

## Effects of educational practice on self-care and management of Type 1 Diabetes Mellitus in childhood\*

Repercussões da prática educativa no autocuidado e manejo do Diabetes *Mellitus* tipo 1 na infância  
Repercusiones de la práctica educativa sobre el autocuidado y manejo de la Diabetes *Mellitus* tipo 1 en la infancia

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**Abstract: Objective:** to present the effects of health education for the self-care and management of type 1 Diabetes Mellitus among children. **Method:** a qualitative study with a focus group and description of the children's glycemic profile. The health education activities, of a playful type and with an educational booklet, were carried out with four children with diabetes and their families, in an outpatient clinic of a university hospital. Thematic content analysis was performed. **Results:** physical activity proved to be an effective option for the practice of self-care, however, there was non-compliance to the adoption of dietary habits aimed at diabetes, concerning inadequate glycemic control, and increased complications. Changes in the management of the disease were observed when comparing the before and after of educational activities. **Conclusions:** playful resources and an educational booklet had a positive impact on family management and the self-care of children with Diabetes Mellitus.

**Descriptors:** Diabetes mellitus; Child health; Health education; Pediatric nursing; Play and playthings

**Resumo: Objetivo:** apresentar as repercussões de uma prática de educação em saúde para o autocuidado e manejo da Diabetes *Mellitus* tipo 1 entre crianças. **Método:** estudo qualitativo com grupo focal e descrição do perfil glicêmico das crianças. As atividades de educação em saúde, lúdica e com cartilha educativa, foram desenvolvidas com quatro crianças com diabetes e seus familiares, em ambulatório de hospital universitário. Análise de conteúdo do tipo temática. **Resultados:** a atividade física mostrou-se como alternativa eficaz para prática de autocuidado, porém, houve resistência à adoção de hábitos alimentares direcionados ao diabetes, relacionados ao controle glicêmico inadequado e aumento de complicações. Observou-se mudanças no manejo da doença comparando-se o antes e após as atividades educativas.

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**Conclusões:** recursos lúdicos e cartilha educativa repercutiram positivamente no manejo da família e no autocuidado da criança com Diabetes *Mellitus*.

**Descritores:** Diabetes mellitus; Saúde da criança; Educação em saúde; Enfermagem pediátrica; Jogos e Brinquedos

**Resumen: Objetivo:** presentar las repercusiones de una práctica de educación para la salud sobre el autocuidado y manejo de la Diabetes *Mellitus* tipo 1 en niños. **Método:** estudio cualitativo con grupo focal y descripción del perfil glicémico de los niños. Las actividades de educación para la salud, lúdicas y con cartilla didáctica, se desarrollaron con cuatro niños con diabetes y sus familiares, en el ambulatorio de un hospital universitario. Análisis de contenido de tipo temático. **Resultados:** la actividad física demostró ser una alternativa eficaz para la práctica del autocuidado, sin embargo, hubo resistencia a la adopción de hábitos alimentarios dirigidos a la diabetes, relacionados con un control glucémico y aumento de complicaciones. Se observaron cambios en el manejo de la enfermedad comparándose el antes y después de las actividades educativas. **Conclusiones:** los recursos lúdicos y la cartilla educativa repercutieron positivamente en el manejo de la familia y en el autocuidado de los niños con Diabetes *Mellitus*.

**Descriptores:** Diabetes mellitus; Salud del niño; Educación en Salud; Enfermería pediátrica; Juego e Implementos de Juego

## Introduction

Diabetes Mellitus is characterized by impaired glucose metabolism, due to changes in the secretion and action of the insulin hormone, resulting in chronic hyperglycemia.<sup>1-2</sup> In Type 1 Diabetes Mellitus (DM1), insulin deficiency results from the destruction of beta cells pancreatic because of the interaction of the immune response, predisposing genetic factors, and environmental factors.<sup>2</sup>

