Effectiveness of an Evidence-Based Practice Educational Program on the Knowledge of Adolescents and the Parents of Children with Type1 Diabetes Mellitus: A Quasi-Experimental Study

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Abstract. There is a growing prevalence of Type 1 Diabetes Mellitus (T1DM) worldwide. T1DM is one of the most common chronic and challenging children and adolescent diseases requiring the patients or their caregivers to be familiar with the different dimensions of treatment protocols. This study aimed to assess the effectiveness of an educational program based on the International Society of Pediatric and Adolescents Diabetes Guidelines (ISPAD) on improving the knowledge of adolescents and the parents of children with T1DM. A quasi-experimental, one-group pretest-posttest design was used to measure the parents of children and adolescents' knowledge at baseline and post-intervention using the Parent's and Adolescent's Knowledge Questionnaire of Type 1 Diabetes Mellitus (PAKQ-T1DM). The participants received an educational program including 10 domains about the management and treatment of T1DM. A total of 44 participants; 29 parents of children with T1DM and 15 adolescents completed the PAKQ-T1DM pre and post-receiving the educational program. McNamara's test revealed a highly significant improvement ($p < 0.001$) in the participant's correct answers regarding the appropriate mini-dose glucagon used to manage persistent hypoglycemia during sick days, HbA_{1c} target for preschool children, and honey restriction during infancy. The paired t-test demonstrated a statistically significant improvement in the overall knowledge scores from the pretest ($M = 21.39$, $SD = 3.89$) to the posttest [$M = 25.68$, $SD = 5.152$, $t(43) = 4.417$, $p < 0.000$]. Based on the findings of this study, providing an evidence-based T1DM educational program could considerably improve parents' knowledge of the children and adolescents with type 1 diabetes.

Keywords: Type 1 Diabetes Mellitus · Health Education · Adolescents · Children · Knowledge

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1 Introduction

Type 1 Diabetes Mellitus (T1DM) is the most common metabolic disorder among children. Type 1 Diabetes Mellitus (T1DM) is highly prevalent globally, with one in every 300 people, and its incidence is increasing progressively by 3% each year, and incidence among infants increases by months (Robert, Al-Dawish, Mujammami, & Dawish).

According to the report of the International Diabetes Federation (2022), there were 8.75 million people with T1DM of which 1.52 million were younger than 20 years (Atlas, 2022). As an autoimmune, T1DM have a major impact on individuals and families they affect, as well as on society and healthcare costs, and current projections propose that it may soon take its place among the predominant medical disorders (Miller, 2023). Patients with T1DM may experience symptoms like high blood glucose, frequent urination, increased thirst, severe fatigue, and extra weight loss, and if not controlled could lead to diabetic ketoacidosis which requires urgent medical intervention to maintain normal blood sugar levels (Castellanos, Tuffaha, Koren, & Levitsky, 2020). In this realm, Othman and colleagues studied how parents and patients deal with symptoms of ketoacidosis if they are subjected to an educational program. They found that 67% of participants went to the hospital immediately when symptoms appeared, 20% increased their insulin dose, and 27% of patients went to an emergency when the symptoms exacerbated. Accordingly, the authors recommended focusing on health education and self-management as an essential part of the management of the disease and prevention of ketoacidosis (Othman et al., 2018). On the other hand, diabetic patients may experience hypoglycemia which in severe cases may be fatal. So, education about the management of hypoglycemia is critically important. This is especially true when it comes to young children who could have impaired awareness of hypoglycemia, and also for adolescents experiencing hormonal changes. Alkhatatbeh et al., 2019) conducted a study in northern Jordan and found that 16% of 94 diabetic children and adolescents aged from 5–16 years had impaired awareness of hypoglycemia, 66% had more than one incident of hypoglycemia per month, and 18% developed severe hypoglycemia during the previous year (Alkhatatbeh, Abdalqader, & Alqudah, 2019). Congruently, a Turkish study showed that receiving structured education improved awareness of hypoglycemia by 12% and decrease in blood sugar by 80% among 40 children with T1DM (Demir, Özen, Çetin, Darcan, & Gökşen, 2019).

