The Association between Parents´ Knowledge and Proper Use of Insulin in Patients with Type I Diabetes Mellitus

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Abstract:

Background: It is possible that treatment may not be successful, and the expenses of therapy may increase due to patients' lack of knowledge and inappropriate conduct. Insufficient knowledge regarding the use of insulin can hinder its effectiveness and adherence. Therefore, it is crucial for diabetic patients to follow guidance on insulin management to ensure better outcomes.

Objectives: to investigate the correlation between parents' knowledge of children with type I diabetes and their ability to properly administer insulin to their children in the outpatient diabetes clinic in Nasiriya City.

Methodology: A cross-sectional study was conducted at the Center of Endocrinology and Diabetes in Nasiriyah, Iraq between October 4, 2022, and March 30, 2023. The study enrolled 180 children and adolescents diagnosed with type 1 diabetes mellitus. The surveys were translated into formal Arabic and administered through face-to-face interviews and patient-caregiver. The knowledge phase comprised 15 questions, while the final segment on taking insulin had five questions. Blood samples were collected from the patients to measure their fasting blood sugar and Glycated hemoglobin. The collected data underwent descriptive analysis using SPSS version 25 software.

Results: A total of 180 children and adolescents with type I diabetes were part of the study. The patient's average age was (10.75 ±4.36) years, and they had been diagnosed with type 1 diabetes for an average of (6.24 ±3.70) years. Their fasting blood sugar level was out of control (208.42 ±95.0 mg/dl) and their HbA1c level was (9.90±2.85%). Most of the patients (52.2%) were female and had only completed kindergarten (43.3%). The majority of caregivers were parents or guardians who were either illiterate (30.6%) or had an elementary education (33.9%).

Conclusions: The study concluded that most of the caregivers had poor behaviors and insufficient knowledge about insulin usage in type 1 diabetic patients.

Keywords: Type 1 diabetes mellitus; Insulin, knowledge, Practices, Parents.

Introduction

The slow loss of the insulin-producing beta cells which ends with total beta cell loss and complete reliance on exogenous insulin is the cause of T1DM, an immune-mediated condition (1). Children often develop the chronic disease T1DM, and although illness may manifest at any age, most patients are diagnosed before the age of 30 years (2, 3). Globally, diabetes is estimated to have afflicted 171 million people in 2000; by 2011, that figure had increased to more than 366 million, and by 2030, those numbers are projected to reach more than 552 million (4). The T1DM is the second most prevalent chronic pediatric ailment in Western industrialized nations, behind asthma (5). According to Iraqi estimates, the frequency of T1DM rose in Iraq from 7.8 per 100,000 children under 15 years in 1995 to 14.2 in 2000 and 24.7 in 2014. (6). For people and communities to manage this disease, they must be aware of DM (7).

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Patients with better knowledge of their condition had a positive outlook and engaged in healthy behaviors, allowing them to seek medical attention earlier in their illness (8).

Patients also had less influence over such factors when they were ignorant of their illness risk (9).

Pediatricians must be aware of the causes of T1DM in children having poor glycemic control to conduct more effective interventions to stop the progression of DM (10). Insulin usage must be explained to all diabetic patients (11). Despite this, at least one-third of patients do not take their insulin as directed, and 20% of adults purposefully miss doses (12). Diabetes demands knowledge and expertise that can only be acquired through time. Self-care education for diabetic patients is necessary for good diabetes management. Unanswered concerns, worry, mistrust, and rage are consequences of inadequate patient education on diabetes and associated issues. Diabetic patients' clinical outcomes and quality of life have improved due to instruction (13). While the

patients had good knowledge, good practice, and a favorable attitude toward insulin self-administration, it was not sufficient; thus, to achieve a maximum level, the hospital should develop several strategies, like constant information and education communication to reach a maximum level (14). The current research aimed to determine the relationship between parents' understanding of children with T1DM and their correct insulin application to their kids.

