Determinants of Glycemic Control in Children and Adolescents with Type 1 Diabetes at the Diabetes Center of Al-Yarmouk Teaching Hospital in Baghdad

[1]Ali Jasim Ibraheem MBChB, FICMS
[1]Ruaa Salah Mahdi Alanizi MBChB, FICMS
[1]Marwa Jafar Wadi MBChB, FICMS

[1]Department of Pediatric Medicine, College of Medicine, Ibn Sina University of Medical and Pharmaceutical Sciences, Baghdad, Iraq

Email:
***Ali Jasim Ibraheem: dr.ali.ibraheem@ibnsina.edu.iq (Corresponding Author)**
Ruaa Salah Mahdi Alanizi: ruaa.alanizi@ibnsina.edu.iq
Marwa Jafar Wadi: marwajafar@ibnsina.edu.iq

Date of submission= 25/2/2026
Date of Accepted= 7/4/2026
Date of publication= 23/4/2026

ABSTRACT

Background: Type 1 Diabetes Mellitus (T1DM) is a major global health concern affecting children and young people worldwide, with limited data available from low- and middle-income countries, including Iraq.

Objectives: To investigate the clinical characteristics, management practices, and determinants of glycemic outcomes among pediatric patients with T1DM in Baghdad, Iraq.

Methods: A cross-sectional study was conducted at the Diabetes Center of Al-Yarmouk Teaching Hospital in Baghdad from January 2024 to January 2025. A total of 250 children and adolescents aged 1–18 years with confirmed T1DM were enrolled. Demographics and clinical presentation data, insulin regimen, frequency of blood glucose monitoring, use of diabetes technology, frequency of acute complications and psychosocial aspects was collected. Independent predictors of poor glycemic control (defined as HbA1c >9%) in the study population were identified using multivariate logistic regression analysis.

Results: Mean age of the study population was 10.5 ± 3.2 years. Males represented 52% of the study population. Diabetic ketoacidosis at the time of diagnosis was reported in 39.2% of patients. Only 40% of the study group achieved optimal glycemic control (defined as HbA1c<7%). Most participants (85%) received treatment with multiple daily insulin injections; however, continuous glucose monitoring was only available for 8%. Adolescence and infrequent self-monitoring of blood glucose (SMBG) were independently associated with poor glycemic control, with adjusted odds ratios (aORs) of 3.84 and 3.21, respectively. Additionally, lack of structured diabetes education (aOR = 2.87), low parental education level (aOR = 2.54), and family dysfunction (aOR = 2.42) were also identified as independent predictors of poor glycemic control.

Conclusion: Suboptimal glycemic control and a high rate of acute complications were demonstrated in children and adolescents with T1DM in Baghdad. Clinical, educational, and family-related factors were shown to be modifiable and had a significant impact on the outcomes for the study population. Enhanced structured diabetes education, improved access to SMBG, and the incorporation of family-centered support may improve pediatric T1DM care in resource- limited settings.

Keywords: Type 1 diabetes mellitus; glycemic control; children; adolescents; Baghdad

INTRODUCTION

Type 1 diabetes mellitus (T1DM) is one of the most common chronic illnesses affecting children and adolescents, with an estimated 1.1 million children living with the condition. The annual growth rate of new cases for T1DM has been reported to be between 2 – 5%, making it a growing concern for healthcare systems worldwide. [(1)] While there are more children with T1DM living in high-income countries than low- and middle-income countries, the number of children being diagnosed with T1DM is increasing rapidly in these countries, including the Middle East and North. [(2)] The rapid growth of T1DM in low- and middle-income countries places additional strain on overstretched healthcare systems. [(1)]

T1DM is caused by the autoimmune destruction of the pancreatic beta cells that results in complete loss of insulin production and consequently, affected individuals require exogenous insulin for life. [(3)] If diabetes is inadequately managed or if the child is diagnosed late, affected children are at greater risk for severe complications. Diabetic ketoacidosis (DKA) is a significant cause of morbidity and mortality among children with T1DM in resource-poor settings. [(4)] Although technology, such as continuous glucose monitors and insulin pumps, has improved the quality of life for children with T1DM in high-income countries, they remain limited in many developing areas. [(5)]

