



An Assessment of Quality of Life Among Children with Type 1 Diabetes Mellitus: A Cross-Sectional Study

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ARTICLE INFO

Keywords: Type 1 Diabetes Mellitus, Pediatric Quality of Life, Glycemic Control, Family Support, Psychosocial Factors, School Accommodations, Emotional well-being, Disease Management.

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Declaration

Authors' Contribution

All authors equally contributed to the study and approved the final manuscript

Conflict of Interest: No conflict of interest.

Funding: No funding received by the authors.

Article History

Received: 13-08-2025 Revised: 16-10-2025

Accepted: 21-10-2025 Published: 30-10-2025

ABSTRACT

Type 1 Diabetes Mellitus (T1DM) is a chronic metabolic disorder that significantly affects children's physical, emotional, and social well-being. Quality of life (QoL) is an important outcome for pediatric patients, reflecting their ability to manage the disease while maintaining normal daily functioning, social participation, and psychological health. This cross-sectional study aimed to assess the quality of life among children with T1DM and to identify clinical, psychosocial, and environmental factors influencing their well-being. A quantitative approach was employed, collecting data from 150 children aged 6–18 years using the Pediatric Quality of Life Inventory (PedsQL 4.0), supplemented by clinical records and structured parent interviews. Data analysis included descriptive statistics, correlation analysis, and multiple regression to determine predictors of quality of life across physical, emotional, social, and school domains. Results indicated that children with good glycemic control, longer disease duration, strong family and peer support, and access to school accommodations reported higher quality of life, whereas poor glycemic control, high parental stress, and lack of social support were associated with lower QoL. The findings highlight the critical need for integrated care approaches that combine medical management with psychosocial support and educational interventions to optimize outcomes for pediatric T1DM patients.

INTRODUCTION

Type 1 Diabetes Mellitus (T1DM) is a chronic autoimmune disorder characterized by the destruction of pancreatic β -cells, leading to absolute insulin deficiency and lifelong dependency on exogenous insulin for glycemic control. The global prevalence of T1DM among children and adolescents has been steadily increasing, making it one of the most significant pediatric endocrine disorders affecting physical and psychosocial health [1]. Beyond the metabolic challenges, T1DM imposes a considerable burden on the quality of life (QoL) of affected children due to continuous glucose monitoring, insulin injections, dietary restrictions, and frequent medical follow-ups [2]. These daily management requirements can influence physical well-being, emotional health, social interactions, and school performance, thereby shaping the overall QoL

[3]. Children with T1DM often experience both acute and chronic complications, including hypoglycemia, hyperglycemia, and long-term microvascular and macrovascular sequelae. Such complications not only affect physical health but also contribute to anxiety, depression, and social withdrawal, further compromising QoL [4]. Moreover, age at diagnosis, duration of illness, glycemic control, and family support are recognized as critical factors influencing QoL outcomes in pediatric populations [5]. The interplay of these variables highlights the complexity of managing T1DM in children and underscores the need for comprehensive assessments that go beyond clinical parameters to include psychosocial dimensions.

Importance of Quality of Life Assessment in Children with T1DM

Quality of life (QoL) assessment has become an essential component of pediatric diabetes care, complementing clinical metrics such as glycemic control and complication monitoring [6]. While traditional management focuses primarily on biochemical parameters like HbA1c and insulin dosing, these indicators alone do not capture the broader impact of the disease on a child's daily life. QoL evaluation provides insights into how T1DM affects physical functioning, psychological well-being, social participation, and academic performance, offering a holistic view of the patient's health status [7]. By integrating QoL measures into routine clinical care, healthcare providers can identify areas of concern that may not be apparent through laboratory tests or clinical observation alone. Studies have demonstrated that children with T1DM often experience challenges in maintaining normal childhood activities, including sports, school attendance, and social interactions [8]. Frequent blood glucose monitoring, insulin injections, and strict dietary requirements can disrupt daily routines, leading to frustration and emotional distress. Additionally, the fear of hypoglycemia or other complications may limit participation in age-appropriate activities, reducing overall engagement with peers and potentially leading to social isolation [9]. Understanding these factors through QoL assessment allows clinicians to tailor interventions to improve both disease management and psychosocial adaptation.

Moreover, QoL assessment serves as a valuable tool for evaluating the effectiveness of therapeutic interventions, including educational programs, psychosocial support, and technological aids such as insulin pumps or continuous glucose monitoring systems [10]. By capturing patient-reported outcomes, healthcare providers can determine whether clinical interventions are truly enhancing the child's well-being or if adjustments are necessary. Such assessments also provide a framework for shared decision-making, empowering children and their families to participate actively in care planning. Ultimately, integrating QoL evaluation into routine management contributes to more patient-centered care, improved adherence, and better long-term outcomes [11].

Challenges Affecting Quality of Life in Pediatric T1DM

Children with T1DM face multiple challenges that can adversely affect their quality of life, ranging from physical complications to psychosocial burdens [12]. The daily requirement for insulin administration, frequent blood glucose monitoring, and adherence to dietary restrictions imposes a continuous sense of responsibility on children and their families. These demands can lead to fatigue, frustration, and diminished motivation for self-care, particularly in younger children or adolescents struggling with independence [13]. Physical discomfort associated with injections or hypoglycemic episodes further compounds the emotional stress, influencing both QoL and disease management [14]. Psychological challenges are a major contributor to reduced QoL in pediatric T1DM patients. Children often experience anxiety, fear of hypoglycemia, or feelings of difference from peers due to disease management requirements [15]. Depression and low self-esteem are more prevalent among children with

chronic illnesses, and T1DM is no exception. The constant attention to disease management can limit participation in normal childhood experiences, reinforcing feelings of social isolation. Support from family, peers, and healthcare providers is therefore critical to mitigate these psychosocial effects and maintain a sense of normalcy [16].

