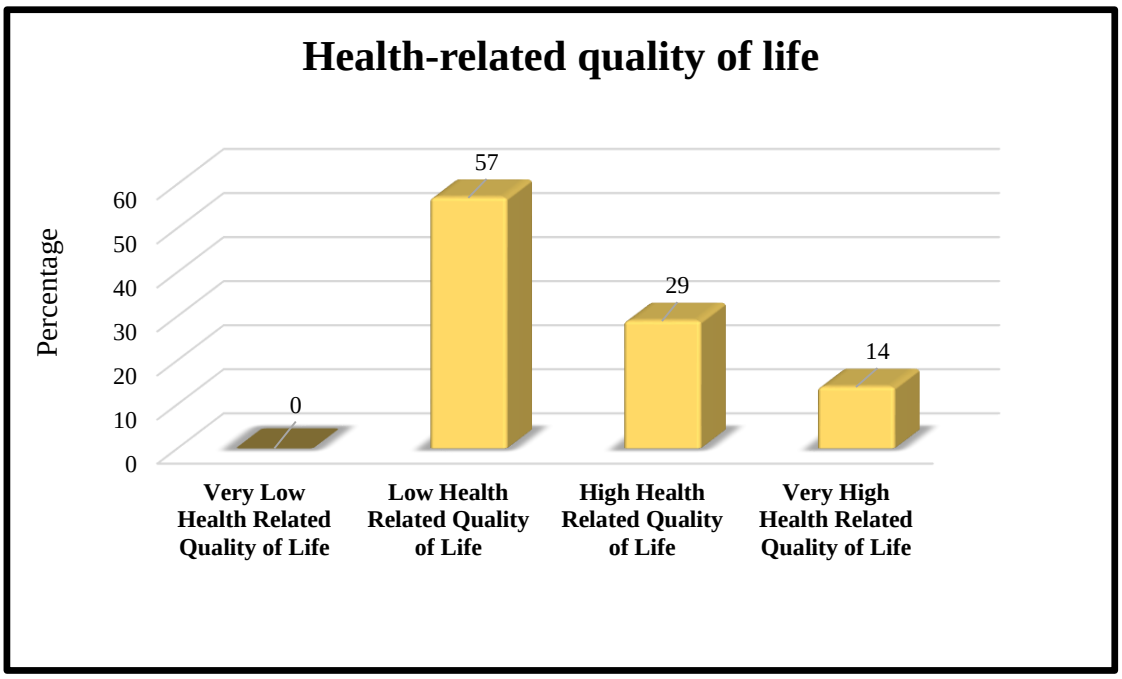

Figure 1: Column graph showing percentage distribution of participants according to health-related quality of life.

Analysis and interpretation of mean, mean percentage, median, mode, standard deviation of health related quality of life score.

Table 3 presents the mean, mean percentage, median, mode, and standard deviation of the readiness scores of nurses for health related quality of life among adults with type 2 diabetes mellitus.

[n=100]

Components	Test score
Mean	62.99
Mean %	44.99
Median	48.5
Mode	42
Standard deviation	24.13

The findings of Table 3 reveals that the present's descriptive statistics of the health-related quality of life scores among adults with type 2 diabetes mellitus. The mean health-related quality of life score was 62.99 (44.99%) with a standard deviation of 24.13, indicating variability in quality of life among participants. The median score was 48.5, while the mode was 42. These findings suggest that, on average, participants had a relatively low level of health-related quality of life.