Over the last decade, the incidence of pediatric T1DM has increased in Iraq, similar to trends observed amid other challenges faced by the healthcare system, including conflict and economic instability. [(6)] Providing optimal care requires a multi-disciplinary approach that includes insulin therapy, structured dietary advice, diabetes self-management education, psychological support, and routine screening for complications. [(7)] However, there are multiple barriers to providing this care to children with T1DM in Iraq, including limited educational resources, limited access to new-generation insulin analogues and glucose monitoring devices, and a limited number of qualified pediatric endocrinologists. [(8)]

Research has shown that children with T1DM in Iraq have increased rates of DKA and poorer glycemic control than those in developed countries; largely attributable to late diagnosis, socio- economic disadvantages, and limited knowledge about diabetes. [(9)] Additionally, psychosocial pressures in conflict-affected regions can adversely affect adherence to treatment recommendations and ultimately affect the child's clinical outcome. [(10)] Although international guidelines recommend diagnosing children with T1DM early, using intensive insulin therapy regimens, educating them about diabetes self-care, and regularly monitoring their blood glucose levels, [(11, 12)] implementation of these guidelines remains limited in resource-limited countries. In fact, regional studies conducted in neighboring Middle Eastern countries found that 50 – 70% of adolescents with T1DM have poor glycemic control; [(13, 14)] however, there are no studies from Iraq that examine the management of pediatric T1DM or the psychosocial factors that may contribute to poor glycemic control.

Objectives of study

- To explore the clinical profile of children and adolescents with T1DM in Baghdad.
- To assess treatment methods used in pediatric T1DM management.
- To evaluate glycemic control among the study population.
- To identify modifiable predictors of poor glycemic control.
- To inform targeted interventions and policies for improving pediatric diabetes care.

METHODS

Study design, setting, and participants

A cross-sectional study conducted at the Diabetes Center of Al-Yarmouk Teaching Hospital in Baghdad, Iraq. The data were collected over a one-year time frame between January 2024 and January 2025. The department sees approximately 400 patients with T1DM each year. All consecutive eligible children and adolescents attending the clinic for care during the study period were consecutively enrolled until the target sample size was achieved of 250. Eligible children/adolescents were defined as being between the ages of 1-18 years and having been diagnosed with T1DM for at least 6 months, based on the American Diabetes Association criteria. [15]

They also had to be receiving regular insulin therapy and had attended at least two clinic visits within the previous 12 months. Exclusions included type 2 diabetes, monogenic or secondary diabetes, presence of chronic conditions affecting glucose metabolism, the use of medication that affects glucose metabolism in the month prior to enrollment, incomplete medical records, and refusal to participate in the study.

Sample size

Based on previous studies reporting 60% suboptimal glycemic control, [9, 16] the required sample size was calculated using the formula:

$$n=Z^2 p (1-p)/d^2$$

Where n is the sample size, Z is the standard normal deviate at 95% confidence level (1.96), p is the estimated proportion (0.60), and d is the margin of error. A minimum sample of 215 patients was required at a 95% confidence level. To ensure adequate power, 250 patients were enrolled.