As the most common chronic health condition among children, DM1 requires differentiated modified care from the diagnosis of the disease. Changes that involve eating habits, physical activity, insulin injection, and glucose monitoring. These changes require better understanding and adaptation to the child and family's routine for adequate management and control of the disease, in a way that, the stimulus to self-care occurs according to the child's age and experience.<sup>3</sup>

To carry out self-care, the child must obtain skills to better manage the demands of DM1, such as adequate self-monitoring of serum glucose, directly related to the maintenance of normoglycemia. Glycemia is checked by capillary glucose tests, which offer correct information for keeping and managing glycemic status. With these results, it is possible to plan the management of the disease, changes in the daily diet readjustment of the calculation of insulin dosages.<sup>4</sup> A

condition that challenges health professionals to formulate strategies to help achieve and maintain safe glycemic levels.

In the publication “Standards of Medical Care in Diabetes”,<sup>5</sup> there is a recommendation to support educational initiatives aimed at self-care as a method of self-management/management of diabetes for children and adolescents. Personalized education, culturally appropriate, was recommended, in the diagnosis and routine care, assuming that regardless of how consistent the medical regime may be, it will only be effective if the family and/or the affected individuals can implement it.<sup>5</sup>

As an example of these initiatives, the use of therapeutic toys to teach insulin therapy is cited,<sup>6</sup> as well as games aimed at DM1 to influence behaviors and preferences and contribute to disease management.<sup>7-8</sup> Another strategy, which uses robotic technology, is the creation of an affective, autonomous, cognitive and motivational robot with a “diabetes robot”, aiming to support the perception of self-efficacy and emotional well-being of children with diabetes.<sup>9</sup>

Robin, the robot child, offers positive experiences in managing diabetes in a context of playful yet realistic and natural interaction. Therefore, the use of fun in the management of DM1 is a tool that contributes to reduce stress, so the tensions of suffering from living with DM1 in their daily lives are lessened and they can take control of the situation and rescue their autonomy even in the face of the chronic condition.<sup>9</sup>

Currently, there are different strategies for the development of self-care activities aimed at Diabetes Mellitus, be those that require the intervention of technological devices, such as telephone, software, or instruments to assess knowledge and attitudes about the diverse characteristics of the disease, such as Questionnaires of Knowledge (DKN-A) and Psychological Diabetes Attitude Questionnaire (ATT), resources that can assist in the creation of educational strategies for self-care, in a personalized way and enhancing the instrumentalization for coping with the disease.<sup>10-12</sup>

In this context, health education activities based on people’s needs, offered in a dialogical, participatory, and systematic way can be positive. And in this way, they result in improved understanding of children and adolescents about the adequate management of the disease,

promoting self-care ability, as an example in the injection of insulin.<sup>3</sup>

Thus, the objective was to present the effects of a health education practice for the self-care and management of type 1 Diabetes Mellitus among children.

## **Method**

A qualitative study, of the participatory research type, which used focus group, combining elements of an in-depth interview with participant observation, as a data collection technique. In participatory research, there is the interaction between researcher and participants, in an interactive and active relationship, so that those involved can change their practices through learning, through the dialogical construction of knowledge.<sup>13</sup> A quantitative description of data related to the children's glycemic profile was also addressed in the study.

To be included in the study, children should have a medical record of at least 60 days from the date of inclusion in the investigation of glycemic indexes (fasting glycemia and glycated hemoglobin - Hb1Ac). As well as, having an appointment scheduled for the data collection period, being excluded those who did not show up at the scheduled appointment on the day of the focus group meetings. The family members included in the study were the child's companions to consultations at the outpatient clinic and declared being their main caregiver, excluding those who did not attend all meetings of the educational activity. Thus, six children and their families were initially included in the investigation, totaling 12 participants. However, throughout the seven meetings of educational activities, there were dropouts, resulting in the participation of eight people in the focus group at the end. Of this total, four were children aged eight to 12 years with DM1, users of the endocrinology outpatient clinic of a university hospital and four guardian family members. It should be emphasized that the focus group was conducted in the outpatient clinic itself, previously scheduled, in the meeting room.