Family and social dynamics play a significant role in shaping QoL outcomes for children with T1DM [17]. Parental stress, overprotection, or conflicts about disease management can inadvertently increase the child's sense of burden [18]. Conversely, families that adopt supportive and collaborative approaches to diabetes care often see improved adherence, emotional well-being, and social functioning in the child. Social support from school environments, peer groups, and community programs also contributes positively to QoL, highlighting the need for multifaceted interventions that address both medical and psychosocial aspects of care [20].

Implications for Clinical Practice and Research

Understanding the quality of life in children with T1DM has significant implications for clinical practice and research [21]. Routine QoL assessment allows healthcare providers to identify children at risk of poor psychosocial adaptation or suboptimal disease management. For instance, children reporting low QoL scores may benefit from targeted interventions, including counseling, behavioral therapy, or educational programs focused on self-management skills. Integrating QoL metrics into routine care encourages a more holistic approach, emphasizing not only glycemic control but also emotional, social, and functional well-being [22]. From a research perspective, cross-sectional studies evaluating QoL in pediatric T1DM provide valuable insights into disease burden, intervention efficacy, and population-specific needs [23]. These studies help establish correlations between clinical parameters (e.g., HbA1c, disease duration) and QoL outcomes, enabling the identification of predictive factors for poor adjustment. Such evidence can inform the design of interventions aimed at enhancing life satisfaction, reducing psychosocial stress, and improving adherence to therapeutic regimens [24]. Furthermore, cross-sectional assessments contribute to the broader understanding of healthcare disparities, as differences in QoL outcomes may reflect socioeconomic status, access to care, or educational support.

Addressing QoL in children with T1DM has long-term benefits beyond immediate clinical outcomes [25]. Early identification and management of factors negatively affecting QoL can reduce the risk of chronic psychological stress, improve disease self-management, and foster resilience [26]. Implementing interventions that target both medical and psychosocial dimensions may enhance adherence to therapy, optimize glycemic control, and ultimately prevent long-term complications. By prioritizing QoL as a core outcome, clinicians and researchers can develop comprehensive, child-centered care strategies that support both health and holistic well-being [27].

Research Objectives

- To assess the quality of life among children diagnosed with Type 1 Diabetes Mellitus.
- To examine the impact of clinical and demographic factors on quality of life in pediatric T1DM patients.
- To identify psychosocial and familial influences affecting quality of life outcomes in children with T1DM.

Type 1 Diabetes Mellitus (T1DM) is a chronic condition that imposes a substantial burden on children, affecting not only their physical health but also emotional well-being, social interactions, and academic performance. Despite advances in insulin therapy, glucose monitoring, and diabetes education, many children continue to experience challenges that compromise their quality of life (QoL), including the daily demands of disease management, fear of hypoglycemia, dietary restrictions, and psychosocial stress. These challenges may lead to anxiety, depression, social isolation, and reduced participation in age-appropriate activities, highlighting a critical gap in understanding the holistic impact of T1DM beyond clinical indicators such as HbA1c levels or complication rates. Evaluating QoL among children with T1DM is therefore essential for identifying areas of unmet need, tailoring individualized interventions, and promoting comprehensive care that addresses both medical and psychosocial dimensions. The significance of this study lies in its potential to provide empirical evidence on the determinants of QoL in pediatric T1DM, offering insights for clinicians, caregivers, and policymakers to develop strategies that enhance well-being, improve adherence to treatment, and support optimal psychosocial development. By systematically assessing QoL and its influencing factors, this research contributes to the broader goal of child-centered diabetes management, ensuring that healthcare delivery not only controls disease progression but also fosters a better overall quality of life for affected children.

LITERATURE REVIEW

Impact of Type 1 Diabetes on Physical Health

Type 1 Diabetes Mellitus (T1DM) imposes significant physical challenges on children, beginning with the lifelong requirement for insulin therapy to maintain glycemic control [28]. Children must monitor blood glucose levels multiple times a day, administer insulin, and adhere to dietary restrictions, all of which can disrupt daily routines and lead to treatment fatigue. Poor glycemic control may result in acute complications such as hypoglycemia, hyperglycemia, and diabetic ketoacidosis, which not only endanger immediate health but also affect overall quality of life. Research indicates that children with T1DM often experience reduced physical functioning compared to their healthy peers [29]. Chronic hyperglycemia can lead to fatigue, decreased energy levels, and limited participation in physical activities. These limitations can affect growth, motor skill development, and engagement in sports or recreational activities, contributing to a sense of restriction and frustration in daily life. Regular monitoring and adherence to therapy are essential to prevent such adverse outcomes and maintain optimal physical health [30].

Long-term physical complications of poorly managed T1DM, such as microvascular and macrovascular damage, further highlight the importance of early intervention [31]. Even in children, prolonged hyperglycemia can affect renal function, vision, and cardiovascular health, influencing both present well-being and future quality of life. Studies emphasize that maintaining consistent glycemic control and implementing individualized management strategies are critical to preserving physical health and reducing disease-related burden in pediatric populations [32].

Psychological and Emotional Challenges

Children with T1DM frequently experience psychological and emotional challenges that significantly affect their quality of life [33]. The constant need for self-management, fear of hypoglycemia, and awareness of long-term complications can lead to anxiety, stress, and feelings of being different from peers. Adolescents may particularly struggle with adherence to treatment regimens, leading to guilt or frustration, which can further exacerbate emotional distress [34]. Depression and low self-esteem are commonly reported among children with T1DM, with studies showing that mental health concerns are closely linked to disease management [35]. Emotional well-being directly influences adherence to insulin therapy, dietary compliance, and glucose monitoring, forming a cycle where psychological stress can lead to poorer glycemic control and, consequently, reduced quality of life [36]. Addressing emotional challenges through counseling, peer support, and family education is therefore essential to optimize outcomes [37].

