

# Evaluating the Quality of Life in Children Aged 10- 16 with Type 1 Diabetes in Yazd: A Comprehensive Assessment of Psychological, Social, and Health-Related Challenges

Mohammad Mehdi Falahati<sup>1</sup>, Nasim Namiranian<sup>2</sup>, Vida Sadat Anoosheh<sup>3</sup>, Masoud Rostami<sup>4</sup>, Farzad Ferdosian<sup>5</sup>, Ahmad Shajari<sup>6\*</sup>

<sup>1</sup>Student of Medicine, Ali-Ebn-Abitaleb School of Medicine, Islamic Azad University, Yazd Branch, Yazd, Iran.

<sup>2</sup>Diabetes Research Center, Shahid Sadoughi University of Medical Sciences, Yazd, Iran.

<sup>3</sup>Department of Ergonomics, School of Health, Shiraz University of Medical Sciences, Shiraz, Iran.

<sup>4</sup>Department of Languages and Literature, Yazd University, Yazd, Iran.

<sup>5</sup>Children Growth Disorder Research Center, Shahid Sadoughi University of Medical Sciences, Yazd, Iran.

<sup>6</sup>Assistant Professor of Pediatrics Nephrology Ali-Ebne-Abitaleb School of Medicine, Islamic Azad university, Yazd, Iran.

## Abstract

**Objective:** Type 1 diabetes significantly affects children physical, emotional, social, and academic well-being, reducing their Quality of Life (QoL) and potentially causing psychological problems. This study evaluates the QoL in children aged 10 - 16 with type 1 diabetes in Yazd.

**Materials and Methods:** In this analytical cross-sectional study, 75 children with type 1 diabetes who visited healthcare clinics in Yazd were assessed. Data were collected using a demographic questionnaire and the Pediatric QoL Inventory (PedsQL), QoL questionnaire, evaluating four subscales: physical, emotional, social, and academic performance. Data were analyzed using SPSS -24 software.

**Results:** The highest QoL score was in the physical dimension (mean: 8.51 ( $\pm$  7.04)), while the lowest was in academic performance (mean: 4.02 ( $\pm$  3.75)). A significant relationship was found between gender and academic performance (girls: 2.43 ( $\pm$  1.58), boys: 1.93 ( $\pm$  1.04)) ( $P=$  0.021). HbA1C levels significantly correlated with academic ( $P=$  0.028) and social ( $P=$  0.013) dimensions. Parental education (father:  $P=$  0.007, mother:  $P=$  0.047) and employment status (father:  $P=$  0.039, mother:  $P=$  0.025) were also associated with QoL and academic performance.

**Conclusion:** Type 1 diabetes particularly impacts the academic and social dimensions of QoL in children, potentially leading to long-term psychological consequences. Further research should explore therapeutic, educational, and familial interventions to enhance their QoL.

**Keywords:** Life quality, Children, Type 1 diabetes, Yazd

## QR Code:



**Citation:** Falahati M M, Namiranian N, Anoosheh V S, Rostami M, Ferdosian F, Shajari A. Evaluating the Quality of Life in Children Aged 10- 16 with Type 1 Diabetes in Yazd: A Comprehensive Assessment of Psychological, Social, and Health-Related Challenges. IJDO 2025; 17 (1) :10-18

**URL:** <http://ijdo.ssu.ac.ir/article-1-930-en.html>



10.18502/ijdo.v17i1.18029

## Article info:

**Received:** 12 December 2024

**Accepted:** 20 January 2025

**Published in February 2025**



This is an open access article under the (CC BY 4.0)

## Corresponding Author:

**Ahmad Shajari**, Assistant Professor of Pediatrics Nephrology Ali-Ebne-Abitaleb School of Medicine, Islamic Azad University, Yazd, Iran.