Because managing diabetes is multifactorial, supportive healthcare systems are needed to prepare patients and their caregivers with adequate and evidenced-based knowledge to help them comply with treatment plans. Many studies attribute educational programs to increased knowledge (Tönnies et al., 2018), and accordingly better blood glucose levels (Shehata, 2020).

Alassaf et al. recommended that more attention should be paid to educating mothers and children on counting carbohydrates and providing support for diabetic children at schools in Jordan (Alassaf et al., 2019). Consistent results were obtained in Egypt by Abolwafa et al. in which they found significant improvement in the knowledge and reported practices of 50 adolescents with T1DM post receiving an educational program (Abolwafa, Ahmed, & Aly, 2017). So, it is important to test the effectiveness of diabetic health education on the patient's and caregiver's knowledge to uncover gaps that need more emphasis and improvement. In addition, investigating factors that contribute to

the patient's and caregiver's knowledge like demographic variables and disease management–related variables could considerably help healthcare providers to modify these variables where possible (Powers et al., 2015). In this area, Al-Odayani et al. assessed the mother's knowledge about aspects of diabetes in Saudi Arabia and found that mothers with higher levels of knowledge and education had greater control of HbA1c levels. The study showed that it is necessary to increase the mother's knowledge and education to improve control and reduce complications among children with T1DM (Al-Odayani, Alsharqi, Al-Asmari, Al-Borie, & Qattan, 2013).

The method of delivering education was also investigated in which an in-class education session was more effective in improving the adolescent's knowledge regarding carbohydrate counting when compared to an Internet-based education (Pais, Patel, Ghayoori, & Hamilton, 2021). In the current study, an in-class education was used to assess the effectiveness of an evidenced-based type 1 diabetes health education program on the knowledge of adolescents and parents of children with T1DM.

2 Methodology

2.1 Design

A pre-test and post-test quasi-experimental design was used to test the effectiveness of a structured diabetic educational program on parents' and adolescents' knowledge. This design is relatively simple to implement and provides better evidence of the effectiveness of the program compared to other designs like post-test design (Fain, 2020).

2.2 Setting

This study was conducted at a Pediatric Teaching Hospital in Jordan. The hospital has a capacity of 112 beds, it provides emergency services, medical and surgical services, and critical care services. As a public hospital, diabetic patients are covered by health insurance. It is the only pediatric referral hospital serving the northern region, and nearly 60,000 children each year ("MOH," 2022).

2.3 Population and Sampling

All parents/caregivers of children less than 13 years of age and adolescents aged from 13 to 18 years old with T1DM were targeted in the current study. An online invitation to attend an educational program was sent to 125 contacts through WhatsApp group including an explanation about the aim of the study and the data collection process.

2.4 Educational Program

The educational program was developed (Atiyeh, 2020) based on the International Society of Pediatric and Adolescent Diabetes (ISPAD) Clinical Practice Consensus Guidelines; the only comprehensive set of clinical recommendations for children, adolescents, and young adults with T1DM worldwide ("ISPAD," International Society for Pediatric

and Adolescents Diabetes, 2023). The education was provided in the Arabic language through a PowerPoint presentation where multiple images were displayed to facilitate participants' learning. The presentation included 10 topics reflecting the following domains; Nature of T1DM, Blood Glucose Targets, Insulin Treatment, Management and Treatment of Preschool and School Age Children with T1DM, Hyperglycemia and Ketoacidosis, Management and Treatment of Hypoglycemia, Sick Day Management of Children and Adolescents with T1DM, Nutrition of Children and Adolescents with T1DM, and Complications and Associated Conditions in Children and Adolescents with T1DM.