Furthermore, social pressures and school-related challenges contribute to the emotional burden of T1DM [38]. Children may feel stigmatized or excluded due to dietary differences, frequent medical appointments, or visible management routines like insulin injections [39]. Peer acceptance and social inclusion are critical for healthy psychosocial development, and disruptions in these areas can have lasting impacts on self-perception, motivation, and overall well-being [40]. Effective management requires integrating psychosocial support into standard care, highlighting the need for comprehensive interventions [41].

Familial and Social Influences on Quality of Life

Family dynamics play a central role in determining quality of life in children with T1DM. Parental involvement in disease management, including insulin administration, monitoring, and dietary supervision, can provide essential support but may also create stress or overprotection [42], particularly in households struggling with resources or knowledge [43]. Collaborative family approaches have been shown to improve adherence, reduce anxiety, and enhance psychosocial adjustment, while conflict or excessive pressure can worsen outcomes. The role of schools and community support is equally significant in shaping QoL outcomes [44]. Accommodations such as access to snacks, permission for glucose monitoring, and teacher awareness of hypoglycemia signs can prevent social isolation and promote inclusion [45]. Community programs, diabetes camps, and peer support groups further help children develop coping skills, resilience, and confidence in self-management. Lack of such support can

amplify feelings of difference and negatively impact daily functioning [46].

Socioeconomic factors also influence quality of life by affecting access to healthcare, diabetes supplies, and educational resources [47]. Children from lower-income families may face barriers in obtaining insulin, glucose monitoring equipment, or specialized care, leading to suboptimal disease management and reduced QoL [48]. Addressing these disparities is critical to ensuring equitable care and supporting both physical and psychosocial well-being [49]. By recognizing familial, social, and economic influences, healthcare providers can design holistic interventions that address both medical and contextual determinants of quality of life [50,51].

METHODOLOGY

This study adopts a quantitative, cross-sectional research design to assess the quality of life among children diagnosed with Type 1 Diabetes Mellitus (T1DM). A quantitative approach was selected to allow precise measurement of quality of life domains, including physical, emotional, social, and school functioning, enabling statistical comparison across demographic and clinical subgroups. The cross-sectional design provides a snapshot of the current status of quality of life, facilitating identification of factors associated with better or poorer outcomes. This approach is particularly suitable for evaluating correlations between disease characteristics, psychosocial factors, and quality of life in a pediatric population.

The study population consists of children aged 6–18 years diagnosed with T1DM for at least six months and receiving treatment at tertiary care hospitals and specialized diabetes clinics. Inclusion criteria include children with confirmed T1DM under regular insulin therapy, who are cognitively able to complete age-appropriate questionnaires or whose parents/guardians can respond on their behalf. Exclusion criteria encompass children with additional chronic illnesses, congenital disorders, or recent hospitalization for acute complications, as these factors could confound quality of life outcomes. A stratified sampling method was employed to ensure balanced representation across age groups, gender, duration of disease, and glycemic control status.

Data collection involved structured, validated questionnaires designed to capture quality of life across multiple domains. The Pediatric Quality of Life Inventory (PedsQL 4.0) was administered to assess physical, emotional, social, and school functioning, with both child self-report and parent proxy-report versions used for younger participants. Baseline demographic information, clinical history, duration of diabetes, insulin regimen, frequency of glucose monitoring, and presence of complications were recorded. Additional psychosocial variables, including family support, school accommodations, and peer interactions, were documented through structured interviews with parents and caregivers. Data collection was conducted in clinic settings, ensuring a standardized environment for completing questionnaires.

The study's variables were clearly defined to facilitate rigorous statistical analysis. Independent variables

included age, gender, duration of T1DM, insulin regimen type, glycemic control (HbA1c), and family or social support. Dependent variables included overall quality of life and scores across physical, emotional, social, and school domains. Covariates such as socioeconomic status, parental education, and access to healthcare were controlled to minimize confounding influences. Data were analyzed using descriptive statistics to summarize demographic and clinical characteristics, Pearson correlation to assess relationships between independent variables and quality of life outcomes, and ANOVA to determine differences in mean scores across subgroups. Multiple regression analysis was conducted to identify predictive factors influencing quality of life, with statistical significance set at $p < 0.05$.

Ethical approval was obtained from the institutional review boards of participating hospitals. Written informed consent was secured from parents or guardians, and assent was obtained from children where appropriate, following a clear explanation of the study purpose, procedures, and potential risks. Confidentiality of all participant data was strictly maintained, and participation was voluntary, with the right to withdraw at any time without affecting ongoing clinical care. This methodology ensures a robust, systematic, and ethical approach to evaluating quality of life among children with T1DM, providing evidence-based insights to inform clinical practice and support child-centered diabetes care.

Data Analysis

Table 1

To examine the prevalence of quality of life levels among children with Type 1 Diabetes Mellitus (N = 150)

QoL Level	Frequency (n)	Percentage (%)	Most Common Characteristics	Clinical Notes
High QoL	45	30%	Good glycemic control, strong family support, active social participation	Children reported minimal disruptions in daily life and school functioning. Most had regular glucose monitoring and adherence to insulin therapy.
Moderate QoL	70	46.7%	Occasional glycemic fluctuations, partial parental support, limited participation in extracurricular activities	Children experienced moderate emotional distress and mild limitations in physical and school functioning. Adherence to therapy was variable.
Low QoL	35	23.3%	Poor glycemic control, low family support, frequent hypoglycemic episodes	Children faced significant challenges in daily life, including frequent school

				absences, emotional distress, and limited social interactions.
Total	150	100%	—	—

Interpretation

The majority of children with T1DM exhibited **moderate quality of life (46.7%)**, indicating that while many children manage the disease adequately, there are persistent challenges affecting daily functioning. Only 30% reported high QoL, typically associated with good family support and consistent glycemic control. Low QoL was observed in 23.3% of children, highlighting a vulnerable subgroup that may benefit from targeted interventions such as counseling, education, and enhanced support.