Patients and Methods

In this descriptive, cross-sectional study one hundred eighty patients (children and adolescents) with T1DM who visited the Center of Endocrinology and Diabetes in Nasiriyah City, Iraq, were enrolled. The research was carried out between 4 October 2022 and 30 March 2023.

Inclusion criteria: Participants in this study had to be T1DM treated in the diabetic clinic, their age 18 and less, and be free of any comorbid diseases such as heart diseases

Exclusion criteria: The research eliminated all participants who had type 2 diabetes mellitus.

By requesting face-to-face interviews from the participants' caregivers, the researcher could gather personal information on the kids and teenagers who participated in the study. The researcher directly consulted one hundred eighty patients while she completed the questionnaire. It had two components:

1. Age, gender, caregiver educational level, patient educational level, family monthly income, and socio-demographic traits: disease-related variables (duration of disease), fasting blood sugar, and glycated hemoglobin tests)
2. The researcher employed a questionnaire on understanding and use of insulin (15). Questions were translated into formal Arabic using legal methods (16, 17). There were 15 questions in the knowledge segment and fins related to insulin usage.

Blood Sample Collection and Preparation: By using a 23g disposable plastic syringe venous blood sample (5ml) was drawn from each patient while they were fasting and taken for analysis (this is standard procedure at this facility), and the patients were questioned while they were waiting for the findings before they see the physicians each patient completed the study questionnaires in around 25 minutes. For the HbA1c measurement, 2ml of blood obtained was maintained in an ethylene diamine tetra acetic acid (EDTA) tube. The remaining blood sample (3ml) was transferred to a plane tube and left to coagulate for 30 minutes then centrifuged for 10 minutes at a speed of 4000 rpm to obtain serum. the serum was used for the measurement of fasting blood glucose. The Central Scientific Committee of the College of Pharmacy at the University of Baghdad had approved the study's conduct, and participating parents granted their agreement after being told of its goals and before any data were collected. To make the researcher's job more accessible, the required formal approvals were acquired from the Ministry of Health through official letters sent to the center's directorate.

Statistical analyses: Statistical Package for the Social Sciences (SPSS) version 25 was used to analyze the data. All of the study's items were subjected to descriptive statistics. While categorical data were reported as frequencies and percentages, continuous variables were expressed as means and standard deviation (SD). The difference between the routine practice of doing lab check-ups and the parents' overall knowledge score was assessed using an independent *t*-test. The relationship between the caregivers' overall knowledge score and how they administer insulin to their children was evaluated using a one-way ANOVA. Statistical significance was defined as a *P*-value of 0.05.

Results

Demographic characteristics of the type I diabetes mellitus participating patients

The average (SD) age of the T1DM who participated in this trial was 10.75(4.36) years. On average, they experienced T1DM for 6.24 years. They had HbA1c (9.90 2.85 %) (Table 1). Most (52.2%) of patients were females and had only completed kindergarten (43.3%). Parents and guardians comprised the majority of caregivers and most had only completed primary school (30.6 %) or were illiterate (33.9 %). Family monthly incomes for most caregivers were less than 0.5 million (43.9%).

Table 1: Demographic characteristics of the type I diabetes mellitus participating patients and their caregivers

Parameter	Minimum	Maximum	Mean	Std. Deviation
Age (years)	3.0	19.0	10.75	4.36
HbA1c (%)	4.8	19.7	9.90	2.85
Duration of Type I DM (years)	1.0	15.0	6.24	3.70

		N	%
Patient gender	Male	86	47.8
	Female	94	52.2
Caregiver education level	Illiterate	55	30.6
	Primary school	61	33.9
	Secondary school	31	17.2
	University	33	18.3
Family monthly income (Iraqi dinars)	<0.5 million	79	43.9
	0.5-1.0 million	74	41.1
	>1.0 million	24	15

The parents got high marks on 5 out of the 15 knowledge-related categories (Table 3). Moreover, the parents were able to name five things, but they required assistance to comprehend the other 10. The five items that received the correct responses were: 1) regular exercise can help lower high blood pressure (58.9%); 2) wearing more large-sized shoes is beneficial (55%); 3) when children have the flu, they should test for glucose more frequently (57.8%); 4) a child's glucose level drops if they take insulin and skip meals (52.8%); and 5) the importance of having regular checkups is to prevent disease complications (78.9%).In contrast, the two least amount correctly answered questions were: 1) Infection may raise blood sugar (34.4%), and 2) numbness and tingling may be signs of nerve illness (35.6%).