2.5 Data Collection Instrument

Data were collected by a questionnaire survey including two parts; the first part included background variables; demographic variables and diabetes management-related variables. The second part included the Type 1 Diabetes Mellitus Parents and Adolescents Knowledge Questionnaire (T1DM-PAKQ) developed by Atiyeh (2020). The questionnaire is composed of 34 questions designed to test the participant's knowledge about the 10 domains of the educational program. A panel of experts; an endocrinologist, gastroenterologist, pediatrician, registered nurse expert in pediatric intensive care, a registered nurse expert in medical pediatrics, and a clinical pharmacist were asked to evaluate the contents of the T1DM-PAKQ according to the steps recommended by Yusoff, Muhamad, Saiful, and Bahri (2019). The scale-level content validity index based on the universal agreement method (S-CVI/UA) was used. The S-CVI/UA has been calculated by the sum of UA scores divided by the number of items (Yusoff, 2019). The revealed S-CVI/UA for the T1DM-PAKQ was 0.9. Which is acceptable when using six experts (Polit & Beck, 2020). Kuder Richardson (KR-20) was used to test the reliability of the knowledge scale; a special case of Cronbach's alpha was used for the dichotomy scale (Mohamad, Sulaiman, Sern, & Salleh, 2015), and it was (0.781).

2.6 Data Collection Procedure and Ethical Considerations

Ethical approval was obtained from the Institutional Review Boards (IRB) of the (deleted for anonymity), and approval to obtain the patient's contact information was obtained from the ethical research committee of the ministry of health and the pediatric hospital. Participants were required to choose one of three pre-determined dates in advance according to their convenience. Participants were asked to inform the health educator about the date of attendance in advance. Unfortunately, 2 sessions were held because of the lockdown during COVID-19, educational sessions were held at the same hospital in a convenient and calm room.

The researcher provided a full explanation of the study's purpose and the participants' expected benefits, emphasizing their voluntary participation and confidentiality of responses. The attendance of educational sessions was considered implied consent. Then, the participants were asked to fill out a background data form and to answer the T1DM-PAKQ pre-education. Then, the educational program lasted for 4 h. Finally, the participants were asked to answer the same questionnaire post-education.

2.7 Data Analysis

Statistical analyses were conducted using SPSS (version 25 for Windows). Demographic and management-related variables were analyzed using descriptive statistics. McNemar's test was used to show differences in the number of correct answers to each question pre- and post-education. Paired t-test was used to test mean differences in total knowledge scores pre- and post-education. The alpha level was considered statistically significant at $\alpha \leq 0.05$.

3 Results

3.1 Participants' Demographic Variables

Forty-eight participants attended the educational program and answered T1DM-PAKQ. A total of 44(91.6%) were valid for analysis; 29 parents of children with T1DM and 15 adolescents completed the PAKQ-T1DM pre and post-receiving the educational program. The results showed that the children and adolescents mean age was 10.9 years (SD = 3.3), and more than half were males (59.1%). Also, 56.8% of children and adolescents were cared for by their mothers (Table 1).

3.2 Diabetes Management-Related Variables

The results revealed that more than half of the participants (56.8%) were admitted due to ketoacidosis after being diagnosed with T1DM, and about 23% had severe hypoglycemia associated with convulsions. In addition, 50% of participants adhered to routine glycated hemoglobin (HbA1c) tests. On the other hand, the results revealed that no one of the participants knew how to test ketones at home as presented in Table 2.

3.3 Differences in Participants' Scores Pre and Post-education Regarding T1DM Knowledge Questions

McNemar's test was used to test if there were significant differences in the participants' answers to T1DM-PAKQ pre- and post-education. As presented in Table 3, significant improvement in the participant's knowledge was detected in terms of the signs and symptoms of hyperglycemia (54.5%vs.15.9% P = 0.003), and glucose levels that are reflected by HbA_{1c} result (70.5% vs. 95.5%p = 0.003).