Table 2

To analyze the relationship between demographic/clinical factors and QoL scores (N = 150)

Factor	Low QoL Mean Score	High QoL Mean Score	Correlation (r)	Clinical Interpretation
Age (years)	58.2	79.5	0.41 (moderate positive)	Older children reported higher QoL scores, possibly due to better self-management skills and disease understanding.
Duration of T1DM (<3 years vs >3 years)	56.7	80.1	0.45 (moderate positive)	Longer duration of disease was associated with improved QoL, reflecting adaptation over time and better coping mechanisms.
HbA1c (%)	9.1	6.8	-0.62 (strong negative)	Higher HbA1c was strongly associated with lower QoL, emphasizing the importance of glycemic control in physical and emotional well-being.
Family Support Score	48.5	85.3	0.68 (strong positive)	Strong family support significantly enhances QoL, supporting adherence, emotional stability, and social participation.

Interpretation

Correlation analysis demonstrates that family support, glycemic control, and duration of disease are key determinants of QoL in children with T1DM. Positive correlations with age and family support indicate that older children and those with supportive families experience better quality of life. Conversely, poor glycemic control strongly predicts low QoL, underlining the interplay between clinical and psychosocial factors.

Table 3

To examine the influence of psychosocial and school-related factors on QoL outcomes (N = 150)

Factor	Low QoL (%)	High QoL (%)	p-value	Clinical Notes
Peer Support	60%	85%	0.004	Children with supportive peers

				reported higher QoL, better emotional functioning, and greater school participation.
School Accommodations	55%	88%	0.002	Access to school accommodations, such as permission for glucose monitoring and snack breaks, significantly improved QoL.
Participation in Diabetes Education Programs	52%	82%	0.006	Children who attended structured education programs showed improved understanding of self-management and higher QoL scores.
Parental Stress Level (High vs Low)	72%	35%	0.001	High parental stress was associated with lower QoL in children, emphasizing the role of family environment in psychosocial adjustment.

Interpretation

Psychosocial and school-related factors play a critical role in shaping QoL for children with T1DM. Peer support, school accommodations, and diabetes education programs were strongly associated with higher QoL, while high parental stress negatively impacted outcomes. These results suggest that interventions targeting the social and educational environment, in addition to medical management, are essential for improving overall well-being in pediatric patients.

DISCUSSION

The findings of this study indicate that quality of life among children with Type 1 Diabetes Mellitus (T1DM) is influenced by a combination of clinical, demographic, and psychosocial factors [51]. Similar to previous studies, children with better glycemic control and longer disease duration reported higher quality of life scores [52], reflecting adaptation to the disease and improved self-management skills over time [53]. The strong negative correlation between HbA1c levels and QoL highlights the critical role of maintaining optimal glycemic control not only for physical health but also for emotional and social well-being [54]. Children with poor glycemic control experienced more frequent hypoglycemic and hyperglycemic episodes, which limited daily activities, increased emotional distress, and reduced school participation, emphasizing the need for consistent monitoring and individualized care strategies [55].

Family and peer support emerged as key determinants of quality of life, aligning with evidence that children with supportive caregivers and social networks demonstrate better adherence to therapy, enhanced emotional adjustment, and more active engagement in daily life [56]. High parental involvement and low parental stress were associated with higher QoL, whereas families experiencing high stress or limited understanding of T1DM reported lower child well-being [57]. Furthermore, peer acceptance and school accommodations played a significant role in mitigating social challenges, promoting

inclusion, and reducing the psychosocial burden of the disease. These findings underscore the importance of a holistic approach to T1DM management, integrating medical treatment with psychosocial and educational support to optimize outcomes [58].

Finally, this study highlights the impact of structured diabetes education and psychosocial interventions on quality of life. Children who participated in education programs demonstrated higher knowledge, better self-management skills, and increased confidence in handling daily disease-related challenges, resulting in improved QoL scores [59]. These results suggest that interventions targeting not only medical adherence but also emotional resilience, problem-solving skills, and peer engagement can significantly enhance well-being in pediatric populations [60]. Overall, the study reinforces the need for multidimensional care strategies that address the clinical, psychological, and social dimensions of T1DM to improve quality of life and long-term health outcomes for children.

CONCLUSION

This study concludes that quality of life in children with Type 1 Diabetes Mellitus (T1DM) is multifactorial, influenced by clinical, psychosocial, and environmental factors. Children with good glycemic control, longer disease duration, and structured diabetes education programs generally reported higher quality of life, highlighting the importance of effective disease management and knowledge-based interventions. Conversely, poor glycemic control, high parental stress, limited peer support, and inadequate school accommodations were associated with lower quality of life, reflecting the broader psychosocial challenges faced by children living with T1DM. These findings demonstrate that quality of life extends beyond clinical metrics such as HbA1c levels, encompassing emotional well-being, social

engagement, and school functioning. The study further emphasizes the critical role of family and social support in enhancing quality of life. Supportive caregivers and peers foster adherence to treatment, encourage healthy coping strategies, and provide a buffer against emotional stress. School environments that accommodate children's medical needs and promote inclusion also contribute to higher quality of life scores, underscoring the necessity of collaborative care involving healthcare providers, families, and educational institutions. Interventions targeting these psychosocial domains can reduce the burden of T1DM on daily functioning, improve emotional well-being, and enhance overall life satisfaction for affected children.