**Tel:** (98) 913 151 1813

**Email:** a\_shajari@yahoo.com

**Orcid ID:** 0000-0003-2305-4733

## Introduction

Type 1 diabetes (T1D) is a chronic autoimmune disease in which the body's immune system mistakenly attacks and destroys insulin-producing beta cells in the pancreas (1). Unlike type 2 diabetes, which is primarily linked to lifestyle factors and is common in adults, type 1 diabetes is predominantly diagnosed in children and adolescents (2). This form of diabetes is increasing globally, presenting significant challenges in terms of public health management (3). It is estimated that over 1.1 million children and adolescents worldwide live with T1D, with the highest incidence rates observed in regions such as Europe and North America (4,5). The burden of managing T1D is substantial, requiring constant monitoring of blood glucose levels, insulin administration, dietary management, and regular medical check-ups (6).

The impact of T1D on the daily life of affected children and adolescents is multifaceted (7). In addition to the physical challenges of managing the disease, children with diabetes often face emotional, social, and academic difficulties (8,9). The constant need for blood glucose testing, insulin injections, and dietary monitoring can lead to stress and anxiety, affecting their mental health (10). Furthermore, social challenges, such as stigma and isolation, are common, as children with diabetes may feel different from their peers due to visible changes in their lifestyle and medical needs (11). Academic performance can also be affected, as cognitive and emotional pressures from managing the disease impact a child's ability to focus and participate in school activities (12). Studies have shown that children with T1D typically perform worse academically compared to their peers without diabetes, and experience higher rates of school absenteeism due to fluctuating blood sugar levels (13,14).

Quality of Life (QoL) is a comprehensive measure used to assess the overall well-being of individuals, evaluating aspects such as

physical, emotional, social, and academic functioning (15-17). In the context of chronic diseases like T1D, assessing QoL provides valuable insights into how the disease affects daily functioning and overall life satisfaction (18,19). Pediatric QoL Inventory (PedsQL) is a widely used tool for evaluating the QoL in children and adolescents, covering various life domains that may be impacted by chronic conditions such as type 1 diabetes (20, 21). By assessing the physical, emotional, social, and academic functioning of children with type 1 diabetes, PedsQL helps provide a deeper understanding of how the disease affects various aspects of a child's life, offering essential information for healthcare providers, caregivers, and policymakers (22).

There is significant population of children with T1D in central Iran, Yazd (23). However, limited research has been conducted in this region to assess the impact of this disease on the QoL of these children. While global studies on the QoL in children with T1D are abundant, regional differences in healthcare access, social and cultural factors, and family dynamics may influence outcomes (24). Therefore, investigating the specific context of Yazd is crucial to understanding the experiences of these children and identifying ways to improve their QoL through targeted interventions (25).

This study evaluates the QoL in children aged 10 to 16 with T1D in Yazd, focusing on physical, emotional, social, and academic aspects. It examines the relationships between demographic and disease-related factors, such as gender, parental education, and HbA1c levels, and aims to inform healthcare strategies to improve the well-being of these children. The findings may guide interventions and policy development to enhance T1D management and QoL at a regional level.

## Material and Methods

This analytical cross-sectional study aimed to investigate the QoL of children and

adolescents with T1D in Yazd, Iran, in 2023. The study population included all children and adolescents aged 10 -16 years who had a confirmed diagnosis of T1D and were referred to the Yazd Diabetes Center. This age group was chosen due to the critical importance of adolescence in shaping health-related behaviors and its impact on QoL. The sample size was determined using Cochran's formula, considering a 95% confidence level and a 5% margin of error. A total of 75 participants were included in the study. Sampling was conducted using a convenience method, whereby all eligible children and adolescents were consecutively enrolled as they visited the center until the required sample size was achieved. The inclusion criteria for the study were: being between the ages of 10-16, having a confirmed diagnosis of T1D by a specialist, a minimum of one year since diagnosis, the ability to understand and respond to the questionnaires, fluency in Persian, and obtaining informed consent from both parents and children to participate. The exclusion criteria included having other chronic diseases, physical or psychological conditions that could affect understanding or completing the questionnaires, relocation outside Yazd during the study period, and withdrawal by either the child or parents at any stage of the study.

