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# Educational Needs and Home-Care Preparedness among Mothers of Children with Type 1 Diabetes Mellitus: A Cross-Sectional Study in Karbala, Iraq

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**Abstract:** Considerable care is reliant upon the skills of the caregiver, as successful management of childhood type 1 diabetes mellitus (T1DM) relies on insulin administration, glucose monitoring, and meal/activity coordination as well as acute glycemic event recognition. Availability of family-centered diabetes education will require identification of specific topics to be addressed in low resource settings. **OBJECTIVE:** To assess maternal knowledge and reported home-care practices for their children with pediatric Type 1 diabetes mellitus (T1DM) and to develop a prioritized topic list for structured caregiver education. **Methods:** A descriptive cross sectional study among 100 mothers of children with T1DM who were followed up in the Diabetes and Endocrine Disease Center in Karbala (Iraq) from July to August 2026. Purposive sampling was used for recruiting participants. Sociodemographic characteristics, 13 knowledge items and 35 family-care practices were collected through questionnaires administered by interviewers. Participants were analyzed using SPSS version 26 through descriptive statistics. **Results:** The mean maternal knowledge score was 2.21 (SD 0.44) on a three-point scale, indicating a moderate degree of knowledge management. For the overall Family-Care Practice Score the mean score was 2.18 (SD 0.41), indicating moderate, variable readiness as well. Knowledge was best for blood glucose monitoring based on finger-prick (83%), recognizing carbohydrate-rich food (78%), insulin deficiency as the basis of T1DM (69%), insulin excess in causing hypoglycemia (74%) and recognition of hypoglycemia symptoms (74%). Large deficits related to primal insulin timing (33% correct), the lifelong nature of T1DM (43%), interpretation of fasting glucose levels (46%), how exercise affects insulin needs (44%), and the role of diet alone in managing T1DM (25%). **Conclusion:** Mothers had limited understanding and were not adequately prepared to care for the children with diabetic at home. Protocoled, skill-centered family education should focus on individualized insulin-meal coordination (including consideration of timing of insulin dose), glucose interpretation and, related to that both physical-activity planning as well as nutrition, and the managements of hypo- and hyperglycemia. The study recommended that Provide semi-structured caregiver education at diagnosis with scheduled reassessment during follow-up. **Concrete Methods in More Detail:** We recommend using demonstration, teach-back and return-demonstration for the most common types of insulin administration (e.g., subcutaneous injection or via an external pump), glucose monitoring (e.g., finger-stick blood glucose testing, continuous glucose monitoring), ketone testing when indicated, and emergency management. Provide individual-written action plans for families, not one-size-fits-all insulin-timing or glucose-target statements. **Visual Materials** Use culturally appropriate visual materials of common Iraqi meals and literacy needs. **Schools** should be included in hypoglycemia recognition, meal advances, physical-activity contriving, and broadcast of emergencies. **Psychosocial screening** for and referral of caregiver distress and diabetes-related family burden. **Assessments** of educational programs can be made using caregivers knowledge, observed skills, self-efficacy, episodes of severe hypoglycemia, diabetic ketoacidosis or days spent in target range (if available), time in range where applicable and HbA1c.

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**Keywords:** children; type 1 diabetes mellitus; caregiver education; family-centered care; home management; Iraq

## 1. Introduction

Type 1 diabetes mellitus (T1DM) is a chronic autoimmune disease resulting from the destruction of pancreatic beta-cells and requiring reliance on exogenous insulin for life. Safe management in children and adolescents requires 24/7 collaboration between the child, family, diabetes team and school. International guidelines recommend that diabetes self-management education and support be initiated at diagnosis, be developmentally appropriate, involve parents or caregivers, and be provided repeatedly as treatment technologies, developmental needs and family circumstances evolve [1], [2], [3].