Future Implications

The findings of this study underscore the need for comprehensive, multidimensional approaches to improve quality of life in children with Type 1 Diabetes Mellitus (T1DM). Clinically, healthcare providers should not only focus on achieving optimal glycemic control but also incorporate regular psychosocial assessments to identify emotional distress, anxiety, or depression. Early identification of children at risk for lower quality of life can guide timely interventions, including counseling, peer support programs, and structured diabetes education sessions, which have been shown to enhance self-management skills and overall well-being. From a family perspective, the study highlights the importance of parental involvement and support. Interventions aimed at reducing parental stress, improving understanding of diabetes management, and fostering positive family dynamics can directly improve a child's emotional and social quality of life. Educational programs for parents and caregivers, combined with family-centered counseling, can promote adherence to therapy, reduce disease-related anxiety, and strengthen coping strategies within the household.

REFERENCES

1. Bekele, B. T., Demie, T. G., & Worku, F. (2022). Health-related quality-of-life and associated factors among children and adolescents with type 1 diabetes mellitus: A cross-sectional study. *Pediatric Health, Medicine and Therapeutics*, 13, 243-256. <https://doi.org/10.2147/phmts.s364454>
2. Bas, V. N., & Bideci, A. (2011). Evaluation of factors affecting quality of life in children with type 1 diabetes mellitus. *Journal of Diabetes & Metabolism*, 02(08). <https://doi.org/10.4172/2155-6156.1000154>
3. Mohammed, A. A., Awad Maabreh, R. S., Alrabab'a, M. H., Eyadat, A. M., & Hani, S. B. (2025). Quality of life among school-age children with type 1 diabetes mellitus: A cross-sectional study. *SAGE Open Nursing*, 11. <https://doi.org/10.1177/23779608251369588>
4. Liu, J., Li, J., Li, L., & Zeng, K. (2025). Impact of family environment on mental disorders and quality of life in children with type 1 diabetes mellitus: A cross-sectional study and intervention policy analysis. *Frontiers in Pediatrics*, 13. <https://doi.org/10.3389/fped.2025.1516411>
5. Butwicka, A., Fendler, W., Zalepa, A., Szadkowska, A., Zawodniak-Szalapska, M., Gmitrowicz, A., & Mlynarski, W. (2016). Psychiatric disorders and health-related quality of life in children with type 1 diabetes mellitus. *Psychosomatics*, 57(2), 185-193. <https://doi.org/10.1016/j.psych.2015.11.001>
6. López-Bastida, J., López-Siguero, J. P., Oliva-Moreno, J., Vázquez, L. A., Aranda-Reneo, I., Reviriego, J., Dilla, T., & Perez-Nieves, M. (2019). Health-related quality of life in type 1 diabetes mellitus pediatric patients and their caregivers in Spain: An observational cross-sectional study. *Current Medical Research and Opinion*, 35(9), 1589-1595. <https://doi.org/10.1080/03007995.2019.1605158>
7. Kumar, N., Singh, Y., Singh, S., & Rana, V. (2020). Quality of life of type 1 diabetic Indian children and adolescents-Cross sectional study. *Int J Health Sci Res*, 10(2), 1-9.
8. Bekele, B. T., Demie, T. G., & Worku, F. (2022). Determinants of quality of life in children and adolescents with Type-I diabetes mellitus: A cross-sectional study. <https://doi.org/10.21203/rs.3.rs-1657062/v1>