Data collection was conducted using the standardized Pediatric QoL Inventory (PedsQL 4.0) (21). This internationally validated instrument is widely used to assess the QoL in children and adolescents across physical, emotional, social, and school functioning domains. The questionnaire consists of 23 items divided into four subscales: physical functioning (8 items), emotional functioning (5 items), social functioning (5 items), and school functioning (5 items). Responses are scored on a 5-point Likert scale (never= 0 to almost always= 4). The total score is reverse-coded and transformed into a 0-100 scale, with higher scores indicating better QoL (21). The translated standard questionnaire was used (21,26).

The questionnaires were administered in two versions: one for the children and one for their parents. Data collection was carried out by a trained researcher, adhering to standardized protocols. To minimize potential errors, the study's objectives were thoroughly explained to the parents and children. The questionnaires were completed in a quiet and stress-free environment to ensure accurate and honest responses.

Following data collection, the information was analyzed using SPSS version 24. Descriptive statistics, including means, standard deviations, and frequency distribution tables, were used to describe demographic variables and QoL scores. For inferential analysis, independent T-tests were used to compare mean QoL scores across demographic variables, and Pearson correlation coefficients were employed to examine relationships between quantitative variables. A significance level of less than 0.05 was considered statistically significant in all analyses.

### Statistical analysis

The collected data were analyzed by SPSS software version 22. To compare the variables in different groups, paired t-test was used. The significance level was set at 0.05 for all statistical tests.

### Ethical considerations

Ethical considerations were meticulously observed throughout the study. Ethical approval was obtained from the Ethics Committee of the University of Medical Sciences (Ethics Code: IR.IAU.KHUISF.REC.1403.024). Written informed consent was obtained from both parents and children. Confidentiality and anonymity of the data were maintained at all stages. The results were reported only in aggregate form, ensuring that no individual information was disclosed.

### Results

The study included participants aged between 10-16 years, with the youngest being

10 years old and the oldest 16 years. The age distribution was as follows: 15.3% were 10 years old, 40.0% were aged 11-12 years, 25.3% were 13-14 years old, and 9.3% were 15-16 years old. The gender distribution showed that 68% of the participants were girls, and 32% were boys. Educationally, 21% of the participants were in high school, and 79%

Regarding parental education, the highest percentage of mothers had a high school diploma (42.6%), while the lowest percentage had a PhD or higher (3.7%). Among fathers, 28.7% had a high school diploma, while the lowest percentage had a PhD or higher (5.3%).

Parental income was reported as follows: 62.7% of the families had a monthly income between 1,000,000 and 5,000,000 tomans. In terms of occupation, 53.3% of fathers were self-employed, while 6.7% were unemployed. Among mothers, homemaking was the most

common occupation (46.7%), while the lowest percentage was in administrative jobs (18.7%). In terms of residence, 53.3% of participants lived in urban areas.

Concerning HbA1c levels, the results indicated that 73.3% of participants had HbA1c levels of 7% or higher, suggesting suboptimal glycemic control in the studied group.

The results from the completed questionnaires, as shown in Table 1, indicate the average QoL scores in various functional domains among adolescents with T1D.

The analysis of QoL by gender is showed in Table 2 and the analysis of QoL by age group is showed in Table 3.

Furthermore, the QoL of children with T1D was assessed based on parental education levels.

