

# The level of knowledge and awareness of teachers in the province of Kayseri for type 1 diabetes mellitus, the adequacy of schools in diabetes mellitus management

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## Abstract

Type 1 Diabetes Mellitus (T1DM) is an important chronic health problem of childhood. Cooperation of parents and teachers is necessary in diabetes management. In our cross-sectional study, a 3-part questionnaire evaluating the educational status of teachers for T1DM was used. Questions consisting of 4 factors were asked about the level of knowledge, awareness, living with diabetes, and school life with diabetes. In scoring the answers given to the questions in the first part, each correct answer was recorded as +1 point, each incorrect answer as -1 point, and 'I have no idea' as 0 points. The total score ranged from -21 to +21 points. Those who scored 11 points or more were considered to have a sufficient level of knowledge and awareness about T1DM. The validity of the first part of the scale, *KMO* and *Bartlett's* test score, was found to be 0.94. The reliability of the first part of the scale, *Cronbach's* alpha value, was 0.91. The mean score of the first part of the scale was  $9.3 \pm 5.1$ , and range was between -3 to 19 points. In our study, the number of those who scored 11 points or more in the questions measuring the level of knowledge and awareness about diabetes were 268 (46.4%). We observed that the level of knowledge and awareness about diabetes in schools in our province is not sufficient.

**Keywords:** Diabetes mellitus, knowledge, school, teacher, type 1 diabetes

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## Introduction

Type 1 Diabetes Mellitus (T1DM) is an important chronic health problem of childhood. Many countries around the world have clear legal guidelines to support chronically ill children, especially diabetics, in the education system [1]. In a study published in Türkiye in 2017, the national prevalence and incidence of T1DM were found to be 0.75/1000 and 108/100.000, respectively [2]. Support from family, doctor, nurse, dietitian, and psychologist is of great importance in childhood diabetes management. Depending on the age, some responsibilities can be given to the child. With the school age, the time spent in the home environment decreases, and a large part of the day is spent at school. Mostly parents, sometimes school nurses and teachers support the child who continues his or her diabetes management and daily life with blood sugar monitoring, insulin administration, nutrition, and sports activities. 'Diabetes Prevention and Control Program in Türkiye' is a program that has been carried out since 2010 to prevent the development of type 2 diabetes mellitus (T2DM), early detection of T1DM and T2DM, and improve diabetes care. 'Childhood Diabetes Control Program' is included as a separate subject in this program. As part of this program, with the cooperation of the Ministry of Health and the Ministry of National Education and with the contributions of the Turkish Pediatric Endocrinology and Diabetes Association, "Diabetes Program at School" was started and this program continues actively throughout Türkiye [3]. The main purposes of this program are to increase the level of knowledge and awareness about T1DM in schools and teachers, to provide early detection of diabetes mellitus, to improve diabetes management, to reduce the frequency of diabetic ketoacidosis complications, and to prevent the development of obesity by developing healthy eating attitudes. 'A guide to school exams for children with diabetes', 'Individualized Diabetes Management Plan' (DMP), and 'School Action Plan' were prepared and sent to schools. In October 2020, a directive was published by the Turkish Ministry of National Education and the duties and responsibilities of families, teachers,

and nurses in schools were determined. Teachers were asked to attend the training and take part in diabetes management. In a study that audited the effectiveness of the "Diabetes Program at School" and evaluated the knowledge and attitude scores of teachers throughout Turkey, the lowest scores were found in Central Anatolia and Southeastern Anatolia regions, and it was determined that the level of knowledge and awareness of school staff about T1DM showed regional differences [4]. In our study, we evaluated the knowledge level and awareness of teachers in public and private schools operating under the Provincial Directorate of National Education in the province of our city in the Central Anatolian region, and the adequacy of the school equipment, with a scale consisting of 3 parts.

## Materials and Methods

### Study Design

The study was approved by the clinical research ethics committee of Kayseri City Training and Research Hospital (2022-607). Survey records were obtained online between 30 May and 30 June 2022. Research ethical principles were conducted in accordance with the Declaration of Helsinki. In our cross-sectional study, a 3-part questionnaire evaluating the educational status of teachers for T1DM was used. The scale consisted of 43 questions. In the first section, questions consisting of 4 factors were asked about the level of knowledge, awareness, living with diabetes, and school life with diabetes. The answers were determined as 'True', 'Wrong', and 'No idea'. In scoring the answers given to the questions in the first part, each correct answer was recorded as +1 point, each incorrect answer as -1 point, and 'I have no idea' as 0 points. The total score ranged from -21 to +21 points. Those who scored 11 points or more (those whose scores are above average) were considered to have a sufficient level of knowledge and awareness about T1DM. In the second part, multiple choice questions measuring the level of direct knowledge of the teachers about the treatments used in diabetes management were asked and the rate of choosing the correct answer from 4 options was evaluated. In the third part, questions were asked to measure the school's responsibilities and equipment adequacy for diabetes care. The

answers were determined as 'Yes', 'No', and 'No idea'.