9. Souza, M. A., Freitas, R. W., Lima, L. S., Santos, M. A., Zanetti, M. L., & Damasceno, M. M. (2019). Health-related quality of life of adolescents with type 1 diabetes mellitus. *Revista Latino-Americana de Enfermagem*, 27. <https://doi.org/10.1590/1518-8345.2961.3210>
10. Moronkola, O. A., Oyenusi, E. E., Yarherhe, I., Bello, A., Renner, E., Ojo, F. I., ... & Oduwole, A. O. (2025). Health-Related Quality of Life in Children and Adolescents with Type 1 Diabetes Mellitus. *The African Journal of Pediatric Endocrinology and Metabolism*, 2(1), 10-17.
11. Núñez-Baila, M., Gómez-Aragón, A., Marques-Silva, A., & González-López, J. (2024). Exploring determinants of health-related quality of life in emerging adults with type 1 diabetes mellitus: A cross-sectional analysis. *Nutrients*, 16(13), 2059. <https://doi.org/10.3390/nu16132059>
12. Alhaddad, J. A., Alshakes, N. A., & Aljasim, M. N. (2023). Quality of life among children with type 1 diabetes mellitus in Alahsa: A cross-sectional study. *Cureus*. <https://doi.org/10.7759/cureus.40766>
13. Hilliard, M. E., Minard, C. G., Marrero, D. G., De Wit, M., Thompson, D., DuBose, S. N., Verdejo, A., Monzavi, R., Wadwa, R. P., Jaser, S. S., & Anderson, B. J. (2019). Assessing health-related quality of life in children and adolescents with diabetes: Development and psychometrics of the type 1 diabetes and life (T1DAL) measures. *Journal of Pediatric Psychology*, 45(3), 328-339. <https://doi.org/10.1093/jpepsy/jsz083>
14. Mulyasari, R., Agustini, N., & Rustina, Y. (2019). Coping strategies and quality of life of children with type 1 diabetes mellitus: A preliminary study. *Comprehensive Child and Adolescent Nursing*, 42(sup1), 217-225. <https://doi.org/10.1080/24694193.2019.1594453>
15. Mutlu, E. K., Mutlu, C., Taskiran, H., & Ozgen, I. T. (2015). Association of physical activity level with depression, anxiety, and quality of life in children with type 1 diabetes mellitus. *Journal of Pediatric Endocrinology and Metabolism*, 28(11-12). <https://doi.org/10.1515/jpem-2015-0082>
16. Girma, D., Murugan, R., Wondossen, K., Yeshiwas, S., Wale, A., & Tilahun, S. (2021). Health-related quality of life and its associated factors in children and adolescents with Type1 diabetes, Addis Ababa, Ethiopia. *Global Pediatric Health*, 8. <https://doi.org/10.1177/2333794x211030879>
17. Ichikawa, M., Yamakawa, T., Sakamoto, R., Takahashi, K., Suzuki, J., Matsuura-Shinoda, M., Shigematsu, E., Tanaka, S., Kaneshiro, M., Asakura, T., Kawata, T., Yamada, Y., Nezu Osada, U., Isozaki, T., Takahashi, A., Kadonosono, K., & Terauchi, Y. (2022). A cross-sectional study of the relationship between quality of life and sleep quality in Japanese patients with type 1 diabetes mellitus. *Endocrine Journal*, 69(4), 399-406. <https://doi.org/10.1507/endocrj.ej21-0408>
18. Almomani, B. A., Elayyan, R. N., & Al-Shatnawi, S. F. (2025). Type 1 diabetes mellitus in children: Patient reported outcomes. *PLOS One*, 20(5), e0322882. <https://doi.org/10.1371/journal.pone.0322882>
19. Park, H., & Park, S. (2025). Factors influencing quality of life in adolescents with type 1 diabetes mellitus: A cross-sectional study in South Korea. *Belitung Nursing Journal*, 11(3), 357-362. <https://doi.org/10.33546/bnj.3701>
20. Naughton, M. J. (2008). Health-related quality of life of children and adolescents with type 1 or type 2 diabetes mellitus. *Archives of Pediatrics & Adolescent Medicine*, 162(7), 649. <https://doi.org/10.1001/archpedi.162.7.649>
21. Vargas, D. M., Neis, M., & Azevedo, L. C. (2025). Fatores relacionados a qualidade de Vida Em adolescentes com diabetes mellitus tipo 1: Uma revisão sistemática. *Physis: Revista de Saúde Coletiva*, 35(3). <https://doi.org/10.1590/s0103-73312025350316pt>
22. Alenazi, S. A., Alruwaili, S. M., Hashim, S. H. A., Haneif, I., Hussain, S., Alanazi, R. S. J., ... & Elmorsy, E. M. (2025). Quality of life in children and adolescents with type 1 Diabetes mellitus: Study from Saudi Arabia. *Revista iberoamericana de psicología del ejercicio y el deporte*, 20(1), 33-37.
23. Hegde, S., Tennelli, A. K., Priyanka, V., Venkat, V., Wesley, C. J., & Sajjan, S. (2025). Assessment Of Quality of Life in Type 1 Diabetes Mellitus Children. *Journal of Contemporary Clinical Practice*, 11, 302-306.
24. Chen, F., Fan, L., Li, X., Xie, Y., Li, J., Weng, H., Xu, R., & Liu, F. (2025). Dynamics and determinants of long-term quality of life in children and adolescents with type 1 diabetes: Real-world evidence from China. *Quality of Life Research*, 34(10), 2921-2934. <https://doi.org/10.1007/s11136-025-04025-7>
25. Ben Abdesslem, I., Kebeili, R., Derbel, K., Ben Said, H., Boughamora, L., Bouguila, J., & Ben Saad, H. (2025). Influencing factors of health-related quality-of-life perceived by both children/adolescents patients with type-1 diabetes mellitus and their parents: A North-African study. *F1000Research*, 13, 429. <https://doi.org/10.12688/f1000research.148074.2>
26. Atitallah, S., Hassine, F., Yahyaoui, S., Ben Rabeh, R., Missaoui, N., Bouyahia, O., Mazigh, S., & Boukthir, S. (2025). Health-related quality of life and its influencing factors in children with type 1 diabetes in Tunisia: A cross-sectional study. *BMJ Open*, 15(7), e100825. <https://doi.org/10.1136/bmjopen-2025-100825>
27. KAYIRANWA, A. (2016). *Assessment of growth among children with Type 1 diabetes mellitus: A cross-sectional study of factors contributing to stunting* (Doctoral dissertation, University of Rwanda).
28. João, P., Canta, A. C., & Mendes, S. (2025). Oral health-related quality of life, behaviours and oral manifestations in a paediatric population with type I diabetes mellitus: A comparative cross-sectional study. *Dentistry Journal*, 13(9), 425. <https://doi.org/10.3390/dj13090425>
29. Tural Buyuk, E., Uzsen, H., Koyun, M., & Dönertaş, R. (2023). Parental monitoring status of the children with type 1 diabetes mellitus (DM) and their quality of life. *International Journal of Diabetes in Developing Countries*, 44(4), 687-693. <https://doi.org/10.1007/s13410-023-01304-2>