**Table 1. QoL scores by functional domain**

Variable	Mean ( $\pm$ Standard Deviation)
Physical functioning	8.04 ( $\pm$ 7.51)
Emotional functioning	6.31 ( $\pm$ 6.24)
Social functioning	4.39 ( $\pm$ 3.71)
Academic functioning	3.75 ( $\pm$ 4.02)

**Table 2. QoL of children with type 1 diabetes by gender**

Variable	Gender	Mean $\pm$ Standard Deviation	P-value
Physical functioning	Male	1.89 ( $\pm$ 0.35)	0.279
	Female	1.45 ( $\pm$ 0.15)	
Emotional functioning	Male	1.21 ( $\pm$ 0.32)	0.582
	Female	1.66 ( $\pm$ 0.218)	
Social functioning	Male	1.07 ( $\pm$ 0.20)	0.404
	Female	0.92 ( $\pm$ 0.14)	
Academic functioning	Male	1.04 ( $\pm$ 0.19)	0.021
	Female	1.58 ( $\pm$ 0.24)	

**Table 3. QoL of children with type 1 diabetes by gender**

Variable	Age Group	Mean $\pm$ Standard Deviation	P-value
Physical functioning	10	1.94 ( $\pm$ 1.13)	0.696
	11-12	1.72 ( $\pm$ 1.58)	
	13-14	2.11 ( $\pm$ 1.40)	
	15-16	2.89 ( $\pm$ 1.92)	
Social functioning	10	1.21 ( $\pm$ 1.68)	0.229
	11-12	2.16 ( $\pm$ 1.81)	
	13-14	2.83 ( $\pm$ 1.54)	
	15-16	2.06 ( $\pm$ 1.30)	
Emotional functioning	10	1.41 ( $\pm$ 1.04)	0.286
	11-12	2.83 ( $\pm$ 1.75)	
	13-14	2.61 ( $\pm$ 1.79)	
	15-16	2.07 ( $\pm$ 1.59)	
Academic functioning	10	1.82 ( $\pm$ 1.78)	0.411
	11-12	2.81 ( $\pm$ 1.89)	
	13-14	2.19 ( $\pm$ 1.43)	
	15-16	2.52 ( $\pm$ 1.09)	

A significant correlation was found between overall QoL and parental education levels (father:  $P= 0.007$ , mother:  $P= 0.047$ ). Specifically, a significant relationship was observed between the educational subscale of QoL and parental education levels (father:  $P= 0.049$ , mother:  $P= 0.025$ ).

The study found that the QoL of children with Type 1 diabetes is influenced by parental occupation and income levels. A significant relationship was observed between the academic functioning subscale and the father's occupation ( $P= 0.039$ ,  $P= 0.018$ ), where children of self-employed fathers had lower academic performance compared to those with fathers in other occupations. Similarly, the mother's occupation showed a significant association with academic functioning ( $P= 0.025$ ), with children of housewives scoring slightly lower. No significant associations were found for physical, social, or emotional functioning in relation to parental occupation.

Regarding family income, significant relationships were noted for the social functioning ( $P= 0.009$ ) and academic functioning ( $P= 0.017$ ) subscales. Children from lower-income families scored lower in both social and academic functioning compared to those from middle or high-income families. However, no significant differences were found for physical or emotional functioning across income levels.

Overall, these results suggest that economic stability, reflected through parental occupation and income, plays a key role in the academic and social QoL of children with Type 1 diabetes. Addressing financial disparities and providing targeted educational support may help improve outcomes in these areas.

The results showed a significant relationship

between disease severity, based on HbA1c levels and QoL (Table 4)

## Discussion

T1D is one of the most common chronic diseases in children and adolescents, with significant impacts on their physical, psychological, social, and academic well-being. This disease is typically diagnosed during childhood or adolescence, and due to the need for strict blood sugar control and continuous treatment, it places considerable pressure on both the affected individuals and their families. In addition to physical complications such as cardiovascular diseases, nephropathy, and retinopathy, psychological issues like depression, anxiety, and stress can arise, all of which affect the QoL of patients and make them different from healthy individuals (27,28).

The present study, which investigates the QoL in children and adolescents aged 10-16 years with T1D in Yazd city, found that the highest scores for QoL were related to physical performance, while academic performance had the lowest scores. These findings align with similar studies, which reported that the QoL in diabetic adolescents ranged from moderate to good (29-31). QoL, particularly in chronic diseases, is a multidimensional concept that includes physical, psychological, social, and academic domains, and various factors such as age, gender, parental education level, and living environment can influence it (32-34).