The study was approved by the clinical research ethics committee. The date of approval is March 10, 2022, and the number is 607. The conditions of the Ministry of National Education for scientific research were fulfilled, and a questionnaire form was created to be answered electronically, with the approval of the Provincial Directorate of National Education and the Provincial Health Directorate. This survey was shared for around 20,700 teachers working in the province. As a random method, educators were asked to fill out the surveys on a voluntary basis. The participation rate in the survey was around 3%.

### Statistical Analysis

The validity of the first part of the scale was evaluated by factor analysis and after the analysis, 2 statements were removed from the scale, and the final *KMO* and *Bartlett's* test score were found to be 0.94. It was statistically significant. ( $p < 0.001$ ). The questions in the scale were collected in 4 factors and the cumulative variance was 53.7%. The questions in the first part of the scale were also evaluated with reliability analysis. *Cronbach's* alpha value was 0.91. As such, the scale was found to be a valid and reliable scale. The answers given by the individuals to the questions in the second and third parts (categorical variables) are shown as numbers and percentages. According to the answers given to the questions in Table 3, the scores obtained by the participants in the first part were also compared by ANOVA analysis and Bonferroni as a *Post-Hoc* method. A *p*-value less than 0.05 was considered statistically significant.

### Results

A total of 577 teachers, 320 (55.5%) female, and 257 (44.5%) male, participated in our study. The distribution of teachers by age range was as follows: 29 teachers of aged 20-29 (5%), 240 teachers of aged 30-39 (41.6%), 190 teachers of aged 40-49 (32.9%), 106 teachers of aged 50-59 (18.4%), and 12 teachers of aged over 60 (2.1%). The responses given to the statements evaluating the level of knowledge, awareness, daily life, and school life about diabetes were shown in Table 1.

Statement 2 and Statement 9, which are among the items in this section, were excluded from the validity analysis due to their low factor loads. The mean score of the answers given to the questions in the first part of the scale was  $9.3 \pm 5.1$  and the range was between -3 and 19 points. In our study, the number of those who scored 11 points or more in the questions measuring the level of knowledge and awareness about diabetes was 268 (46.4%). Questions containing general information about T1DM treatment management are shown in Table 2.

The questions related to T1DM management and equipment adequacy at school are shown in Table 3. According to the answers given to the questions in Table 3, the scores obtained by the participants in the first part were also compared. The scores of those who answered "Yes" (first part score  $11.5 \pm 4.6$ ) to the question of whether there was anyone who had received education on diabetes at school were significantly higher than those who answered "I have no idea" (first part score  $9 \pm 5.2$ ;  $p = 0.001$ ) and those who answered "No" (first part score  $9.25 \pm 5.2$ ;  $p = 0.008$ ). The scores of those who answered "Yes" (first part score  $10.6 \pm 5.0$ ) to the question of whether there is a child with diabetes in the institution I work in/ around me were significantly higher than those who answered "I have no idea" (first part score  $8.2 \pm 5.5$ ;  $p < 0.001$ ) and those who answered "No" (first part score  $9.4 \pm 4.9$ ;  $p = 0.04$ ).

**Table 1.** The responses given to the statements evaluated the level of knowledge, awareness, daily life, and school life about diabetes.