Much of the day-to-day management of diabetes, especially in younger children, is done by parents. They include administering insulin; monitoring glucose levels; estimating carbohydrate content of food plus meal planning; preparing for physical activity and managing sick days as well as recognizing and treating hypoglycemia & hyperglycemia. These responsibilities require not just knowledge of the facts but also practical skills, and confidence, and also adapting treatment decisions in the context of the day to day life of a child [1], [4], [5], [6].

Involving families can increase adherence and health outcomes, but information by itself does not equal effective care. Family conflict, treatment burden, psychological distress, financial constraints and limited access and engagement with structured education may impede implementation. Such findings support the use of family-centered interventions, but are only helpful when incorporated with information and demonstration, skills rehearsal for behavior-change skills such as communication and problem solving, or ongoing psychosocial support [7], [8], [9], [10].

This is especially true in the case of Iraq where there is a need for evidence that is specific and relevant to local conditions. Iraqi studies report a high and increasing burden of childhood T1DM, challenges to glycemic control and diabetes service delivery [11], [12]. Yet evidence focused on caregivers in central Iraq remains scarce, and educational programs cannot be effectively tailored without quantifying what mothers know or do not know (i.e., where gaps in understanding or misconceptions remain).

Thus, the aim of this study was to investigate maternal knowledge and reported home-care practices amongst mothers of children with type 1 diabetes mellitus (T1DM) at specialist care. We did not simply want to report a global knowledge score but rather identified clinically important educational priorities that could be used to direct structured, family-centered education in pediatric diabetes services.

### Study objectives

- a. To evaluate mothers' understanding of T1DM in childhood and its home management.
- b. Evaluate reported family-care practices: parents of children with T1DM.
- c. To determine item-level misconceptions and uncertainties that should be prioritized when developing caregiver educational materials.

## 2. Materials and Methods

### 2.1 Study design and setting

Abstract A descriptive cross-sectional study was carried out at the Diabetes and Endocrine Disease Center in Karbala, Iraq. It was reported that data collection took place from June 2026 to august 2026.

### 2.2 Participants and sampling

This study included 100 mothers during follow-up of children diagnosed with T1DM who visited the study center. This was done by using a purposive sampling strategy. Eligibility criteria Participants were mothers who had primary or shared responsibility for the child's daily diabetes care and consented to participate.

### 2.3 Data collection instrument

We used a questionnaire that had been pre-tested and was answered verbally by an interviewer. The instrument is composed of three parts: (1) sociodemographic characteristics, (2) 13 items about maternal knowledge on T1DM and; (3) 35 items assessing reported family-care practices related to medication and follow-up, nutrition, hygiene, sleep, and physical activity. Fifteen experts in the relevant fields reviewed the questionnaire for its content relevance and clarity. also it should be mention the The internal consistency of the questionnaire was assessed using Cronbach's alpha coefficient. Chantal is one of the researchers from generously receiving pilot study feedback based on experience running a study with mothers of children with type 1 diabetes mellitus who were excluded . Cronbachs alpha identified acceptable reliability in the knowledge and family-care practice domains, supporting that items within each domain are suitable for measuring maternal knowledge and home-care practices. The Cronbach's alpha coefficient was 0.82 for the knowledge domain and 0.87 for the family-care practice domain, indicating good internal consistency

### 2.4 Scoring

Knowledge responses received a score of 1–3 in ascending order of accuracy. Family-care items were coded similarly, such that higher values indicated greater reporting of consistent practice. Scores on the 4-point Likert scale were, therefore, classified as low (1.00–1.66), moderate (1.67–2.33) or high (2.34–3.00). Item level percentages are maintained as global mean scores may mask clinically significant misconceptions.

### 2.5 Statistical analysis

Data were analyzed using IBM SPSS Statistics, version 26. Frequencies and percentages were used to summarize categorical variables, and means with standard deviations were used for scale scores. No additional inferential analyses were included because participant-level data were not available for the final manuscript revision. Consequently only descriptive results are reported in the current manuscript.