Table 2: Measurement of Diabetes Knowledge among the Participants

Knowledge Items	True, No. (%)	False, No. (%)	Don't know, No. (%)
Glycated hemoglobin (HbA1c) is a test that measures average blood glucose levels in the past weeks.	68 (37.8)	20 (11.1)	92 (51.1)
A piece of chicken has more carbohydrates than a piece of potato?	43 (23.9)	72 (40)	65 (36.1)
Urine testing and blood testing are both equally suitable for testing the level of blood glucose.	32 (17.8)	68 (37.8)	80 (44.4)
Unsweetened fruit juice raises blood glucose levels.	29 (16.1)	79 (43.9)	72 (40)
Exercising regularly can help reduce high blood pressure.	106 (58.9)	36 (20)	38 (21.1)
Exercising does not affect blood sugar levels for a person in reasonable control.	48 (26.7)	69 (38.3)	63 (35)
Infection is likely to cause an increase in blood sugar levels.	62 (34.5)	42 (23.3)	76 (42.2)
Wearing shoes size bigger than usual helps prevent foot ulcers.	99 (55)	18 (10)	63 (35)
Eating foods lower in fat decreases your risk for heart disease.	88 (48.9)	43 (23.9)	49 (27.2)
Numbness and tingling may be symptoms of nerve disease.	64 (35.6)	34 (18.9)	82 (45.6)
Lung problems are usually associated with diabetes.	70 (38.9)	22 (12.2)	88 (48.9)
You should test for glucose more often when sick with the flu.	104 (57.8)	29 (16.1)	47 (26.1)
High blood glucose levels may be caused by too much insulin.	81 (45)	31 (17.2)	68 (37.8)
If you take your morning insulin but skip breakfast, your blood glucose level will usually decrease.	95 (52.7)	21 (11.7)	64 (35.6)
Regular checkups with your doctor can help spot the early signs of disease complications.	142 (78.9)	14 (7.8)	24 (13.3)

Data are presented as numbers and percentages.

Impact of parents' knowledge on the practice of insulin usage to the type I diabetic participants

Regarding the practice of insulin use, the techniques for using and administering insulin were adequate for two but less effective for the other three items of insulin use practice (Table 4).

More than half of the participants' parents performed well in terms of avoiding missing meals after taking insulin (61.7%) and reading the insulin package leaflet (56.7%). On the other hand, around one-third or less avoided injecting cold insulin (23.9%), rotated injection sites (28.9%) and cleaned the injection site with spirit before use.

As shown in Table 5, the one-way ANOVA revealed a significant (P<0.05) variation in administering cold insulin depending on the parents' overall diabetes awareness. That is to say, parents with better overall knowledge scores do not give their kids cold insulin. However, the parents' awareness has an insignificant (P>0.05) impact on the other items regarding insulin administration methods

Table 3: Impact of parents' knowledge on the practice of insulin usage to the type I diabetic participants

The practice of insulin use	No. (%)	Total parent knowledge Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		P-value
					Lower Bound	Upper Bound	
Rotate sites of injection.							
Usually 52	(28.9%)	6.67	2.19	0.30	6.06	7.28	
Sometimes 64	(35.6%)	7.22	2.07	0.26	6.70	7.74	.370
No 64	(35.6%)	7.16	2.39	0.30	6.56	7.75	
Inject cold insulin							
Usually 69	(38.3%)	6.81	2.19	0.26	6.29	7.34	
Sometimes 68	(37.8%)	6.51	2.08	0.25	6.01	7.02	.000
No 43	(23.9%)	8.23	2.11	0.32	7.58	8.88	
Clean the injection site with spirit before use.							
Usually 59	(32.8%)	7.20	2.30	0.30	6.60	7.80	
Sometimes 82	(45.6%)	7.07	2.19	0.24	6.59	7.55	.565
No 39	(21.7%)	6.72	2.21	0.35	6.00	7.43	
Skip food after taking insulin.							