Data collection

Data were collected through review of patient charts and through the completion of structured interviews by trained personnel using pre-designed standardized interview tools. The variables assessed were demographic information, age at diagnosis, length of time since diagnosis, clinical presentation of the disease at diagnosis, incidence of DKA at diagnosis, type of insulin regimen used, frequency of self-monitoring of blood glucose (SMBG), the most recent hemoglobin A1c measurement, occurrence of acute diabetes-related events over the past 12 months, and screening results, when available, for chronic complications. In addition, standardized instruments assessing psychosocial and educational factors related to diabetes management were administered using validated Arabic versions of the standardized measures. These instruments included the PedsQL™ Diabetes Module, the Problem Areas in Diabetes Treatment (PAID-T) in adolescents, and family functioning assessments. [17]

Structured diabetes education was defined as participation in a standardized clinician-led program delivered at the Diabetes Center of Al-Yarmouk Teaching Hospital in Baghdad by a pediatric endocrinology team, consisting of at least two formal sessions in the past 12 months and covering essential diabetes self-management topics. Participants receiving informal or non- standardized counseling were classified as not having received structured education.

Definitions

HbA1c was determined using certified high-performance liquid chromatography. Based on established thresholds, glycemic control was categorized into three levels: optimal (<7.0%), suboptimal (7.0–9.0%), and poor (>9.0%). [18] DKA was defined and classified in accordance with the ISPAD criteria, [19] while severe hypoglycemia referred to any episode requiring external assistance. [20]

Statistical analysis

Statistical analysis was performed using SPSS version 26. Continuous variables were summarized as means ± standard deviations, categorical variables as frequencies and percentages. Comparisons between groups were performed using independent t-tests or chi- square tests, as appropriate to the data structure. Multivariable logistic regression was performed to identify independent predictors of poor glycemic control (HbA1c >9%). Results were presented as adjusted odds ratios (aORs) with 95% confidence intervals. Model adequacy was evaluated using appropriate goodness-of-fit tests, and statistical significance was set at $p < 0.05$.

Ethical Considerations

The Institutional Review Board of the Ibn Sina University of Medical and Pharmaceutical Sciences (ISU-2022-345) has given ethical approval for this study. Informed written consent was obtained from all the parents or legal guardians of the children. All procedures were carried out according to the Declaration of Helsinki.

Results

Participant characteristics

A total of 250 children and adolescents diagnosed with T1DM were enrolled. The mean age was 10.5 ± 3.2 years. Most participants were in the 6–12 years age group (48.0%), followed by 13–18 years (34.0%) and 1–5 years (18.0%). Males accounted for 52.0% of the sample, while females represented 48.0%. The mean duration of diabetes was 4.1 ± 2.3 years. (Table 1)

Table 1: Demographic and clinical characteristics (n = 250)

Variable	Value
Age, mean ± SD (years)	10.5 ± 3.2
Age group, n (%)	
1–5 years	45 (18.0)
6–12 years	120 (48.0)
13–18 years	85 (34.0)
Sex, n (%)	
Male	130 (52.0)
Female	120 (48.0)
Duration of diabetes, mean ± SD (years)	4.1 ± 2.3

Clinical presentation and diagnosis

Classic manifestations of hyperglycemia, including polyuria, polydipsia, and weight loss, were observed in 75% of patients. DKA at initial presentation was identified in 39.2% of cases. Detailed diagnostic approaches and presenting characteristics are summarized in Table 2.

Table 2: Clinical presentation and diagnosis

Variable	n (%)
Classic symptoms at presentation (polyuria, polydipsia, weight loss)	188 (75.0)
DKA at diagnosis	98 (39.2)
Family history of diabetes	70 (28.0)
Diagnosis based on ADA criteria	250 (100)

Management practices and access to technology

Eighty-five percent of patients used multiple daily insulin injections; 50% of patients used an insulin pump for management of their diabetes. Access to diabetes-related technologies was limited; continuous glucose monitoring (CGM) was utilized by 8% of the study participants. Information on SMBG and the use of insulin delivery systems is shown in Table 3.

Table 3: Diabetes management and technology use

Variable	n (%)
Insulin regimen	
Multiple daily injections	213 (85.2)
Insulin pump therapy	37 (14.8)
SMBG frequency	
≥2 times/day	145 (58.0)
<2 times/day	105 (42.0)
CGM use	20 (8.0)

Glycemic control and acute complications

Regarding glycemic control (HbA1c <7.0%), 40% of study participants had achieved this goal; whereas, a glycemic category representing "poor" levels of control (HbA1c >9.0%) was observed in 35% of the sample. Additionally, over the preceding 12 months, 35.2% of the participants experienced DKA requiring treatment, and 24.8% had an episode of severe hypoglycemia. The frequency of complications by each glycemic category is displayed in table 4.