Analysis and interpretation of the data related to determinants of type 2 diabetes mellitus among adults with type 2 diabetes mellitus

Table 4: Frequency and percentage distribution of determinants of type 2 diabetes mellitus

[n=100]

Sr. No.	Determinants	YES		NO	
		f	%	f	%
1.	Present Diabetes complications	15	15.00	85	85.00
2.	Poor medication adherence	98	98.00	2	2.00
3.	Poor dietary compliance	99	99.00	1	1.00
4.	Irregular blood sugar monitoring	100	100.00	0	0.00
5.	Missed medical follow-ups	100	100.00	0	0.00
6.	Financial difficulty for treatment	96	96.00	4	4.00
7.	No health insurance	96	96.00	4	4.00
8.	Reduced work capacity	97	97.00	3	3.00
9.	Inability to afford healthy food	97	97.00	3	3.00
10.	Diabetes-related anxiety	90	90.00	10	10.00
11.	Diabetes-related depression	69	69.00	31	31.00
12.	Felt social stigma	2	2.00	98	98.00
13.	Presence of Social isolation	25	25.00	75	75.00
14.	Poor family support	76	76.00	24	24.00
15.	Lack of emotional support	14	14.00	86	86.00
16.	Poor healthcare access	3	3.00	97	97.00

17.	Unsupportive healthcare professionals	10	10.00	90	90.00
18.	Inadequate diabetes guidance	31	31.00	69	69.00
19.	Unsafe and non convenient exercise environment	100	100.00	0	0.00
20.	Transportation difficulty	40	40.00	60	60.00

Table 4 shows the frequency and percentage distribution of determinants of type 2 diabetes mellitus among adults. A very high proportion of participants reported poor dietary compliance 99 (99.0%), poor medication adherence 98 (98.0%), irregular blood sugar monitoring 100 (100.0%), and missed medical follow-ups 100 (100.0%). Financial and resource-related issues were also prominent, including financial difficulty for treatment 96 (96.0%), no health insurance 96 (96.0%), reduced work capacity 97 (97.0%), and inability to afford healthy food 97 (97.0%). Psychological determinants revealed that diabetes-related anxiety was present in 90 (90.0%) participants, while diabetes-related depression was observed in 69 (69.0%). Social factors such as poor family support was reported by 76 (76.0%), whereas social isolation was noted in 25 (25.0%) participants. Only 2 (2.0%) participants reported felt social stigma. Healthcare-related determinants were less frequently reported, including poor healthcare access 3 (3.0%), unsupportive healthcare professionals 10 (10.0%), and inadequate diabetes guidance 31 (31.0%). Environmental barriers were substantial, with unsafe and non-convenient exercise environment reported by 100 (100.0%) and transportation difficulty by 40 (40.0%) participants. Overall, the findings indicate that behavioral, financial, psychological, and environmental determinants were highly prevalent among adults with type 2 diabetes mellitus.