Significant improvement was also detected regarding the insulin injection site least affected by physical activity. (95.5%vs.68.2%p = 0.002). This is also true about the definition of the Honeymoon phase (56.58% vs. 84.1% p = 0.012), and Dawn Phenomenon (50.0% vs. 75.0% p = 0.027). Also, significant improvements were detected regarding the HbA_{1c} target among preschool children (29.5% vs. 77.3% $p \leq 0.001$), the proper amount of sugar needed to manage hypoglycemia, and the precautions of using honey during infancy (43.2% vs. 88.6% $p \leq 0.001$).

The participant's correct answers were also significantly increased regarding the risk factors of developing cerebral edema during DKA, and the management of hypoglycemia during and after physical activity (50% vs. 81.8% p = 0.004). Furthermore, another

Table 1. The Participants' Socio-demographic Variables (N = 44)

Demographic variables	**N (%)**
Age in years (Mean = 10.93, SD 3.33)	
Gender	
Male	26(59.1)
Female	18(40.9)
The participants' kinship with the patient	
Patient him/herself	13(29.50)
Mother	25(56.80)
Father	4(9.1)
Sister	1(2.3)
Brother	1(2.3)
The educational level of the mother/caregiver	
High school or less	26(59.1)
Higher education	18(40.9)
Is the mother/caregiver employed?	
Yes	14(31.8)
No	30(68.2)
Is there any other family member/s diagnosed with T1DM?	
Yes	8(18.2)
No	36(81.8)

significant improvement was in the use of mini-dose glucagon to manage persistent hypoglycemia during sick days (25% vs. 70.5% $p = 0.000$). Lastly, the participant's knowledge was improved regarding the source of protein-containing carbohydrates as presented in Table 3.

3.4 Differences in Participants' Scores Pre and Post Education regarding knowledge Domains.

The paired t-test revealed significant mean differences between pre-education and post-education regarding the *Blood Glucose Targets* (2.23 vs. 2.73$p \leq 0.001$), and *Insulin Treatment* (2.50 vs. 3.75 $p \leq 0.0010$). The results also showed a significant difference in the management and treatment of preschool children with T1DM. Furthermore, a difference was reported regarding *Hyperglycemia and Ketoacidosis* and *Sick Day Management* (2.41 vs. 3.11 $p \leq 0.001$). Finally, the results revealed an overall improvement in the participants' knowledge as presented in Table 4.

Table 2. The Participants' Diabetes Management-related Variables (N = 44)

T1DM Management Variables	N (%)
Do you test HbA1c every 3 or 4 months?	
Yes	22(50)
No	22(50)
The result of the last HbA1c test.	
5–5.9	4 (9.1)
6–6.9	8 (18.2)
7–7.9	8 (18.2)
8–8.9	3 (6.8)
9–9.9	12 (27.3)
10–10.9	6 (13.6)
11–11.9	3 (6.8)
More than 12	0(0)
Is there any previous admission due to ketoacidosis? (Except the first time at initial diagnosis)	
Yes	25(56.8)
No	19(43.2)
Is there any history of severe hypoglycemia (convulsion)?	
Yes	10 (22.7)
No	34 (77.3)
Do you check sugar before meals?	
Yes	39(88.6)
No	5(11.4)
How many glucocheck strips do you buy monthly?	
25 strips	6(13.6)
50 strips	18(40.9)
75 strips	6(16.6)
100 strips	7(15.9)
More than 100 strips	7(15.9)
Do you know how to test ketones at home?	
Yes	0(0)
No	44(100)

Table 3. McNemar's Test Analysis of Participants' Correct Answers to Knowledge Questions pre- and post-T1DM health education.