Usually,	15	(8.3%)	7.87	2.00	0.52	6.76	8.97	
Sometimes	54	(30.0%)	6.57	2.18	0.30	5.98	7.17	.094
No	111	(61.7%)	7.15	2.25	0.21	6.73	7.58	
Read the package insert supplied along with the insulin.								
The practice of insulin use		No. (%)	Total parent knowledge Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean	P-value	The practice of insulin use
Usually,	30	(16.7%)	6.47	2.34	0.43	5.59	7.34	
Sometimes	48	(26.7%)	7.23	2.43	0.35	6.52	7.93	.294
No	102	(56.7%)	7.12	2.08	0.21	6.71	7.53	

Data are presented as numbers and percentages.
*Significant (P-value< 0.05) according to One-way ANOVA

Discussion

The purpose of the research is to assess the impact of type 1 diabetes knowledge among the parents of children and teenagers who have T1DM. The results of the current study demonstrated that the majority of the participating patients had a mean age of 10.75(4.36) years. Regarding age, when we compared it to another study in Iraq, which revealed that the prevalence of diabetes in primary school students in Baghdad was 159 per 100,000, which was higher than the prevalence rate in Basrah, where it was 87 per 100,000. These results, however, were based on a retrospective data analysis of computerized records for T1DM patients enrolled at the Faiha Specialized Diabetes, Endocrine, and Metabolism Center, a tertiary referral facility in Baghdad (18). The majority of the sample was female in terms of gender this finding is consistent with research conducted in the United States that identified a substantial relationship between DM and gender and found that women were more likely than males to have the disease (19). In the Kingdom of Saudi Arabia, a cross-sectional case-control study revealed that women had a higher chance of developing DM than men which may be primarily due to women's consistently higher survival rate (20). Additionally, it was shown that in Duhok City, women were more likely than men to have DM (15.2% vs. 11.8%) (22). Another research in Iraq revealed that 52.8 percent of diabetic patients were females (21). Children with caregivers who were illiterate had less understanding of insulin and glucose monitoring than caregivers with a high education level. According to a study conducted in Iraq, patients' uncontrolled glycemic states were more prevalent in older children, their parents' low educational levels contributed to their patients' poor glycemic control in about two-thirds of cases, and about 25% of them experienced acute complications and academic achievement issues (23). Other studies showed a significant relationship between the low education of parents and poor glycemic control (24,25). In our study, the level of education was poor as most patients´ caregivers were with primary school educational levels. Although insulin injections usually cause no significant pain, injecting at the same spot repeatedly can cause inflammation or fat tissue increase (lipodystrophy or scarring; 26). In the current study, most patients did not rotate sites of injection, although rotation of injection sites is important to prevent lipodystrophy and/ or scarring, and thus improve the predictability of insulin absorption and action. Depending on the parents' overall diabetes awareness, there are significant variances administered. In other words, parents who have better full-knowledge scores don't give their kids cold insulin. Occasionally, the discomfort of an injection is increased by using cold insulin, thus many healthcare professionals recommend keeping the insulin bottle at room temperature (27). According to insulin practice, inject insulin that has a temperature of the surrounding room (20–30 °C) because injecting cold insulin is painful (27). In our study, most patients inject cold insulin. Another study explained that pain was also associated with injecting through clothes, injecting cold insulin, and incorrect site rotation (28).