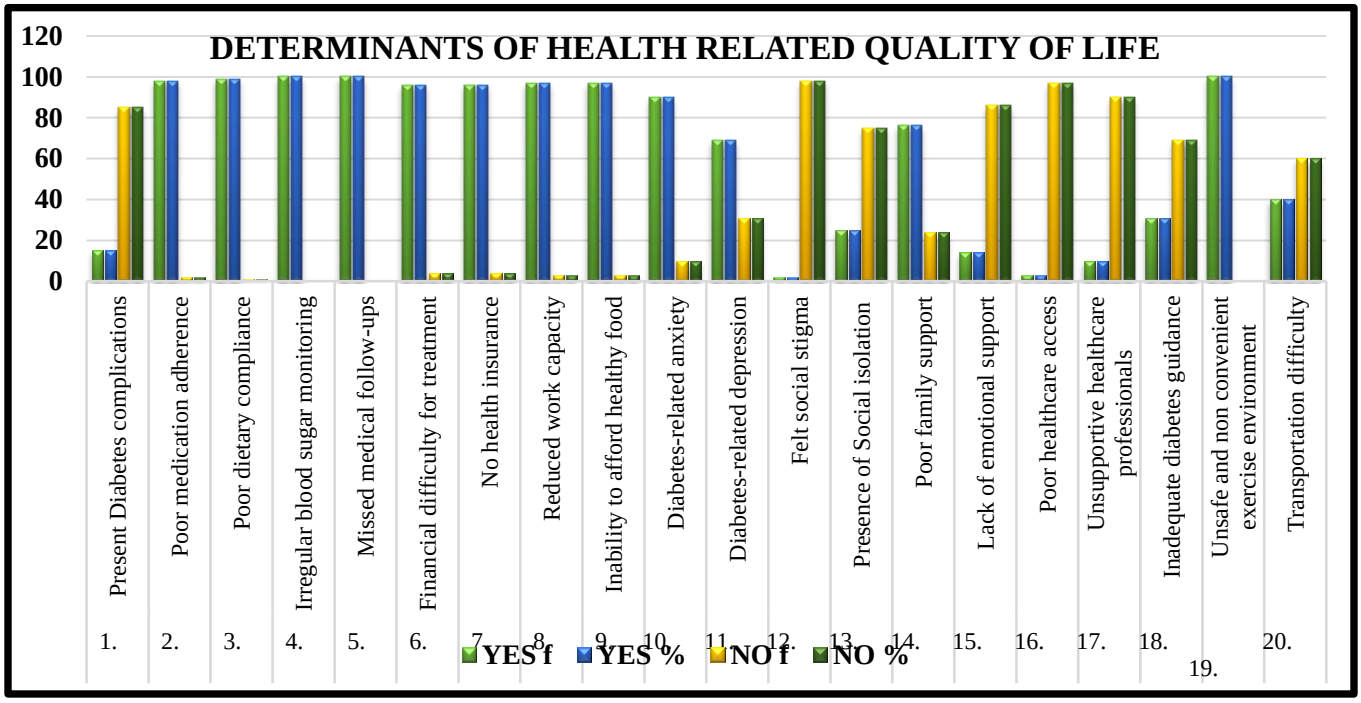

Figure 2: Column graph showing percentage distribution of participants according to determinants of health related quality of life.

Analysis and interpretation of the data related to co-relation between health-related quality of life and its determinants among adults with type 2 diabetes mellitus

Table 5: Co-relation between health related quality of life and its determinants among adults with type 2 diabetes mellitus

[n=100]

Sr. No.	Determinants		Pearson Correlation	P value
1.	Present Diabetes complications	Health related quality of life	-.263**	0.008
2.	Poor medication adherence		-.265**	0.008
3.	Poor dietary compliance		-0.18	0.073
4.	Irregular blood sugar monitoring		Cannot be computed because at least one of the variables is constant	
5.	Missed medical follow-ups		Cannot be computed because at least one of the variables is constant	
6.	Financial difficulty for treatment		-.380**	0.001
7.	No health insurance		-.315**	0.001
8.	Reduced work capacity		-.252*	0.012
9.	Inability to afford healthy food		-.332**	0.001
10.	Diabetes-related anxiety		-.222*	0.026
11.	Diabetes-related depression		-.244*	0.014
12.	Felt social stigma		-0.009	0.93
13.	Presence of Social isolation		-0.174	0.084
14.	Poor family support		-.282**	0.004
15.	Lack of emotional support		0.067	0.505
16.	Poor healthcare access		-0.159	0.115
17.	Unsupportive healthcare professionals		-0.183	0.068
18.	Inadequate diabetes guidance		-0.083	0.414
19.	Unsafe and non convenient exercise environment		Cannot be computed because at least one of the variables is constant	
20.	Transportation difficulty		0.043	0.672

Table 5 illustrates the Pearson correlation analysis between health-related quality of life (HRQoL) and its determinants, revealing several statistically significant negative correlations. Financial difficulty for treatment demonstrated the strongest negative association with HRQoL ($r = -0.380$, $p < 0.001$), followed by the inability to afford healthy food (= -0.332, p = 0.001) and a lack of health insurance ($r = -0.315$, $p = 0.001$). Significant negative relationships were also observed for clinical and functional factors, including poor medication adherence ($r = -0.265$, p = 0.008$), present diabetes complications ($r = -0.263$, $p = 0.008$), and reduced work capacity ($r = -0.252$, $p = 0.012$). Furthermore, poor family support (r = -

0.282, p = 0.004) alongside psychological distress—specifically diabetes-related depression (r = -0.244, p = 0.014$) and anxiety (r = -0.222, p = 0.026$)—were significantly linked to diminished HRQoL. Conversely, variables such as irregular blood sugar monitoring, missed medical follow-ups, and unsafe exercise environments yielded constant values across the sample, rendering correlation uncomputable.