Table 4: Glycemic control and acute complications

Variable	n (%)
HbA1c categories	
Optimal (<7.0%)	100 (40.0)
Suboptimal (7.0–9.0%)	62 (24.8)
Poor (>9.0%)	88 (35.2)
DKA in previous 12 months	88 (35.2)
Severe hypoglycemia	62 (24.8)

Psychosocial factors and education

Only 38% of the study group received structured diabetes education. Adolescents were found to be at higher risk for clinically significant levels of diabetes-related distress (43.5%). A substantial proportion (28.8%) of families demonstrated evidence of dysfunction. Detailed psychosocial characteristics are presented in Table 5.

Table 5: Education and psychosocial factors

Variable	n (%)
Lack of structured diabetes education	155 (62.0)
Adolescents with significant distress	37 (43.5)*
Adolescents receiving psychological support	4 (4.7)*
Family dysfunction	72 (28.8)

* Adolescent-specific data based on n=85.

Predictors of poor glycemic control

The multivariate logistic models identified the following factors as independent predictors of poor glycemic control (defined as HbA1c >9%): adolescent age (aOR = 3.84); infrequent SMBG < 2 times per day (aOR = 3.21); absence of structured diabetes education (aOR = 2.87); low parental education (aOR = 2.54); family dysfunction (aOR = 2.42). The model demonstrated acceptable calibration and discrimination. Detailed findings are provided in Table 6.

Table 6: Independent predictors of poor glycemic control (HbA1c >9%)

Predictor	Adjusted OR (95% CI)	p-value
Adolescent age (13–18 years)	3.84 (1.92–7.68)	<0.001
SMBG <2 times/day	3.21 (1.65–6.24)	0.001
Lack of structured education	2.87 (1.48–5.56)	0.002
Low parental education	2.54 (1.32–4.89)	0.005
Family dysfunction	2.42 (1.15–5.09)	0.020

Model performance: Hosmer–Lemeshow $p = 0.52$ (good fit); AUC-ROC = 0.78

DISCUSSION

The study identifies significant gaps in the management and outcomes of T1DM, reflected by suboptimal glycemic control and a high burden of acute complications. Only 40% of patients achieved target HbA1c levels, while more than one-third experienced DKA at diagnosis or during follow-up. These findings underscore ongoing challenges in early detection, continuity of care, and long-term disease management in resource-limited settings.

The prevalence of DKA at diagnosis in this study was higher (39.2%) compared to reports from other high-income countries (range 6-8%). [21] However, it is similar to previously published rates of DKA in nearby Middle Eastern countries, specifically Saudi Arabia (30-45%) [22] and Kuwait (30-45%). [23]These findings suggest similar regional barriers to early detection, public knowledge, and access to primary care for patients with T1DM. In contrast, registry-based data from Europe and North America have reported much lower rates of DKA; however, these differences can be attributed to the established structured healthcare delivery systems and the comprehensive diabetes education provided in many of these areas. [24, 25]

In comparison to glycemic outcomes reported in high-resource settings, the results obtained in this study were poorer, especially among adolescents. Adolescence has been identified internationally as a high-risk age for developing poor glycemic control. This trend has been attributed to the numerous physiological and psychosocial changes occurring in adolescence, including insulin resistance, reduced adherence, and increased autonomy in disease management. [26] These observations have also been reported in regional studies examining the glycemic control of children with T1DM, where the adolescent population exhibited higher average HbA1c values than their younger counterparts. [9, 27]

Access to new technology, specifically CGM, was severely limited. Less than 10% of participants in this study used CGM, which is far less than the rate of > 50% reported in some European countries. [28] Studies have demonstrated the utility of CGM in improving glycemic control, reducing episodes of hypoglycemia, and increasing the amount of time spent within the optimal range. [28] It is likely that the limited accessibility of CGM contributed to the poor glycemic control and resulting increase in acute complications observed in this patient population.