Questions	Pre-test N (%)	Posttest N (%)	Test statistic	P-value
1. Nature of T1DM				
1. Which of the following is not associated with hyperglycemia?	28(63.6)	39(88.6)	5.882	*0.013**
2. Which of the followings is not true about type 2 diabetes mellitus?	29(65.9)	23(52.3)	1.042	0.307
3. Insulin hormone is critically important because its main function is to……	38(86.4)	37(84.1)	0.000#	1.000
2. Blood Glucose Targets				
4. The blood glucose target for diabetic children and adolescents before bedtime is…	40(90.9)	44(100)	2.250	0.125
5. It's important to check blood glucose levels in the following times except	27(61.4)	34(77.3)	1.895	0.167
6. HBA1c is a test that denotes the average blood glucose levels over the last …… months.	31(70.5)	42(95.5)	7.692	*0.003**
3. Insulin Treatment				
7. When should the insulin be discarded after usage if kept in the refrigerator?	10(22.7)	17(38.6)	2.118	0.143
8. Which of the following injection sites are least affected by physical activity?	30(68.2)	42(95.5)	8.643	*0.002**
9. The main reason for skin folding while injecting insulin is…….	23(52.3)	35(79.5)	5.500	0.170
10. The Honey Moon phase for T1DM is defined as:	25(56.8)	37(84.1)	6.050	*0.012**
11. Dawn Phenomenon is defined as:	22(50)	33(75)	4.762	*0.027**
4. Management and Treatment of Pre-school Children with T1DM				
12. The target of HbA1c for pre-school children is…….	13(29.5)	37(77.3)	13.793	*0.000***
13. Its recommended not to use honey when feeding infants because …..	19(43.2)	39(88.6)	15.042	*0.000***
14. What is the proper amount of sugar to manage hypoglycemia for preschool children?	32(72.7)	40(90.9)	3.500	0.057
5. Management and Treatment of School-Age Children and Adolescents with T1DM				
15. What is the proper dose of glucagon for a 30 kg child to manage severe hypoglycemia?	13(29.5)	15(34.1)	0.071	0.791
16. All the following interventions are recommended to manage a hypoactive and sweaty child at school following a 30-min football game except……	36(81.8)	35(79.5)	0.000#	1.000

(*continued*)

Table 3. (*continued*)

Questions	Pre-test N (%)	Posttest N (%)	Test statistic	P-value
17. Which of the following does not affect the blood glucose level during physical activity?	28(63.6)	27(61.4)	0.000#	1.000
18. The blood glucose target before physical activities that could last for one hour or more should be……	39(88.6)	40(90.9)	0.000#	1.000
6. Hyperglycemia and Ketoacidosis				
19. Omission or giving low doses of insulin causes an increase of ……in the blood.	43(97.7)	43(97.7)	0.000#	1.000
20. All the followings are symptoms of diabetic ketoacidosis except……	33(75)	40(90.9)	2.400	0.118
21. Which of the following conditions could increase the risk of cerebral edema during diabetic ketoacidosis?	7(15.9)	24(54.5)	8.828	*0.003**
22. Which of the following is not a risk factor for developing diabetic ketoacidosis?	23(52.3)	30(68.2)	1.714	0.189
7. Management and Treatment of Hypoglycemia				
23. Which of the following does not lead to hypoglycemia?	27(61.4)	22(50)	0.640	0.424
24. Which of the following should be given to avoid hypoglycemia during and after physical activity?	22(50)	36(81.8)	7.682	*0.004**
25. The risk of hypoglycemia that could happen 7–11 h after practicing high or moderate-intensity exercises is called……	20(45.5)	29(65.9)	2.560	0.108
8. Sick Day Management of Children and Adolescents with T1DM				
26. What is the appropriate mini-dose glucagon to manage persistent hypoglycemia associated with vomiting/diarrhea or both for a 10 years old, sick child diagnosed with T1DM?	11(25)	31(70.5)	15.042	*0.000***
27. Which of the following interventions should be avoided during sick day management of children/adolescents with T1DM?	37(84.1)	31(70.5)	1.562	0.210
28. What is the most priority action that a mother can do at home if her child is lying down and unresponsive while going to the hospital is not possible immediately?	33(75)	36(81.8)	0.308	0.581
9. Nutrition of Children and Adolescents with T1DM				
29. Which of the followings are nutritional recommendations for diabetic children and adolescents?	39(88.6)	37(84.1)	0.125	0.724
30. Which of the following sources of protein contains carbohydrates too?	28(63.3)	38(86.4)	4.500	*0.031**
31. Which of the following lipid sources is not recommended for T1DM children and adolescents?	42(95.5)	38(86.4)	1.125	0.289
10. Complications and Associated Conditions in Children and Adolescents with T1DM				