Analysis and interpretation of data related to association between demographic variables and health related quality of life among adults with type 2 diabetes mellitus

Table 6: Association between selected demographic variables and health related quality of life

[n=100]

Sr. No.	Demographic Data	Health related Quality of Life			Chi	df	P value	S or NS
		Low	High	Very high				
1	**Age (in years)**				6.111	6	.411	NS
	30–40	17	15	6				
	41–50	10	4	4				
	51–60	12	4	2				
	>60	18	6	2				
2	**Gender**				3.055	2	.217	NS
	Male	34	18	5				
	Female	23	11	9				
3	**Level of Education**				5.217	8	.734	NS
	Illiterate	6	2	1				
	Primary school	14	5	3				
	Secondary school	8	2	2				
	Higher secondary	9	3	3				
	Graduate & above	20	17	5				
4	**Religion**				7.200	4	.126	NS
	Hindu	28	18	8				
	Muslim	21	4	2				
	Christian	8	7	4				
5	**Marital Status**				13.407	8	.099	NS
	Single	0	0	1				
	Married	36	21	8				
	Widowed	12	3	2				
	Divorced	4	5	1				
	Separated	5	0	2				
6	**Number of Children**				6.105[a]	6	.411	NS
	1	12	11	6				
	2	21	10	5				

Sr. No.	Demographic Data	Health related Quality of Life			Chi	df	P value	S or NS
		Low	High	Very high				
	3	16	6	3				
	More than 3	8	2	0				
7	**Occupation**				9.637	8	.291	NS
	Office-based work	15	14	4				
	Agricultural/Farming	3	1	1				
	Construction/Manual labour	11	2	2				
	Domestic/Household	15	7	1				
	Self-employed/Business	13	5	6				
8	**Physical Activity Pattern**				7.103	6	.311	NS
	None	18	10	3				
	Aerobics	9	9	3				
	Strength training	4	2	3				
	Household chores	26	8	5				
9	**Alcohol Consumption**				10.752	6	.096	NS
	Used to drink, stopped	9	2	1				
	Frequently	0	3	0				
	Sometimes	1	2	1				
	Do not drink	47	22	12				
10	**Smoking Habit**				4.220	6	.647	NS
	Used to smoke, stopped	1	0	1				
	Frequently	16	6	2				
	Sometimes	6	4	1				
	Do not smoke	34	19	10				
11	**Duration of Diabetes**				8.572	6	.199	NS
	1–5 years	20	15	10				
	6–10 years	24	8	1				
	11–15 years	5	3	1				
	>15 years	8	3	2				
12	**Dietary Pattern**				5.496	2	.064	NS

Sr. No.	Demographic Data	Health related Quality of Life			Chi	df	P value	S or NS
		Low	High	Very high				
	Vegetarian	34	24	11				
	Non-vegetarian	23	5	3				
13	**Co-morbidity**				17.202	8	.028**	S
	Hypertension	18	13	4				
	Thyroid	5	3	2				
	Kidney disease	12	1	0				
	Others	0	3	0				
	No any	22	9	8				
14	**Type of Therapy**				7.024	4	.135	NS
	Oral medication	28	16	8				
	Injectable (Insulin)	24	6	3				
	Diet & lifestyle only	5	7	3				
15	**Monthly Family Income (₹)**				19.411	6	.004**	S
	≤10,000	1	1	2				
	10,001–20,000	24	8	8				
	21,001–40,000	31	17	1				
	>40,000	1	3	3				