In terms of gender, the results of this study revealed that boys had better QoL in physical and social domains, while girls scored higher in emotional and academic areas.

These gender differences are consistent with

**Table 4. QoL in children with type 1 diabetes based on disease severity (HbA1c levels)**

Subscale	HbA1c Levels	Frequency (%)	df	P-value
Physical functioning	Below 7	26.7 (20)	4	0.491
	$\geq 7$	73.3 (55)		
Emotional functioning	Below 7	26.7 (20)	4	0.138
	$\geq 7$	73.3 (55)		
Social functioning	Below 7	26.7 (20)	4	0.013
	$\geq 7$	73.3 (55)		
Academic functioning	Below 7	26.7 (20)	4	0.028
	$\geq 7$	73.3 (55)		

findings from other studies, which suggest that boys, particularly in the physical and social domains, tend to perform better than girls, while girls show higher satisfaction in life and academic performance (35). Additionally, as age increases, the QoL in adolescents with type 1 diabetes tends to decrease, which could be related to increased psychological pressures, concerns, and the physical changes associated with the disease (36). In this regard, other studies have also indicated that diabetic adolescents experience less life satisfaction as they grow older, and the concerns related to the disease are more prominent in girls (37-39).

Family factors also play a significant role in shaping the QoL. In this study, it was found that as parental education level, particularly that of mothers, increased, the academic performance of diabetic adolescents decreased. This may be due to higher expectations and academic pressures from educated parents, which result in increased stress and, consequently, a lower QoL in adolescents (40). These results align with other studies indicating that parental education level is associated with better health behaviors and QoL for children (41).

Furthermore, the findings of the present study suggest that urban environments, especially those with better access to healthcare and treatment services, are associated with better QoL for diabetic adolescents compared to rural areas. This difference may be attributed to lifestyle changes in cities, including poor nutrition, higher stress, and less physical activity (40). Additionally, studies investigating the prevalence of diabetes in urban and rural areas have shown that diabetes is more common in urban women compared to rural women (42,43).

Regarding the relationship between HbA1c levels and QoL, the results of this study showed that lower HbA1c levels were associated with better QoL in social and academic domains. These findings are in line with studies suggesting that better disease

control can contribute to an improvement in QoL (44). However, some other studies, have reported no significant relationship between HbA1c levels and QoL, indicating the complexity of evaluating QoL in diabetic patients (45,46).

Moreover, this study found a significant relationship between parental income and the QoL of children with diabetes. Children from families with higher income levels had better QoL. Parents with higher income levels can provide better financial and social support, which can help improve self-care behaviors in adolescents and ultimately enhance their QoL (47,48).

The results of this study suggest that the QoL of adolescents with T1D is influenced by several factors, including age, gender, parental education level, occupation, income, and living environment. Therefore, to improve the QoL for these patients, attention should be given to various dimensions of the disease, and comprehensive psychological, social, and educational support should be provided. Further research in this area can help identify new factors that influence the QoL of diabetic patients.

## Conclusion

This study explored the QoL in children and adolescents with T1D in Yazd, Iran, revealing that the disease affects physical, emotional, social, and academic aspects. Boys reported better physical and social QoL, while girls had higher emotional and academic satisfaction. Older adolescents showed lower QoL, and higher parental education was linked to decreased academic performance, possibly due to increased stress. Higher income and urban living conditions improved QoL, while better glycemic control (HbA1c levels) positively impacted social and academic domains. The findings emphasize the need for holistic, culturally sensitive interventions to address both physical and psychosocial challenges.

## Acknowledgments

The authors would like to thank all participants involved in the survey, as well as the associate editor and reviewers for their careful review and insightful comments, which helped us improve this manuscript.

## Funding

None

## Conflict of Interest

The authors declare that there are no conflicts of interest.