## 3. Results

### Maternal knowledge

Table 1 gives responses to the 13 different knowledge items. These parameters were strongest regarding blood glucose management, identification of carbohydrate-sourced food items, hypoglycemia due to insulin deficiency and/or administration as well as symptoms arising from hypoglycemic episodes. The lowest scoring areas were specifically insulin timing relative to meals, the chronic nature of T1DM, interpretation of fasting glucose values, insulin adjustments for exercise, and the role of insulin alongside nutrition.

Table 1. Maternal responses to T1DM knowledge items (n = 100).

| No. | Knowledge item                                          | No, n (%) | Uncertain, n (%) | Yes, n (%) | Mean | SD   | Interpretation |
|-----|---------------------------------------------------------|-----------|------------------|------------|------|------|----------------|
| 1   | Diabetes is a chronic disease that cannot be cured.     | 39        | 18               | 43         | 2.04 | 0.90 | Moderate       |
| 2   | Type 1 diabetes results from insulin deficiency.        | 10        | 21               | 69         | 2.59 | 0.66 | High           |
| 3   | The normal fasting blood glucose value is 80-120 mg/dL. | 40        | 14               | 46         | 2.06 | 0.93 | Moderate       |

| No. | Knowledge item                                                                                          | No, n (%) | Uncertain, n (%) | Yes, n (%) | Mean | SD   | Interpretation |
|-----|---------------------------------------------------------------------------------------------------------|-----------|------------------|------------|------|------|----------------|
| 4   | Hypoglycemia is more dangerous than hyperglycemia.                                                      | 32        | 16               | 52         | 2.20 | 0.89 | Moderate       |
| 5   | Excess insulin can cause hypoglycemia.                                                                  | 15        | 11               | 74         | 2.59 | 0.74 | High           |
| 6   | Diabetes is an inherited disorder.                                                                      | 63        | 17               | 20         | 1.57 | 0.80 | Low            |
| 7   | Hypoglycemia may cause fatigue, drowsiness, and loss of consciousness.                                  | 18        | 8                | 74         | 2.56 | 0.78 | High           |
| 8   | Chronic hyperglycemia can contribute to retinal damage and delayed wound healing.                       | 15        | 17               | 68         | 2.53 | 0.74 | High           |
| 9   | Diet alone is insufficient to manage type 1 diabetes.                                                   | 65        | 10               | 25         | 1.60 | 0.86 | Low            |
| 10  | Physical activity may reduce insulin requirements.                                                      | 49        | 7                | 44         | 1.95 | 0.96 | Moderate       |
| 11  | Blood testing is an appropriate method for checking glucose.                                            | 16        | 1                | 83         | 2.67 | 0.73 | High           |
| 12  | Rice, wheat, pasta, dates, potatoes, bananas, grapes, and soft drinks contain substantial carbohydrate. | 16        | 6                | 78         | 2.62 | 0.74 | High           |

| No. | Knowledge item                                                        | No, n (%) | Uncertain, n (%) | Yes, n (%) | Mean | SD   | Interpretation |
|-----|-----------------------------------------------------------------------|-----------|------------------|------------|------|------|----------------|
| 13  | Rapid-acting mealtime insulin is commonly administered before eating. | 55        | 12               | 33         | 1.78 | 0.91 | Moderate       |

#### Overall knowledge and family-care practice

Table 2. Overall maternal knowledge and family-care practice scores.

| Variable                     | Response distribution              | Mean | SD   | Interpretation |
|------------------------------|------------------------------------|------|------|----------------|
| Overall maternal knowledge   | Low: 12%; moderate: 44%; high: 44% | 2.21 | 0.44 | Moderate       |
| Overall family-care practice | Low: 38%; moderate: 37%; high: 25% | 2.18 | 0.41 | Moderate       |

The mean maternal knowledge score was 2.21 (SD 0.44), and the mean family-care practice score was 2.18 (SD 0.41). Both were within the prespecified moderate category. These values should not be described as “low” because they exceed the stated low-score threshold.