Conclusion

Programs to raise the knowledge of patients and their caregivers about insulin administration are crucial for all people with diabetes in Iraq to improve their comprehension, compliance, and management.

Authors' Declaration:

Conflicts of Interest: None.

We confirm that all tables in the manuscript are ours.

Authors sign on ethical consideration's approval-Ethical Clearance: The local ethical committee in the College of Pharmacy / University of Baghdad approved the project according to code number No. (7923) on Date (20/12/2022)

Author Contributions:

Study conception & design: (Mohammed Y. Jamal). Literature search: (Rokaya K. Jabber). Data acquisition: (Rokaya K. Jabber). Data analysis & interpretation: (Rokaya K. Jabber. Manuscript preparation: (Rokaya K. Jabber). Manuscript editing & review: (Rokaya K. Jabber, Mohammed Y. Jamal).

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العلاقة بين معرفة الوالدين والاستخدام السليم للأنسولين لدى مرضى السكري من النوع الأول

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كلية الصيدلة \جامعة بغداد بغداد –العراق

خلاصة

الخلفية: من الممكن أن لا يكون العلاج ناجحا، وقد تزيد تكاليف العلاج بسبب قلة المعرفة لدى المرضى والسلوك غير المناسب. عدم كفاية المعرفة فيما يتعلق باستخدام الأنسولين يمكن أن يعيق فعاليته والالتزام به. لذلك، من المهم لمرضى السكري اتباع الإرشادات المتعلقة بإدارة الأنسولين لضمان نتائج أفضل. الأهداف: التحقق من العلاقة بين معرفة الوالدين بالأطفال المصابين بداء السكري من النوع الأول وقدرتهم على إعطاء الأنسولين بشكل صحيح لأطفالهم في العيادة الخارجية لمرض السكري في مدينة الناصرية. المنهجية: أجريت دراسة مقطعية في مركز أمراض الغدد الصماء والسكري في الناصرية، العراق في الفترة ما بين 4 أكتوبر 2022 و30 مارس 2023. وقد شملت الدراسة 180 طفلا ومراهقا تم تشخيص إصابتهم بداء السكري من النوع الأول. تمت ترجمة الدراسات الاستقصائية إلى اللغة العربية الرسمية وإدارتها من خلال المقابلات وجها لوجه ومقدمي الرعاية للمرضى. تتألف مرحلة المعرفة من 15 سؤالا، بينما يشتمل الجزء الأخير المتعلق بتناول الأنسولين على خمسة أسئلة. تم جمع عينات الدم من المرضى لقياس نسبة السكر في الدم والهيموجلوبين السكري أثناء الصيام. خضعت البيانات المجمعة للتحليل الوصفي باستخدام برنامج SPSS الإصدار 25. النتائج: شارك في الدراسة ما مجموعه 180 طفلا ومراهقا مصابا بداء السكري من النوع الأول. كان متوسط عمر المريض (10.75 ±4.36) سنة، وتم تشخيص إصابته بداء السكري من النوع الأول لمدة متوسطها (6.24 ±3.70) سنة. كان مستوى السكر في الدم أثناء الصيام خارج نطاق السيطرة (208.42 ± 95.0 ملغم / ديسيلتر) وكان مستوى HbA1c لديهم (9.90 ± 2.85٪). كان معظم المرضى (52.2%) من الإناث وقد أتموا رياض الأطفال فقط (43.3%). كان غالبية مقدمي الرعاية من الآباء أو الأوصياء الذين كانوا إما أميين (30.6%) أو حصلوا على تعليم ابتدائي.(33.9%)

الاستنتاجات: خلصت الدراسة إلى أن معظم مقدمي الرعاية لديهم سلوكيات سيئة ومعرفة غير كافية حول استخدام الأنسولين لدى مرضى السكري من النوع الأول.

الكلمات المفتاحية: داء السكري من النوع الأول، الأنسولين، المعرفة، الممارسات، الآباء.