## Authors' contributions

A.Sh.: contributed to the supervision and data analysis, N.N.: was responsible for data collection, V.S.A.: handled manuscript writing and result analysis, M.R. assisted with translation and manuscript writing, F.F.: performed the data analysis, and M.M.F.: contributed to data collection and manuscript writing.

All the authors critically revised the manuscript, agree to be fully accountable for the integrity and accuracy of the study, and read and approved the final manuscript.

## References

1. Ajmal N, Bogart M, Corbin K, Khan P, Shafqat M, Bergmeier S, et al. 8010 Potent MSB-61 as Type 1 Diabetes (T1D) therapy: mechanism of action in insulin secretion. *Journal of the Endocrine Society*. 2024;8(Supplement\_1):bvae163-886.
2. Kang TG, Youngblood B. Genetics and Epigenetics of Type 1 Diabetes Self-Reactive T Cells. *Cold Spring Harbor Perspectives in Medicine*. 2024;a041586.
3. Yameny AA. Diabetes Mellitus Overview 2024. *Journal of Bioscience and Applied Research*. 2024;10(3):641-5.
4. James S, Maniam J, Cheung PT, Urakami T, von Oettingen J, Likitmaskul S, et al. Epidemiology and phenotypes of diabetes in children and adolescents in non-European-origin populations in or from Western Pacific region. *World Journal of Clinical Pediatrics*. 2022;11(2):173.
5. Ogle GD, James S, Dabelea D, Pihoker C, Svennson J, Maniam J, et al. Global estimates of incidence of type 1 diabetes in children and adolescents: Results from the International Diabetes Federation Atlas. *Diabetes research and clinical practice*. 2022;183:109083.
6. Bahal M, Pande V, Dua J, Mane S. Advances in type 1 diabetes mellitus management in children. *Cureus*. 2024;16(8):e67377.
7. Los E, Wilt AS. Type 1 diabetes in children. Publishing Copyright © 2024, StatPearls Publishing LLC.; 2024.
8. Streisand R, Monaghan M. Young children with type 1 diabetes: challenges, research, and future directions. *Current diabetes reports*. 2014;14:1-9.
9. Giblin S, Scully P, Dalton N, Connolly M, McCaffrey A, Sheikhi A, et al. Parent and child perceptions of physical activity with type 1 diabetes. *BMJ Open Diabetes Research and Care*. 2022;10(6):e002977.
10. Zambanini A, Newson RB, Maisey M, Feher MD. Injection related anxiety in insulin-treated diabetes. *Diabetes research and clinical practice*. 1999;46(3):239-46.
11. Halvorson M, Yasuda P, Carpenter S, Kaiserman K. Unique challenges for pediatric patients with diabetes. *Diabetes Spectrum*. 2005;18(3):167-73.
12. Whitgob EE, Loe IM. Impact of chronic medical conditions on academics of children in the child welfare system. *Frontiers in Public Health*. 2018;6:267.
13. Glaab LA, Brown R, Daneman D. School attendance in children with type 1 diabetes. *Diabetic Medicine*. 2005;22(4):421-6.
14. Mitchell RJ, McMaugh A, Woodhead H, Lystad RP, Zurynski Y, Badgery-Parker T, et al. The impact of type 1 diabetes mellitus in childhood on academic performance: a matched population-based cohort study. *Pediatric Diabetes*. 2022;23(3):411-20.
15. de Wit M, Gajewska KA, Goethals ER, McDarby V, Zhao X, Hapunda G, et al. ISPAD clinical practice consensus guidelines 2022: psychological care of children, adolescents and young adults with diabetes. *Pediatric diabetes*. 2022;23(8):1373.
16. Portela-Pino I, Domínguez-Alonso J, Alvarías-Villaverde M, Chinchilla-Mira JJ. Influence of personal, academic, social, and level of physical activity variables on emotional intelligence. *Children*. 2022;9(2):286.
17. Van Duinkerken E, Snoek FJ, De Wit M. The cognitive and psychological effects of living with type 1 diabetes: a narrative review. *Diabetic Medicine*. 2020 ;37(4):555-63.