#### Priority educational needs

Table 3. Priority topics for caregiver education derived from item-level responses.

| Priority topic            | Evidence from study                                                    | Clinical relevance                                                                                       | Suggested educational response                                                                     |
|---------------------------|------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|
| Insulin-meal coordination | 55% answered no and 12% were uncertain about premeal administration.   | Mismatch between insulin action and food intake may increase glycemic variability and hypoglycemia risk. | Demonstration and return-demonstration using the child's prescribed insulin type and meal plan.    |
| Glucose interpretation    | 40% answered no and 14% were uncertain about the stated fasting range. | Misinterpretation may delay a response to clinically important readings.                                 | Individualized target cards, monitoring logs, and action thresholds provided by the diabetes team. |
| Chronicity of T1DM        | 39% answered no and 18% were uncertain.                                | Misconceptions may weaken expectations for lifelong follow-up and insulin therapy.                       | Plain-language explanation of autoimmunity, insulin dependence, and long-term follow-up.           |

| Priority topic                           | Evidence from study                                  | Clinical relevance                                                                 | Suggested educational response                                                                              |
|------------------------------------------|------------------------------------------------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|
| Physical activity and insulin            | 49% answered no and 7% were uncertain.               | Exercise effects vary with intensity, timing, insulin on board, and glucose level. | Scenario-based instruction on glucose checks, carbohydrate intake, and individualized insulin adjustment.   |
| Integrated nutrition and insulin therapy | Only 25% recognized that diet alone is insufficient. | Overreliance on diet may contribute to unsafe insulin omission.                    | Teach that nutrition, insulin, monitoring, and activity planning are complementary components of treatment. |

#### 4. Discussion

The Complete Guide to Finding Best and Top-Rated T1D parents, Role of T1DM Parents in Providing Care for Children with Type 1 Diabetes A Descriptive Study Showed Moderate Overall Maternal Knowledge and Moderate Reported Family-Care Practice Among Mothers of Children With T1DM. Individual scoring was more revealing than a summary score, showing that mothers understood much of the reinforcement items but were also left with important misunderstandings in critical subject areas requiring individualized thinking.

Pathways most substantially associated with positive responses on the blood-based glucose monitoring survey were related to carbohydrate recognition, insulin deficiency, and hypoglycemia. They are central aspects frequently highlighted during clinic visits. However, the study did not assess whether knowledge was actualized into technically correct behaviors (e.g. insulin mixing/preparation, dose calculation, carbohydrate counting, treatment of hypoglycemia or sick-day management). This is an essential differentiation since there are behavioral, psychosocial and treatment-system influences on diabetes control that are reflective of a person's factual knowledge [7], [8], [9], [10]

Insulin management in relation to meals ( $n = 40$  items) was best studied deficit among the domains. Although this finding is of real practical relevance it does not mean that education should pose a universal (likely to be fixed) time window for every student. However, the timing depends on insulin type, glucose level, meal stimuli (food composition), child older (not a toddler) and cases of young children who may not eat all intended foods. Pediatric guidance therefore currently favours skills-based, individualised instruction over a one size fits all memorized rule [1], [2], [5].

Similar uncertainty regarding glucose targets and physical activity suggests the need for individualized action plans. Exercise is notable for its ability to lower glucose during or after physical activity; however, it is important to remember that response varies with type, duration and intensity of the exercise and pre-exercise insulin on board/ pre-exercise glucose. This use case requires practical algorithms to cover glucose checking, carbohydrate consumption, ketone evaluation when clinically indicated and recommended insulin adjustment steps or management under medical supervision [5], [6], [13].

A dim awareness of dietary influence as insufficient per se is clinically alarming, as T1DM patients develop an absolute need for lifelong insulin replacement. Nutrition is still important, especially carbohydrate-counting and meal planning, but it mainly accompanies, rather than supplants insulin. Adaptation of some educational materials, which are culturally appropriate to common Iraqi foods among others has been recommended; meal demonstrations and visual carbohydrate guide should be used [3], [4], [14].