NS = Not Significant **S = Significant ($p < 0.05$)**

Table 6 shows no statistically significant association between HRQoL and variables such as age ($\chi^2 = 6.111$, $p = 0.411$), gender ($\chi^2 = 3.055$, $p = 0.217$), level of education ($\chi^2 = 5.217$, $p = 0.734$), religion ($\chi^2 = 7.200$, $p = 0.126$), marital status ($\chi^2 = 13.407$, $p = 0.099$), number of children ($\chi^2 = 6.105$, $p = 0.411$), occupation ($\chi^2 = 9.637$, $p = 0.291$), physical activity pattern ($\chi^2 = 7.103$, $p = 0.311$), alcohol consumption ($\chi^2 = 10.752$, $p = 0.096$), smoking habit ($\chi^2 = 4.220$, $p = 0.647$), duration of diabetes ($\chi^2 = 8.572$, $p = 0.199$), dietary pattern ($\chi^2 = 5.496$, $p = 0.064$), and type of therapy ($\chi^2 = 7.024$, $p = 0.135$), as all p-values were greater than 0.05. However, a statistically significant association was observed between HRQoL and co-morbidity ($\chi^2 = 17.202$, $p = 0.028$) as well as monthly family income ($\chi^2 = 19.411$, $p = 0.004$). This indicates that the presence of co-morbid conditions and variations in income levels significantly influenced the quality of life of adults with type 2 diabetes mellitus.

Discussion

The findings suggest that adults with type 2 diabetes mellitus experience varying levels of health-related quality of life across different aspects of their lives. Overall, the participants demonstrated a low to moderate level of quality of life, indicating that diabetes has a noticeable impact on their daily well-being. Social relationships and psychological well-being were found to be the relatively stronger domains, suggesting that many participants were able to maintain supportive social interactions and emotional stability despite their condition. Daily functioning was also reasonably maintained among the participants.

However, physical health, treatment-related challenges, financial burden, and dietary and lifestyle restrictions were identified as areas that negatively affected quality of life. These difficulties may result from the long-term nature of diabetes management and the continuous adjustments required in daily living **(Fisher et al., 2019; Hernández-Segura et al., 2022**). The findings emphasize the need for a holistic approach to diabetes care that addresses not only medical management but also psychosocial, financial, and lifestyle-related concerns **(Chauhan et al., 2025; Unnikrishnan et al., 2017)**. Such interventions may contribute to improving the overall health-related quality of life of adults living with type 2 diabetes mellitus.

Conclusion

A major conclusion of this study is that HRQoL scores are significantly associated with specific socio-demographic and clinical variables, highlighting their direct impact on patient health related outcomes. Furthermore, the widespread existence of self-management barriers and psychological distress highlights a critical necessity to raise awareness about effective coping measures. Recognizing a significant lack in existing literature and clinical counselling, this study developed a targeted informational booklet on self-regulation techniques to serve as a practical tool for improving and managing daily HRQoL among diabetic patients.

Acknowledgment

The authors express their sincere gratitude to the participants, validators, concerned department, and hospital for their support.

Conflicts of Interest

The authors declare no conflict of interest.

Source of Funding

Self-funded

References

1. American Diabetes Association. (2024). Standards of care in diabetes—2024. *Diabetes Care*, *47*(Suppl. 1), S1–S323.
2. Cappuccio, F. P., D'Elia, L., Strazzullo, P., & Miller, M. A. (2010). Quantity and quality of sleep and incidence of type 2 diabetes: A systematic review and meta-analysis. *Diabetes Care*, *33*(2), 414–420. https://doi.org/10.2337/dc09-1124
3. Centers for Disease Control and Prevention. (2021). *Measuring healthy days: Population assessment of health-related quality of life*. U.S. Department of Health and Human Services. https://www.cdc.gov/hrqol/index.htm
4. Chauhan, S., et al. (2025). The rising burden of diabetes and state-wise variations in India: Insights from the Global Burden of Disease Study 1990–2021 and projections to 2031. *Frontiers in Endocrinology*, *16*, Article 1505143. https://doi.org/10.3389/fendo.2025.1505143
5. Davies, M. J., Aroda, V. R., Collins, B. S., Gabbay, R. A., Green, J., Maruthur, N. M., Rosas, S. E., Del Prato, S., Mathieu, C., Mingrone, G., Rossing, P., Tankova, T., Tsapas, A., & Buse, J. B. (2022). Management of hyperglycemia in type 2 diabetes, 2022. A consensus report by the