	Items	Answers (number/percentage)		
		Correct	Wrong	No idea
1	The most common diabetes in the world is T1DM.	213 (36.9%)	<b>104</b> ( <b>18%</b> )	260 (45.1%)
2	T1DM is caused by consuming too many sugary (carbohydrate) foods.	184 (31.9%)	<b>256</b> ( <b>44.4%</b> )	137 (23.7%)
3	The most common diabetes in childhood is T1DM	<b>282</b> ( <b>48.9%</b> )	33 (5.7%)	262 (45.4%)
4	A child with T1DM can eat whatever they want like a healthy child.	<b>32</b> ( <b>5.5%</b> )	446 (77.3%)	99 (17.2%)
5	Children with T1DM should not participate in sports/physical education activities.	28 (4.9%)	<b>419</b> ( <b>72.6%</b> )	130 (22.5%)
6	When the blood glucose (sugar) level drops (hypoglycemia) in children with T1DM, some symptoms may occur.	<b>396</b> ( <b>68.6%</b> )	7 (1.2%)	174 (30.2%)
7	T1DM should not effect the child's school life (participation in class, socialization).	<b>250</b> ( <b>43.3%</b> )	216 (37.4%)	111 (19.2%)
8	Drinking a lot of water, frequent urination and weight loss are the findings that can be observed at the time of diagnosis in T1DM.	<b>435</b> ( <b>75.4%</b> )	17 (2.9%)	125 (21.7%)
9	T1DM can resolve spontaneously over time.	34 (5.9%)	<b>367</b> ( <b>63.6%</b> )	176 (30.5%)
10	There is no individualized treatment plan (nutrition/insulin/exercise) specific to every child with T1DM.	39 (6.8%)	<b>406</b> ( <b>70.4%</b> )	132 (22.9%)
11	All children with T1DM can manage their treatment plan and do not need adult support.	53 (9.2%)	<b>408</b> ( <b>70.7%</b> )	116 (20.1%)
12	Changes in the blood glucose (sugar) level (hypoglycemia/hyperglycemia) of a child with T1DM may effect exam success, school performance, and attendance at school.	<b>393</b> ( <b>68.1%</b> )	57 (9.9%)	127 (22%)
13	A child with T1DM should not be allowed to want something to eat during class (citing blood sugar).	69 (12%)	<b>403</b> ( <b>69.8%</b> )	105 (18.2%)
14	Findings such as weakness, fatigue, pallor, sweating, and confusion are observed when blood glucose level decreases (<70 mg/dL).	<b>395</b> ( <b>68.5%</b> )	8 (1.4%)	174 (30.2%)
15	The family and the child are responsible for the problems (hypoglycemia/hyperglycemia) that the child with T1DM may experience at school. It is not the responsibility of the school and the teacher.	48 (8.3%)	<b>390</b> ( <b>67.6%</b> )	139 (24.1%)
16	The child with T1DM has special needs and therefore, peer bullying, neglect, and abuse are more common.	<b>237</b> ( <b>41.1%</b> )	129 (22.4%)	211 (36.6%)
17	If T1DM is not treated correctly and appropriately, it can lead to eye, kidney, cardiovascular, and vascular health problems.	<b>438</b> ( <b>75.9%</b> )	7 (1.2%)	132 (22.9%)
18	Children with T1DM can also live healthy years, be successful in their lives, and achieve good academic standing.	<b>475</b> ( <b>82.3%</b> )	5 (0.9%)	97 (16.8%)
19	A child with T1DM can measure blood glucose without piercing the fingertip (measurement with a glucometer) and her family can monitor it remotely.	<b>244</b> ( <b>42.3%</b> )	44 (7.6%)	289 (50.1%)
20	A child with T1DM cannot do professional sports or become a licensed athlete.	34 (5.9%)	<b>268</b> ( <b>46.4%</b> )	275 (47.7%)
21	The activities of a child with T1DM in the school environment and the social environment can effect the blood glucose (sugar) level.	<b>310</b> ( <b>53.7%</b> )	73 (12.7%)	194 (33.6%)
22	The target blood glucose (sugar) targets of a child with T1DM do not change throughout life.	38 (6.6%)	<b>316</b> ( <b>54.8%</b> )	223 (38.6%)
23	A child with T1DM should be allowed to take his or her needs such as simple carbohydrates (sugar, juice), insulin, blood glucose meter, dipstick, glucagon, and insulin pump when taking the exam.	<b>436</b> ( <b>75.6%</b> )	8 (1.4%)	133 (23.1%)

Items 2 and 9 were excluded from the validity analysis due to their low factor loads.