The disparity between intermediate knowledge and inconsistency with family-care practice argues for the need for education over time, rather than a single counselling session at diagnosis. Current ISPAD and ADA guidance highlight the importance of lifelong diabetes self-management education and active family participation through childhood and adolescence [1], [2], [3]. Studies of family-centered interventions demonstrate that programs including education combined with problem solving, behavioral support and family involvement have been beneficial for relevant child and family outcomes [8], [9], [10].

The local evidence from this study and the identification of content areas that could be incorporated into nursing education programs is critical. Pediatric nurses can utilize the results in creating short, repeated modules that include demonstration, teach-back, return-demonstration and written action plans. But the conclusions are of only limited strength due to descriptive design and incomplete psychometric reporting. Future research should investigate whether knowledge and practice vary by maternal education, socioeconomic status, duration of the disease, type of insulin regimen, previous education to participate in flag-flag (and what content), and child HbA1c; and will evaluate a culturally tailored intervention using a controlled or pre-post design.

#### Proposed Family-Centered Education Framework

- a. Module 1: T1DM 101: AutoImmune destruction of beta-cells, chronicity, lifelong need for insulin and follow-up; when to transfer responsibility with age-appropriate transition
- b. Module 2: Insulin and meals: Types of insulin, prescribed doses, storage, injection technique (subcutaneously), timing according to the individual regimen (basal-bolus as well as continuous subcutaneous insulin infusion), carbohydrate calculation, completion of meals, missing a meal.
- c. Module 3: Measuring glucose and ketones: Correct measurement technique, setting individual targets(T1/T2/other), interpreting trends, recording data, ketone testing (KETONE: threshold for contact with the diabetes team).
- d. Module 4: hypoglycemia and hyperglycemia: identification, initial treatment, checking blood sugar level again, management of serious incidents when available Glucagon sick-day principles referral to hospital
- e. Module five: Nutrition and exercise: Meal planning, carbohydrate-consistent foods, snacks and drinks for hydration, pre-entity + post-exercise self-monitored blood glucose checks + individualised adjustment plan.
- f. Module 6: Psychosocial and school support, including caregiver burden, fear of hypoglycemia, communication with the child, school action plans and coordination with teachers and school health personnel [15].

Each module should incorporate teach-back, return-demonstration, repetition at follow-up visits, and tailoring to the child's age, insulin regimen, technology use, literacy level and family situation.

## 5. Conclusion

Mothers of children with T1DM demonstrated moderate overall knowledge and moderate but inconsistent home-care practices, with the most important educational gaps involving insulin-meal coordination, interpretation of glucose values, understanding of T1DM chronicity, physical-activity planning, and the complementary roles of insulin and nutrition. These findings support continuous, individualized, skills-based, and culturally appropriate family-centered education rather than one-time counseling at diagnosis. Pediatric diabetes services should incorporate demonstration, teach-back, and return-demonstration of insulin administration, glucose and ketone monitoring, and emergency management; provide tailored written action plans and culturally relevant nutrition materials; coordinate school support; and include psychosocial screening for caregiver burden. Future evaluations of such programs should assess caregiver knowledge, observed skills, self-efficacy, severe hypoglycemia, diabetic ketoacidosis, time in range when available, and HbA1c.

#### Limitations

Single-center, purposive sampling thus limiting generalizability. The cross-sectional nature of the study makes it impossible to evaluate causality. Home-care practices were based on self-reports, and thus could be subjected to recall or social-desirability bias. Psychometric information for the questionnaire was not fully described and many of the knowledge statements need clinical refinement because current T1DM management practices are tailored to the individual. Analysis was descriptive, as participant-level raw data were not available after manuscript revision because reliability estimates and associations with sociodemographic or clinical variables could not be calculated. Outcomes excluded were diabetes-related child outcomes (eg, HbA1c, severe hypoglycemia, diabetic ketoacidosis and Time in range).

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