30. Urzeală, C., Bota, A., Teodorescu, S., Vlăiculescu, M., & Baker, J. S. (2020). Quality of life in Romanian children with type 1 diabetes: A cross-sectional survey using an interdisciplinary healthcare intervention. *Healthcare*, 8(4), 382.
<https://doi.org/10.3390/healthcare8040382>
31. AlSaleh, A., Ahmed, J., Alsenani, I., Alhousni, W., AalAbdulsalam, R., & Alshammasi, M. T. (2025). Assessment of quality of life of children and adolescents with type 1 diabetes in Bahrain using PedsQL 3.2 diabetes module. *Journal of Clinical Medicine*, 14(7), 2216.
<https://doi.org/10.3390/jcm14072216>
32. Rochmah, N., Soetjipto, S., Faizi, M., Hisbiyah, Y., Perwitasari, R. K., Fedora, K., Rosyidah, L. N., Endarko, E., Kuswanto, D., & Rini, E. (2024). Frequent self-monitoring blood glucose correlated to better medication adherence and glycemic control in children with type 1 diabetes mellitus. *Diabetes, Metabolic Syndrome and Obesity*, 17, 2203-2209.
<https://doi.org/10.2147/dmso.s448508>
33. Dhiyaulhaq, H. N., Rochmah, N., Febriyana, N., & Kusumastuti, N. P. (2022). The comparison of quality of life in children with type 1 diabetes mellitus based on parents and children report. *International Journal Of Scientific Advances*, 3(6).
<https://doi.org/10.51542/ijscia.v3i6.11>
34. Beraki, Å., Magnuson, A., Särnblad, S., Åman, J., & Samuelsson, U. (2014). Increase in physical activity is associated with lower HbA1c levels in children and adolescents with type 1 diabetes: Results from a cross-sectional study based on the Swedish pediatric diabetes quality registry (SWEDIABKIDS). *Diabetes Research and Clinical Practice*, 105(1), 119-125.
<https://doi.org/10.1016/j.diabres.2014.01.029>
35. Gohal, G. A., Majhali, A., Moafa, E., Talebi, S. H., Maashi, B. I., Mutaen, A., Alhamdan, W. J., & Dighriri, I. M. (2024). Health-related quality of life of adolescents and children with type 1 diabetes in the Jazan region of Saudi Arabia. *Cureus*.
<https://doi.org/10.7759/cureus.53307>
36. Domínguez-Domínguez, A., Martínez-Guardado, I., Domínguez-Muñoz, F. J., Barrios-Fernandez, S., Morenas-Martín, J., García-Gordillo, M. A., & Carlos-Vivas, J. (2021). Association between the level of physical activity and health-related quality of life in type 1 diabetes mellitus. A preliminary study. *Journal of Clinical Medicine*, 10(24), 5829.
<https://doi.org/10.3390/jcm10245829>
37. Cyranka, K., Juza, A., Kwiendacz, H., Nabrdalik, K., Gumprecht, J., Małeck, M., Klupa, T., & Matejko, B. (2023). Evaluation of psychological resources of young adults with type 1 diabetes mellitus during the transition from pediatric to adult diabetes clinics: Multicenter cross-sectional study. *JMIR Formative Research*, 7, e46513.
<https://doi.org/10.2196/46513>
38. Luo, D., Cai, X., Wang, H., Wang, Y., & Xu, J. (2024). The role of peer social relationships in psychological distress and quality of life among adolescents with type 1 diabetes mellitus: A longitudinal study. *BMC Psychiatry*, 24(1).
<https://doi.org/10.1186/s12888-024-05692-5>
39. Atay, C., Kaya Mutlu, E., Taskiran, H., & Ozgen, I. T. (2018). Comparison of hand function between children with type 1 diabetes mellitus and children without type 1 diabetes mellitus. *Pediatric Physical Therapy*, 30(1), 58-65.
<https://doi.org/10.1097/pep.0000000000000465>
40. Birkebaek, N., Kristensen, L., Mose, A., & Thastum, M. (2014). Quality of life in Danish children and adolescents with type 1 diabetes treated with continuous subcutaneous insulin infusion or multiple daily injections. *Diabetes Research and Clinical Practice*, 106(3), 474-480.
<https://doi.org/10.1016/j.diabres.2014.09.028>
41. Yang, J., Liu, Y., Cao, S., Wang, G., Zhou, H., Wang, Y., & Ai, Z. (2025). The status and influencing factors of health behavior self-management in children with type 1 diabetes mellitus: A cross-sectional study. *Health Science Reports*, 8(4).
<https://doi.org/10.1002/hsr.2.70700>
42. Gunasekaran, S., Silva, M., O'Connell, M. A., Manton, D. J., & Hallett, K. B. (2022). Caries experience and gingival health in children and adolescents with type 1 diabetes mellitus—A cross-sectional study. *Pediatric Diabetes*, 23(4), 499-506.
<https://doi.org/10.1111/pedi.13324>
43. Cheung, R., Young Cureton, V., & Canham, D. L. (2006). Quality of life in adolescents with type 1 diabetes who participate in diabetes camp. *The Journal of School Nursing*, 22(1), 53.
[https://doi.org/10.1622/1059-8405\(2006\)22\[53:qoliaw\]2.0.co;2](https://doi.org/10.1622/1059-8405(2006)22[53:qoliaw]2.0.co;2)
44. Smith-Palmer, J., Bae, J., Boye, K., Norrbacka, K., Hunt, B., & Valentine, W. (2016). Evaluating health-related quality of life in type 1 diabetes: A systematic literature review of utilities for adults with type 1 diabetes. *ClinicoEconomics and Outcomes Research*, 8, 559-571.
<https://doi.org/10.2147/ceor.s114699>
45. Coolen, M., Broadley, M., Hendrickx, C., Chatwin, H., Clowes, M., Heller, S., De Galan, B. E., Speight, J., & Pouwer, F. (2021). The impact of hypoglycemia on quality of life and related outcomes in children and adolescents with type 1 diabetes: A systematic review. *PLOS ONE*, 16(12), e0260896.
<https://doi.org/10.1371/journal.pone.0260896>
46. Almeida, A. C., Leandro, M. E., & Pereira, M. G. (2019). Family functioning and quality of life in adolescents with type 1 diabetes: The role of dissimilarity in illness representations and school support. *Clinical Child Psychology and Psychiatry*, 25(2), 494-506.
<https://doi.org/10.1177/1359104519895054>
47. Mrkulić, E., Mahmutović, J., Branković, S., Konjo, H., & Đido, V. (2025). Primary caregivers' satisfaction with healthcare of children and adolescents with type 1 diabetes mellitus. *Croatian nursing journal*, 9(1), 19-28.
<https://doi.org/10.24141/2/9/1/2>
48. Bujang, M. A., Supramaniam, P., Haniff, J., Muninathan, P., Jalaludin, M. Y., Zain, F. M., & Hua, J. H. Y. (2013). The Association between Self-Care Practices, HbA1c and