18. Gopisetty D, Levine B, Liu N, Younge P, Brown A, Close KL, et al. How does diabetes affect daily life? A beyond-A1C perspective on unmet needs. *Clinical Diabetes*. 2018;36(2):133-7.
19. Lukács A, Bettina Zagraj V, Bartkone Kovacs A, Soós A, Török A, et al. Health-related quality of life of preschool-aged children with type 1 diabetes in the context of family and maternal functioning. *Journal of Child Health Care*. 2022;26(1):31-41.
20. Varni JW, Limbers CA, Burwinkle TM. Impaired health-related quality of life in children and adolescents with chronic conditions: a comparative analysis of 10 disease clusters and 33 disease categories/severities utilizing the PedsQL™ 4.0 Generic Core Scales. *Health and quality of life outcomes*. 2007;5:1-5.
21. Varni JW, Seid M, Kurtin PS. PedsQL™ 4.0: Reliability and validity of the Pediatric Quality of Life Inventory™ Version 4.0 Generic Core Scales in healthy and patient populations. *Medical care*. 2001;39(8):800-12.
22. Varni JW, Burwinkle TM, Jacobs JR, Gottschalk M, Kaufman F, Jones KL. The PedsQL™ in type 1 and type 2 diabetes: reliability and validity of the Pediatric Quality of Life Inventory™ generic core scales and type 1 diabetes module. *Diabetes care*. 2003;26(3):631-7.
23. Askari M, Namiranian N, Aghae-Meybody SM, Mozafari Z, Shariati M. The First Phase Registration of Type 1 Diabetes in Yazd, Iran. *Iranian journal of diabetes and obesity*. 2021;13(4):144-49.
24. Laffel LM, Connell A, Vangsness L, Goebel-Fabbri A, Mansfield A, Anderson BJ. General quality of life in youth with type 1 diabetes: relationship to patient management and diabetes-specific family conflict. *Diabetes care*. 2003;26(11):3067-73.
25. Beck JK, Cogen FR. Outpatient management of pediatric type 1 diabetes. *The Journal of Pediatric Pharmacology and Therapeutics*. 2015;20(5):344-57.
26. Sperber AD. Translation and validation of study instruments for cross-cultural research. *Gastroenterology*. 2004;126:S124-8.
27. Shen Y, Chen Y, Huang S, Yao X, Kanwar YS, Zhan M. The Association between Symptoms of Depression and Anxiety, Quality of Life, and Diabetic Kidney Disease among Chinese Adults: A Cross-Sectional Study. *International journal of environmental research and public health*. 2022;20(1):475.
28. Bai JW, Lovblom LE, Cardinez M, Weisman A, Farooqi MA, Halpern EM, et al. Neuropathy and presence of emotional distress and depression in longstanding diabetes: results from the Canadian study of longevity in type 1 diabetes. *Journal of Diabetes and its Complications*. 2017;31(8):1318-24.
29. Shapira A, Harrington KR, Goethals ER, Volkening LK, Laffel LM. Health-related quality of life in youth with type 1 diabetes: Associations with multiple comorbidities and mental health conditions. *Diabetic Medicine*. 2021;38(10):e14617.
30. De Wit M, Delemarre-van de Waal HA, Bokma JA, Haasnoot K, Houdijk MC, Gemke RJ, et al. Monitoring and discussing health-related quality of life in adolescents with type 1 diabetes improve psychosocial well-being: a randomized controlled trial. *Diabetes care*. 2008;31(8):1521-6.
31. Lukács A. Physical fitness and health-related quality of life in children and adolescents with type 1 diabetes mellitus. *Debreceni Egyetem (Hungary)*; 2013.
32. Alcañiz M, Solé-Auró A. Feeling good in old age: factors explaining health-related quality of life. *Health and quality of life outcomes*. 2018 ;16:1-9.
33. Al Qadire M, ALHosni F, Al-Daken L, Aljezawi ME, Al Omari O, Khalaf A. Quality of Life and Its Predictors among Patients with Selected Chronic Diseases. *InNursing Forum* . Hindawi.2023;2023(11):6657164.
34. Redemptus PW, Roga AU. Holistic Therapy to Improve Quality of Life in Chronic Disease Patients. *Jurnal Promkes: The Indonesian Journal of Health Promotion and Health Education*. 2023;11(1SP):108-12.
35. Tanabe T, Snyder AR, Bay RC, Valovich McLeod TC. Representative values of health-related quality of life among female and male adolescent athletes and the impact of gender. *Athletic Training & Sports Health Care*. 2010;2(3):106-12.
36. Abd El-Satar SM, Mohamed SF, Zeid WA, Ismail MA, Atwa HA. Quality of Life among Adolescents with Diabetes Mellitus Type 1 Attending Pediatric Unit of Diabetes Mellitus, Suez Canal University Hospital. *The Egyptian Journal of Hospital Medicine* . 2023;93:7627-32.
37. Siddiqui MA, Khan MF, Carline TE. Gender differences in living with diabetes mellitus. *Materia socio-medica*. 2013;25(2):140.
38. Hirose M, Beverly EA, Weinger K. Quality of life and technology: impact on children and families with diabetes. *Current diabetes reports*. 2012;12:711-20.
39. Graue M, Wentzel-Larsen T, Bru E, Hanestad BR. The coping styles of adolescents with type 1 diabetes are associated with degree of metabolic control. *Clinical Diabetology*. 2004;5(4):217-24.
40. Chiu C, Kyzar K, Zuna N, Turnbull A, Summers JA, Gomez VA. 23 Family Quality of Life. *The Oxford handbook of positive psychology and disability*. 2013:365.
41. Francisco Mora C, Ibáñez A, Balcells-Balcells A. State of the art of family quality of life in early care and disability: A systematic review. *International*