*Abbreviations:* T1DM: type 1 diabetes mellitus. **The correct answers are shown in bold.**

## Discussion

In our study, we evaluated teachers' awareness and knowledge about T1DM with a valid and reliable questionnaire. As far as we know, it is the first study conducted in our province. In our country, as in some countries, guidelines for diabetes management at school have been published. There is an increase in the incidence and prevalence of childhood diabetes in the world. In our study, the level of knowledge, awareness, and the place of life with diabetes in school life was evaluated by the teachers with an appropriate questionnaire and almost half of the participants could answer almost half of the questions correctly (46.4%). In a study conducted with school staff, although 80% of them stated that their experience is sufficient

for the management of T1DM in children and adolescents, 90% of them can work comfortably in schools where children with T1DM are present, and only 47.1% of the school staff are observed to be aware of the methods and practices used in diabetes management [5]. In diabetes management, family, child, and school should be in coordination. Psychological problems (depression, eating disorders) are more common in children with T1DM. The prevalence of depression in adolescent diabetics is 2-3 times higher than in healthy individuals [6]. In addition, the fear of hypoglycemia can be observed in the family or teachers. Problems attending school and staying at home due to fear of hypoglycemia are more common in children with diabetes. These conditions can cause problems such as making

**Table 2.** Questions containing general information about type 1 diabetes treatment management.

Questions	Answers (number/percentage)
What is the blood glucose level of a child with T1DM usually like at the time of diagnosis?	I am not sure (284, 49.2%) Within normal ranges (20, 3.5%) Low (72, 12.5%) <b>High (201, 34.8%)</b>
How does insulin effect blood glucose (sugar) levels?	I am not sure (186, 32.2%) Does not effect (6, 1%) <b>Level down (271, 47%)</b> Level up (114, 19.8%)
In which way/ways can insulin be administered?	I am not sure (130, 22.5%) Oral pill (7, 1.2%) Oral pill and injection (into the skin) (269, 46.6%) <b>Injection and pump therapy (171, 29.6%)</b>
What can be used in the treatment of T1DM?	Surgery (6, 1%) Oral pill (24, 4.2%) Oral pill and insulin (379, 65.7%) <b>Insulin (168, 29.1%)</b>
What should a child with low blood glucose (sugar) levels do?	I am not sure (193, 33.4%) <b>Consuming sugar (270, 46.8%)</b> Consuming protein (13, 2.3%) Insulin (101, 17.5%)
What should be done in case of confusion, fainting, or seizure that can be observed in a child with T1DM?	I am not sure (320, 55.5%) Oral sugar should be given (29, 5%) <b>Glucagon injection should be given (116, 20.1%)</b> Insulin should be administered (112, 19.4%)
What should be done if the blood glucose (sugar) level of a child with T1DM is below 70 mg/dL?	I am not sure (258, 44.7%) Mixed carbs (sandwich, cake) (19, 3.3%) <b>Simple carbohydrates (sugar cubes, fruit juice, etc...) (269, 46.6%)</b> Insulin (31, 5.4%)

*Abbreviations:* T1DM: type 1 diabetes mellitus. **The correct answers are shown in bold.**

insufficient insulin or skipping insulin doses. In long-term studies, early parental responsibility for diabetes management was associated with poor adherence to treatment and poor glycemic control. Therefore, regardless of age, diabetes management mostly depends on the problem-solving skills of the parents [7]. Problems such as socioeconomic inadequacies, inability to reach a healthy meal, low parental education level, insufficient school infrastructure or lack of knowledge and experience of the educator at school, problems in attending school, and frequent school changes also cause weakening of academic achievement. Hypoglycemia or hyperglycemia of a child with T1DM during stress and exam periods may also affect their cognitive abilities [8,9]. In our study, it was questioned whether there were any children with diabetes in the school and this rate was

stated to be 28.9%. The presence of an educator who received training on diabetes at school was 11.3%, and the status of being a nurse at school was 3.8% in our questionnaire. In our study, the status of the child with diabetes receiving support from the school/teacher in cases such as insulin administration and additional meal adjustment was found to be around 23.2%, and this rate was observed to be below 20% in a study in which the sub-dimensions of support were also questioned throughout the country (4). In a study conducted in Istanbul, it was observed that more than 80% of the schools did not have nurses, and 50% of the educators were not aware of the emergency treatment of hypoglycemia and had difficulties in administering insulin at school [10]. Although having a nurse at school has an advantage in diabetes management, different results have been observed in studies conducted