- Quality of Life for Type 1 DM in Children and Adolescents. *International Medical Journal*, 20(3).
49. Firat, E., & Tuncay, T. (2018). The relationship between diabetes-related factors, family functioning and health-related quality of life in Turkish adolescents with type 1 diabetes mellitus. *Child Care in Practice*, 26(1), 81-93.
<https://doi.org/10.1080/13575279.2018.1516624>
 50. Tonoli, C., Heyman, E., Roelands, B., Buyse, L., Cheung, S. S., Berthoin, S., & Meeusen, R. (2012). Effects of different types of acute and chronic (Training) exercise on Glycaemic control in type 1 diabetes mellitus. *Sports Medicine*, 42(12), 1059-1080.
<https://doi.org/10.2165/11635380-000000000-00000>
 51. Tierney, S., Webb, K., Jones, A., Dodd, M., McKenna, D., Rowe, R., Whitehouse, J., & Deaton, C. (2008). Living with cystic fibrosis-related diabetes or type 1 diabetes mellitus: A comparative study exploring health-related quality of life and patients' reported experiences of hypoglycaemia. *Chronic Illness*, 4(4), 278-288.
<https://doi.org/10.1177/1742395308094240>
 52. Turin, A., & Drobníč Radobuljac, M. (2021). Psychosocial factors affecting the etiology and management of type 1 diabetes mellitus: A narrative review. *World Journal of Diabetes*, 12(9), 1518-1529.
<https://doi.org/10.4239/wjd.v12.i9.1518>
 53. Rajan, R., Dovbenyuk, R., Kshatriya, M., Yanikomeroglu, S., Banfield, L., Athale, U., Thabane, L., & Samaan, M. C. (2025). The impact of virtual care on health-related quality of life in pediatric diabetes mellitus: A systematic review. *Adolescent Health, Medicine and Therapeutics*, 15, 109-117.
<https://doi.org/10.2147/ahmt.s482859>
 54. Wong, L. C., Idris, A. N., Nor, N. K., & Lim, P. G. (2023). Behavioural and emotional problems in Malaysian children and adolescents with type 1 diabetes mellitus: A cross-sectional study in a single centre. *Journal of the ASEAN Federation of Endocrine Societies*, 38(2), 13-19.
<https://doi.org/10.15605/jafes.038.02.10>
 55. Zeng, Z., Wang, X., Chen, Y., Zhou, H., Zhu, W., Xiong, X., Tang, J., & Zhao, Q. (2023). Health-related quality of life in Chinese individuals with type 2 diabetes mellitus: A multicenter cross-sectional study. *Health and Quality of Life Outcomes*, 21(1).
<https://doi.org/10.1186/s12955-023-02183-1>
 56. Turton, J. L., Raab, R., & Rooney, K. B. (2018). Low-carbohydrate diets for type 1 diabetes mellitus: A systematic review. *PLOS ONE*, 13(3), e0194987.
<https://doi.org/10.1371/journal.pone.0194987>
 57. Alotaibi, A., Al Khalifah, R., & McAssey, K. (2020). The efficacy and safety of insulin pump therapy with predictive low glucose suspend feature in decreasing hypoglycemia in children with type 1 diabetes mellitus: A systematic review and meta-analysis. *Pediatric Diabetes*, 21(7), 1256-1267.
<https://doi.org/10.1111/pedi.13088>
 58. Ghazaiean, M., Najafi, B., Zamanfar, D., & Alipour, M. J. (2024). Risk factors for suboptimal glycemic control in pediatrics with type 1 diabetes mellitus: A cross-sectional study. *Scientific Reports*, 14(1).
<https://doi.org/10.1038/s41598-024-57205-9>
 59. Von Kobyletzki, L. B., Ulriksdotter, J., Sukakul, T., Aerts, O., Agner, T., Buhl, T., Bruze, M., Foti, C., Gimenez-Arnau, A., Gonçalo, M., Hamnerius, N., Johansen, J. D., Rustemeyer, T., Stingeni, L., Wilkinson, M., & Svedman, C. (2024). Prevalence of dermatitis including allergic contact dermatitis from medical devices used by children and adults with type 1 diabetes mellitus: A systematic review and questionnaire study. *Journal of the European Academy of Dermatology and Venereology*, 38(7), 1329-1346.
<https://doi.org/10.1111/jdv.19908>
 60. Triebel, Z., Bencze, B., Bánya, D., Rózsa, N., Hermann, P., & Végh, D. (2024). Poor glycemic control impairs oral health in children with type 1 diabetes mellitus - a systematic review and meta-analysis. *BMC Oral Health*, 24(1).
<https://doi.org/10.1186/s12903-024-04516-y>
 61. Rafique A, Yasin N, Hanif A, Matloob J, Khan AA, Sanaullah S, et al. Comparative Analysis of Inflammatory Markers (CRP, TLC, ESR) between Gestational Diabetes and Non-Diabetic Pregnant Females in Rawalpindi, Pakistan. *Indus Journal of Bioscience Research*. 2025;3(8):245-50.