- Journal of Environmental Research and Public Health. 2020;17(19):7220.
42. Bolin J, Schulze A, Helduser J, Ory M. The burden of diabetes in rural America. *Rural Healthy People* 2020. 2015:43-53.
  43. Mercado CI, McKeever Bullard K, Gregg EW, Ali MK, Saydah SH, Imperatore G. Differences in US rural-urban trends in diabetes ABCS, 1999–2018. *Diabetes Care*. 2021;44(8):1766-73.
  44. Alsahli MA, Alalwan A, Aburیشه KH, Alarifi FF, Alshaya HM, Alkholaif AF, et al. Assessing satisfaction, quality of life, and HbA1c changes in type 1 diabetes patients who are using freestyle libre glucose monitoring. *Journal of Family Medicine and Primary Care*. 2024;13(6):2367-74.
  45. Rubin RR, Peyrot M. Quality of life and diabetes. *Diabetes/metabolism research and reviews*. 1999;15(3):205-18.
  46. Gebremedhin T, Workicho A, Angaw DA. Health-related quality of life and its associated factors among adult patients with type II diabetes attending Mizan Tepi University Teaching Hospital, Southwest Ethiopia. *BMJ Open Diabetes Research and Care*. 2019;7(1):e000577.
  47. Weissberg-Benchell J, Nansel T, Holmbeck G, Chen R, Anderson B, Wysocki T, et al. Generic and diabetes-specific parent–child behaviors and quality of life among youth with type 1 diabetes. *Journal of pediatric psychology*. 2009;34(9):977-88.
  48. Malik FS, Senturia KD, Lind CD, Chalmers KD, Yi-Frazier JP, Shah SK, et al. Adolescent and parent perspectives on the acceptability of financial incentives to promote self-care in adolescents with type 1 diabetes. *Pediatric diabetes*. 2020;21(3):533-51.