**Table 3.** Questions related to type 1 diabetes management and adequacy of equipment in school.

Questions	Answers		
	Yes	No	No idea
Is there anyone in school who has been trained in diabetes?	65 (11.3%)	167 (28.9%)	345 (59.8%)
Is there a nurse at the school?	22 (3.8%)	539 (93.4%)	16 (2.8%)
Is lunch available for students who are at school all day?	111 (19.2%)	429 (74.4%)	37 (6.4%)
Is there an area/room where the child with T1DM can administer the insulin injection?	166 (28.8%)	310 (53.7%)	101 (17.5%)
Does the child with T1DM have a cabinet for insulin, glucagon, and spare measuring instruments, preferably with a cold storage feature?	239 (41.4%)	228 (39.5%)	110 (19.1%)
Does the child with T1DM receive support from the school/trainer in situations such as insulin administration or additional meal adjustments?	134 (23.2%)	157 (27.2%)	286 (49.6%)
Does the child with T1DM have the opportunity to measure blood sugar and administer insulin in the classroom?	197 (34.1%)	154 (26.7%)	226 (39.2%)
When a child with T1DM faints, the first thing that comes to mind is low blood sugar (hypoglycemia). In this case, urgent intervention is required, the first thing to do is to turn the child on his/her side and administer a glucagon injection (intramuscular) and measure blood sugar at the same time. In this case, is the nearest teacher responsible for making this application?	183 (31.7%)	83 (14.4%)	311 (53.9%)
There is a child with T1DM in the institution where I work.	167 (28.9%)	230 (39.9%)	180 (31.2%)

*Abbreviations:* T1DM: type 1 diabetes mellitus.

in schools with nurses in the literature. The experience level of the nurse and whether she/he has received any previous education on diabetes are important [11]. These results show us that diabetes education should be repeated at regular intervals. It has been suggested to include these topics in school or university curricula [12]. In our research, it was observed that there were no nurses in 93.4% of the schools, no meals were provided in the school in 74.4%, and no place was arranged for insulin administration in 53.7%. When asked whether there is a lunch for students who are at school all day, 19.2% of the participants answered "Yes". This rate was found to be 40% in another study conducted in Turkey [4]. Some of the important results of our study are that most of the teachers do not know the practices to be done for low blood sugar, and they are not aware of the effect of insulin and the way it is applied. When asked what should be done if the blood glucose (sugar) level of a child with T1DM is below 70 mg/dL, 5.4% of the participants answered "insulin". Similarly, 19.4% of the participants answered "insulin" when asked what to do in case of confusion, fainting, or seizures that can be observed in a child with T1DM. It is understood from these results that more emphasis should be placed on awareness and management of hypoglycemia. While some of the participants answered "I am not sure" or oral pills to the question of which way insulin can be administered, 29.6% chose injection or pump therapy as the correct answer. As we revealed in our study, having a child with diabetes at school and having received education on diabetes significantly contribute to the level of knowledge and awareness in diabetes management [13]. We did not question the practical applications of teachers separately, but the literature revealed that teachers should take a more active role in blood glucose measurement, insulin administration, and intervention of hypoglycemia, especially in young children [14,15].

In our research, "Is there an area/room where the child with T1DM can administer the insulin injection?" The answer to the question was "No" by 53.7%. "Does the child with T1DM have a cabinet for insulin, glucagon, and spare

measuring instruments, preferably with a cold storage feature?" The answer to the question was "No" by 39.5%.

A review of diabetes care in the United States published in 2022 found that around 20% of schools did not have locking refrigerators for storing glucagon, insulin, or syringes [16]. The rate of students not being allowed to administer insulin in the classroom is around 79% [16,17]. The rates of schools where students were not allowed to check their blood sugar in the classroom were observed at a rate of 51% [16,18] to 52% [16,17], and the rate of not allowing insulin administration in the classroom was observed at around 79% [16,17]. The rate of being asked to go to school health offices for procedures such as insulin administration or blood sugar control was observed at a rate of 26.7% [16,19].

Our study had some limitations. Firstly, it has a relatively small sample size, and the participation rate among educators was around 3%. Secondly, whether the schools are private or public, the number of schools, and the teachers expertise were not questioned. Thirdly, the questionnaires were obtained through an online system, not face-to-face.

In the literature, there are limited number of survey studies evaluating the knowledge level of teachers about diabetes [20]. More research is needed to make the scales universally usable due to regional and educational differences and limitations such as the intelligibility of the questions.

## Conclusion

As a result, we observed that the level of knowledge and awareness about diabetes in schools in our city is not sufficient. We think that in diabetes education, the management of hypoglycemia should be handled more carefully, teachers should be encouraged about practical applications, and awareness should be increased. It is necessary to make up for the deficiencies of schools following children with diabetes and to re-train teachers at regular intervals to keep their knowledge up-to-date.

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### Conflict of interest

The author declares that there is no conflict of interest.

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