Multiple modifiable determinants were independently predictive of poor glycemic control. The most significant association was found with infrequent SMBG as well as the lack of structured diabetes education. The literature has consistently shown that the implementation of structured diabetes education is associated with improvements in HbA1c levels (-0.5 – 1.0%) and reductions in the incidence of DKA. [29] As such, this represents a modifiable gap in current care.

Additionally, several psychosocial and family-related factors were independently predictive of poor glycemic control. Specifically, family dysfunction and low parental education were identified as predictors of poor glycemic control. While pediatric diabetes care primarily focuses on medical management, family-centered interventions and psychosocial support have been shown to enhance adherence to diabetes regimens and improve metabolic outcomes, particularly among adolescents. [30] However, psychological support services were likely underutilized in this study.

Strengths of this study include its relatively large sample size, as well as the comprehensive assessment of both clinical and psychosocial variables, including a focus on modifiable factors. Potential limitations include the likelihood of residual confounding by socio-economic status, and the fact that the cross-sectional nature of this study precludes causal inference. Additionally, the findings of this study may have limited generalizability given that this study was conducted at a single tertiary center in Baghdad.

These findings have significant clinical and policy implications. Improving access to glucose monitoring tools, establishing and implementing structured, culturally relevant education programs, and incorporating family-centered and psychosocial care into standard care practices are necessary to improve the management of type 1 diabetes. Adolescents represent a particularly vulnerable subgroup that requires additional targeted interventions to achieve long-term outcomes.

Conclusion

Suboptimal glycemic control and a high burden of acute complications were observed among children and adolescents with T1DM in Baghdad. The study highlighted key aspects of disease management, treatment patterns, and glycemic outcomes within this population. Multiple modifiable factors, including monitoring frequency, education, and family-related aspects, were identified as predictors of poor glycemic control. These findings provide evidence to guide targeted interventions and inform healthcare policies aimed at improving pediatric diabetes management in resource-constrained settings.

Funding: No external funding
Conflict of interest: None declared

References:

1. 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, 10th edition. Diabetes Res Clin Pract. 2022 Jan;183:109083. doi: 10.1016/j.diabres.2021.109083.
2. Xie J, Li W, Li X, Zhang X, Liu J, Liu Z, Jing S, Shao H. Global, regional, and national epidemiology of type 1 diabetes in children from 1990 to 2021: trend and health inequality analyses based on the Global Burden of Disease Study 2021. Diabetol Metab Syndr. 2025 Aug 18;17(1):337. doi: 10.1186/s13098-025-01905-3.
3. Krzewska A, Ben-Skowronek I. Effect of Associated Autoimmune Diseases on Type 1 Diabetes Mellitus Incidence and Metabolic Control in Children and Adolescents. Biomed Res Int. 2016;2016:6219730. doi: 10.1155/2016/6219730.
4. Almomani BA, Elayyan RN, Al-Shatnawi SF. Type 1 diabetes mellitus in children: Patient reported outcomes. PLoS One. 2025 May 5;20(5):e0322882. doi: 10.1371/journal.pone.0322882.
5. Tabrah A, Al-Bakri A. Demographic, Clinical, and Biochemical Characteristics of Patients Admitted With Diabetic Ketoacidosis (DKA): A Retrospective Descriptive Study. Cureus. 2025 Jul 28;17(7):e88882. doi: 10.7759/cureus.88882.
6. Lafta RK, Al-Nuaimi MA. War or health: a four-decade armed conflict in Iraq. Med Confl Surviv. 2019 Sep;35(3):209-226. doi: 10.1080/13623699.2019.1670431.
7. Ibraheem AJ, Alanizi RSM, Wadi MJ. Type 1 Diabetes in Pediatric Patients in Baghdad: Diagnosis, Management, and Clinical Outcomes. International Journal of Pediatrics and Neonatology 2025; 7(2): 148- 154. doi: 10.33545/26648350.2025.v7.i2c.158
8. Santos Castro AV, Caneca KO, Garcia PM, Tischer V, Theodoro LC, Leão IS, et al. Type 1 diabetes technology gap between high-income and developing countries: Continuous glucose