(*continued*)

Table 3. (*continued*)

Questions	Pre-test N (%)	Posttest N (%)	Test statistic	P-value
32. All of the following conditions/co-morbidities could be associated with T1DM except?	37(84.1)	40(90.9)	0.364	0.549
33. Which of the following is not a result of injecting insulin in the same site for an extended period?	25(56.8)	18(40.9)	1.440	0.230
34. Which of the following conditions increases insulin absorption?	31(70.5)	24(54.5)	1.714	0.189

No Chi-square output was generated by SPSS because both variables had the same response, "correct."
*Statistically significant at ($\alpha \leq 0.05$) **statistically significant at ($\alpha \leq 0.001$).

Table 4. Paired t-test results for mean differences of knowledge Domain scores pre and post-T1DM health education.

Variable Name	Pretest Mean (SD)	Posttest Mean (SD)	T value	P value
1. Nature of T1DM	2.16 (0.913)	2.25 (0.838)	0.467	0.643
2. Blood Glucose Targets	2.23 (0.803)	2.73 (0.544)	3.786	***0.000*** **
3. Insulin Treatment	2.50 (1.045)	3.75 (0.892)	6.680	***0.000*** **
4. Management and Treatment of preschool children with T1DM	1.45 (0.926)	2.57 (0.629)	6.566	***0.000*** **
5. Management and Treatment of School Age Children and Adolescents with T1DM	2.64 (0.966)	2.66 (0.833)	0.119	0.906
6. Hyperglycemia and Ketoacidosis	2.41(0.756	3.11(0.969)	3.685	***0.001*** **
7. Management and Treatment of Hypoglycemia	1.57(0.949	1.98(0.952)	1.934	0.060
8. Sick Day Management of Children and Adolescents with T1DM	1.84(0.644)	2.20(0.929)	2.380	***0.022*** *
9. Nutrition of Children and Adolescents with T1DM	2.48 (0.664)	2.57 (0.728)	0.628	0.533
10. Complications and Associated Conditions in Children and Adolescents with T1DM	2.11(0.753)	1.86 (0.929)	1.229	0.226
Overall knowledge scores	21.39 (3.89)	25.68 (5.152)	4.417	***0.000*** **

*Statistically significant at ($\alpha \leq 0.05$) **statistically significant at ($\alpha \leq 0.001$).

4 Discussion

Based on the findings, T1DM health education was effective to increase the parent's and adolescents' overall knowledge, especially about specific age groups and conditions. At initial diagnosis of T1DM, diabetic health educators focus mainly on basic skills and knowledge like injecting insulin and using glucocheck monitoring devices (Pihoker et al., 2018) Consequently, precise information relevant to specific age groups may not be included. This was evident in the results of the current study where the participant's knowledge improved regarding the HbA1c target during preschool age and the precautions of using honey to correct hypoglycemia during infancy. Consistently, Schiaffini et al. emphasized the positive effect of educational programs on the care provided for preschool children (Schiaffini et al., 2020). Also, information about the factors that affect insulin absorption like physical activity may be missed or postponed especially when patients or their caregivers are severely traumatized or still denying first-time diagnosis with T1DM. Similarly, the patients and/or their caregivers are usually educated about insulin adjustment in response to variations in meals and fluctuations in blood glucose levels, however, such education may lack information about the adjustment of insulin doses in response to temporary or extraordinary situations like the Honey Moon phase, Dawn phenomenon, and during sick days. This explanation could be supported by the fact that the majority of the participants in the current study checked their blood glucose levels before meals, while most of them have HbA1c levels of more than 7 which is above the acceptable value recommended by the ISPAD guidelines for children and adolescents (DiMeglio et al., 2018). This indicates that parents /care providers and adolescents may have not received a comprehensive education. Alassaf and colleagues recommended that more attention must be paid to educating mothers and children on counting carbohydrates and providing support for diabetic children at schools to help them better adhere to their insulin requirements (Alassaf et al., 2019). Consistently, a recent study showed the positive effect of educational programs on the knowledge of the school staff and the students (Dixe et al., 2020).