American Diabetes Association (ADA) and the European Association for the Study of Diabetes (EASD). *Diabetes Care*, *45*(11), 2753–2786. https://doi.org/10.2337/dci22-0034

6. Fisher, L., Polonsky, W. H., & Hessler, D. (2019). Addressing diabetes distress in clinical care: A practical guide. *Behavioral Medicine*, *45*(2), 139–149. https://doi.org/10.1080/08964289.2019.1601058
7. Glanz, K., Handy, S. L., Henderson, K. E., Slater, S. J., Davis, E. L., & Powell, L. M. (2016). Built environment attributes and diabetes risk: A systematic review. *American Journal of Preventive Medicine*, *50*(4), 531–542. https://doi.org/10.1016/j.amepre.2015.10.003
8. Hernández-Segura, N., Landero-Hernández, R., & González-Ramírez, M. T. (2022). Psychological distress, self-care behaviors, and health-related quality of life in adults with type 2 diabetes. *Frontiers in Psychology*, *13*, Article 891243. https://doi.org/10.3389/fpsyg.2022.891243
9. Huang, Q., et al. (2025). Global burden and risk factors of type 2 diabetes mellitus from 1990 to 2021, with forecasts to 2050. *Frontiers in Endocrinology*, *16*, Article 1538143. https://doi.org/10.3389/fendo.2025.1538143
10. Marín-Peñalver, J. J., Martín-Timón, I., Sevillano-Palacios, C., & Del Cañizo-Gómez, F. J. (2016). Update on the treatment of type 2 diabetes mellitus. *World Journal of Diabetes*, *7*(17), 354–395. https://doi.org/10.4239/wjd.v7.i17.354
11. Saeedi, P., Petersohn, I., Salpea, P., Malanda, B., Karuranga, S., Unwin, N., Colagiuri, S., Guariguata, L., Motala, A. A., Ogurtsova, K., Shaw, J. E., Bright, D., & Williams, R. (2019). Global and regional diabetes prevalence estimates for 2019 and projections for 2030 and 2045: Results from the International Diabetes Federation Diabetes Atlas, 9th edition. *Diabetes Research and Clinical Practice*, *157*, Article 107843. https://doi.org/10.1016/j.diabres.2019.107843
12. The WHOQOL Group. (1995). The World Health Organization Quality of Life assessment (WHOQOL): Position paper from the World Health Organization. *Social Science & Medicine*, *41*(10), 1403–1409. https://doi.org/10.1016/0277-9536(95)00112-K
13. Unnikrishnan, R., Anjana, R. M., & Mohan, V. (2017). Diabetes in South Asians: Is the phenotype different? *The Lancet Diabetes & Endocrinology*, *5*(9), 740–749. https://doi.org/10.1016/S2213-8587(15)00504-9
14. Williams, R., Karuranga, S., Malanda, B., Saeedi, P., Basit, A., Besançon, S., Bommer, C., Esteghamati, A., Ogurtsova, K., Zhang, P., & Colagiuri, S. (2020). Global and regional estimates and projections of diabetes-related health expenditure: Results from the International Diabetes Federation Diabetes Atlas, 9th edition. *Diabetes Research and Clinical Practice*, *162*, Article 108072. https://doi.org/10.1016/j.diabres.2020.108072
15. World Health Organization. (2023). *Diabetes*. World Health Organization. https://www.who.int/news-room/fact-sheets/detail/diabetes