monitoring access remains a challenge in Brazil. Diabet Med. 2025 Oct;42(10):e70116. doi: 10.1111/dme.70116.

9. Kadhim DM, Al-Kaseer EA, Al-Zubaidi MA. Glycemic control in children and adolescents with type 1 diabetes mellitus in post-conflict Iraq: a primary report. J Fac Med Baghdad. 2016;58(3):273-275. doi: 10.32007/jfacmedbagdad.583263

10. Świątoniowska-Lonc N, Tański W, Polański J, Jankowska-Polańska B, Mazur G. Psychosocial Determinants of Treatment Adherence in Patients with Type 2 Diabetes - A Review. Diabetes Metab Syndr Obes. 2021 Jun 16;14:2701-2715. doi: 10.2147/DMSO.S308322.
11. Lamptey R, Amoakoh-Coleman M, Djobalar B, Grobbee DE, Adjei GO, Klipstein-Grobusch K. Diabetes self-management education interventions and self-management in low-resource settings; a mixed methods study. PLoS One. 2023 Jul 14;18(7):e0286974. doi: 10.1371/journal.pone.0286974.
12. Ospelt E, Mungmode A, Hardison H, Wirsch A, Rioles N, Dawson J, et al. The impact of war and conflict on people living with diabetes: a scoping review. Clin Diabetol. 2024;13(6):373-385. DOI: 10.5603/cd.100617
13. Alassaf A, Odeh R, Gharaibeh L, Ibrahim S, Ajlouni K. Personal and Clinical Predictors of Poor Metabolic Control in Children with Type 1 Diabetes in Jordan. J Diabetes Res. 2019 Jul 4;2019:4039792. doi: 10.1155/2019/4039792.
14. Aljulifi MZ, Mahzari M, Fatani HA, Ardah Hl. A retrospective study of the prevalence of diabetic ketoacidosis in Saudi adolescents and adults with type 1 diabetes. J Pioneering Med Sci. 2024;13(6):4-12. doi: 10.61091/jpms2024130602
15. American Diabetes Association. 2. Classification and Diagnosis of Diabetes: *Standards of Medical Care in Diabetes-2021*. Diabetes Care. 2021 Jan;44(Suppl 1):S15-S33. doi: 10.2337/dc21-S002.
16. Dehiol RK, Al-Asadi GMA, Alattabi MAC. Factors associated with uncontrolled type 1 diabetes mellitus in children and adolescents in Thi-Qar, 2016–2017. Thi-Qar Med J. 2019;18(2):411. DOI: 10.32792/tmj.v18i2.87
17. 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 Mar;26(3):631-7. doi: 10.2337/diacare.26.3.631.
18. Rewers MJ, Pillay K, de Beaufort C, Craig ME, Hanas R, Acerini CL, Maahs DM; International Society for Pediatric and Adolescent Diabetes. ISPAD Clinical Practice Consensus Guidelines 2014. Assessment and monitoring of glycemic control in children and adolescents with diabetes. Pediatr Diabetes. 2014 Sep;15 Suppl 20:102-14. doi: 10.1111/pedi.12190.
19. Glaser N, Fritsch M, Priyambada L, Rewers A, Cherubini V, Estrada S, et al. ISPAD clinical practice consensus guidelines 2022: Diabetic ketoacidosis and hyperglycemic hyperosmolar state. Pediatr Diabetes. 2022 Nov;23(7):835-856. doi: 10.1111/pedi.13406.