The current study showed that the participants were highly knowledgeable about the leading causes of DKA. This could be referred to the fact that more than half of the patients had previous admission due to acidosis. However, none of them knew about ketone testing at home. More specifically, the education was effective in improving the participant's knowledge about the risk factors of developing cerebral edema. Consistently, Othman et al. (2018) recommended more emphasis on educational programs and health education to manage diabetes and ketoacidosis (Othman, Awwad, Aziz, Asiri, & Alqahtani, 2018).

The participants' knowledge did not improve post-education regarding delayed hypoglycemia following physical activities. This could be referred to a relatively complex explanation about the effect of counter-regulatory hormones which could be difficult to understand by adolescents and a considerable number of participants given that more than half of mothers /caregivers had high school or less education level. In addition, the vast majority reported that they had not experienced severe hypoglycemia. This could be related to the impaired awareness of hypoglycemia and also the limited number of daily

checks of blood glucose levels. In this realm, Demir et al. reported that structured diabetic health education improved glucose levels among patients with impaired awareness of hypoglycemia (Demir et al., 2019).

The participants' knowledge improvement was evident concerning the appropriate use of mini-dose glucagon needed to manage persistent hypoglycemia associated with vomiting/diarrhea during sick days. This could be related to the fact that the usual diabetic education entails using glucagon injection for the management of severe hypoglycemia associated with convulsion, and this could be the first time participants to receive education about using mini-dose glucagon to manage persistent hypoglycemia during sick days.

The Centers for Disease Control and Prevention emphasized the provision of primary health care for children with T1DM during school days by providing sufficient information about diabetes and its management to maintain the safety and health of children at school (CDC, 2023). Also, strengthening the partnership between service recipients in the school and between school staff and the health team improves diabetes management among school-age children (Sparapani, Fels, & Nascimento, 2017).

5 Limitations and Recommendations

This study was the first to assess the effectiveness of a newly developed T1DM evidenced-based health educational program among adolescents and parents of children with T1DM in Jordan. Unfortunately, this study was conducted during the COVID-19 pandemic when the lockdown and social distancing took place and limited the number of participants who was able to attend educational sessions. Likewise, measuring the effect of education at one point in time post-education could not catch the long-lasting effect of the education on the participants' knowledge. Other research designs could be used to compare the results of the current study with other studies where objective measures could be used to assess the effectiveness of health education programs.

6 Implications and Conclusion

This study highlighted the importance of using evidenced-based diabetic health education, together with assessing the knowledge of adolescents and parents of children with T1DM to identify knowledge gaps and be able to design patient-specific education to meet individualized needs. So, it is critically important to prepare nurses and student nurses as educators while emphasizing the holistic approach, and evidenced-based health education.

Nursing administrators and policymakers should advocate the diabetic patient's right to have adequate glucose and ketone test strips covered by health insurance, to improve the patient's and their caregivers' compliance with glucose and ketone monitoring at home to help them in the early identification of problems related to fluctuations of blood glucose levels. Accordingly, the need for hospitalization and its related cost will decrease, and the patient's tendency to develop complications is diminished leading to a better quality of life.

In addition, nursing administrators should work with policymakers to advocate the diabetic children and adolescents' right to the continuity of care at school. This could be achieved by having qualified nurses at schools together with trained school staff to deal with urgent situations that could be encountered by students with T1DM. Furthermore, it is critically important to involve family members in care plans while providing them with appropriate education until the children and adolescents can manage their diseases independently.

Conflict of Interest Statement. The authors have no competing interests to report.

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