20. Abraham MB, Jones TW, Naranjo D, Karges B, Oduwole A, Tauschmann M, et al. ISPAD Clinical Practice Consensus Guidelines 2018: Assessment and management of hypoglycemia in children and adolescents with diabetes. Pediatr Diabetes. 2018 Oct;19 Suppl 27:178-192. doi: 10.1111/pedi.12698.
21. Neu A, Hofer SE, Karges B, Oeverink R, Rosenbauer J, Holl RW; DPV Initiative and the German BMBF Competency Network for Diabetes Mellitus. Ketoacidosis at diabetes onset is still frequent in children and adolescents: a multicenter analysis of 14,664 patients from 106 institutions. Diabetes Care. 2009 Sep;32(9):1647-8. doi: 10.2337/dc09-0553.
22. Abdul-Rasoul M, Al-Mahdi M, Al-Qattan H, Al-Tarkait N, Alkhouly M, Al-Safi R, et al. Ketoacidosis at presentation of type 1 diabetes in children in Kuwait: frequency and clinical characteristics. Pediatr Diabetes. 2010 Aug;11(5):351-6. doi: 10.1111/j.1399-5448.2009.00600.x.
23. Al Shaikh A, Farahat F, Saeedi M, Bakar A, Al Gahtani A, Al-Zahrani N, et al. Incidence of diabetic ketoacidosis in newly diagnosed type 1 diabetes children in western Saudi Arabia: 11-year experience. J Pediatr Endocrinol Metab. 2019 Aug 27;32(8):857-862. doi: 10.1515/jpem-2018-0548.
24. Hekkala A, Knip M, Veijola R. Ketoacidosis at diagnosis of type 1 diabetes in children in northern Finland: temporal changes over 20 years. Diabetes Care. 2007 Apr;30(4):861-6. doi: 10.2337/dc06-2281.
25. Cherubini V, Grimsmann JM, Åkesson K, Birkebæk NH, Cinek O, Dovč K, et al. Temporal trends in diabetic ketoacidosis at diagnosis of paediatric type 1 diabetes between 2006 and 2016: results from 13 countries in three continents. Diabetologia. 2020 Aug;63(8):1530-1541. doi: 10.1007/s00125-020-05152-1.
26. Gregory JW, Cameron FJ, Joshi K, Eiswirth M, Garrett C, Garvey K, et al. ISPAD Clinical Practice Consensus Guidelines 2022: Diabetes in adolescence. Pediatr Diabetes. 2022 Nov;23(7):857-871. doi: 10.1111/pedi.13408.
27. Mohammad HA, Farghaly HS, Metwalley KA, Monazea EM, Abd El-Hafeez HA. Predictors of glycemic control in children with Type 1 diabetes mellitus in Assiut-Egypt. Indian J Endocrinol Metab. 2012 Sep;16(5):796-802. doi: 10.4103/2230-8210.100679.
28. Šumník Z, Pavlíková M, Pomahačová R, Venháčová P, Petruželková L, Škvor J, et al. Use of continuous glucose monitoring and its association with type 1 diabetes control in children over the first 3 years of reimbursement approval: Population data from the ČENDA registry. Pediatr Diabetes. 2021 May;22(3):439-447. doi: 10.1111/pedi.13184.
29. Murphy HR, Wadham C, Rayman G, Skinner TC. Approaches to integrating paediatric diabetes care and structured education: experiences from the Families, Adolescents, and Children's Teamwork Study (FACTS). Diabet Med. 2007 Nov;24(11):1261-8. doi: 10.1111/j.1464-5491.2007.02229.x.
30. Hood KK, Rausch JR, Dolan LM. Depressive symptoms predict change in glycemic control in adolescents with type 1 diabetes: rates, magnitude, and moderators of change. Pediatr Diabetes. 2011 Dec;12(8):718-23. doi: 10.1111/j.1399-5448.2011.00771.x.