The children and their families were approached in the outpatient follow-up consultation, when they were instructed on the research objectives and invited to participate, when the child and

companion signed the Informed Assent (IA) and Informed Consent (IC), respectively. Then, a structured form was applied, which was filled out before health education activities started and after 90 days after the end of the educational practice.

The form was prepared by the researchers, filled out by the main researcher in an interview with the child or caregivers. This instrument had 20 open questions, about the difficulties the child and family members had in the management of DM1, about the understanding of the disease, who offered information and what information they received on DM1, and the support to manage the care that the disease requires. Habits after the DM1 diagnosis, what is the most difficult thing for the child and the family member in the management of DM1, insulin therapy and its management, glycemic control, recognition of hypo or hyperglycemia situations and how they respond to these situations, diet therapy and physical activity. It also included sociodemographic data, the DM1 profile and glycemic parameters: fasting blood glucose and HbA1c (children's medical records) and weekly average blood glucose - ABG (from the capillary blood glucose monitoring chart done at home).

Health education was carried out during educational activities through the focus group, a research technique that collects data by approaching a specific theme with a small group of people.<sup>14</sup> The group was conducted by a moderator assisted by two observers, who through participant observation, analyzed attitudes and verbal and non-verbal communication of the participants and recorded the data in a field diary,<sup>15</sup> whose observations were part of the interpretation of this research. It is worth mentioning that in this manuscript the non-verbal data were not analyzed, as they referred to the aspect of the interaction between caregiver and child, analyzed and presented in another article. The verbal reports recorded in audio and video, comprised the data of the interviews guided by the questions of the first three meetings: 1. Tell us what it is like to live with diabetes at your age (child)? How was it for you and her family to find out that she had diabetes (caregiver)? 2. Tell us a little about your daily life after diagnosing diabetes (child and caregiver)? 3. Tell us a little about what you know about diabetes (child and caregiver)?

Educational activities were conducted through dialogue, participation and based on the experiences of the children and their families, as theorized by the Freirean method adopted in this study,<sup>16</sup> guided in its content by the DM1 management themes described in an educational booklet,<sup>17</sup> validated and directed to the teaching of the child with diabetes. This was made available at the first meeting for children and their families as support material and consultation at home. The age-appropriate playful methodology was used to conduct health education through group dynamics and educational technologies created by researchers to address, for example, the pathophysiology of Diabetes, in which the “Glucose Path” was created from school materials and toys to simulate the exit of glucose (represented by little cars) from the bloodstream (cardboard tube) and the transport of glucose by insulin (represented by a larger car) into the cell (cardboard box) (Figure 1).



**Figure 1** – Glucose path. Source: Author’s archives

Subtitles: Célula: Cell – Vaso sanguíneo: Blood vessel – Insulina: Insulin - Glicose: Glucose

The health education was carried out for three months, every two weeks, totaling seven educational meetings, lasting nearly ninety minutes each. The first meeting had the objective of introducing integrating and involving the participants; survey of perception about the disease. The others took place according to the booklet’s themes: DM1 and its symptoms; Self-care and insulin

injection; Diet; Capillary glycemia; Physical activity and DM1 complications.

At the end of the period of educational activities and, within 180 days afterward, when the children return to the clinic for a scheduled appointment, the glycemic parameters of the children's medical records were collected. Thus, the total data collection period was from March to August 2017.

The focus group data were recorded in audio and video, transcribed in full and systematized by thematic content analysis, using the NVivo software for coding. Homogeneity; exhaustiveness; exclusivity; objectivity and adequacy or pertinence helped in the construction of empirical categories in content analysis, in the thematic modality.<sup>18</sup>

The analysis was carried out by the triangulation of sources (focus group, participant observation and data from the structured form).<sup>19</sup> The information collected through the structured form was described qualitatively, in the short case format of each child with DM1 and the respective family, comprising part of the data that composed the thematic categories of the study. The analyzes of the biochemical results of the traditional tests were based on the Brazilian Diabetes Society guidelines. The ABG result was estimated from the capillary glycemia monitoring chart performed by the child at home, for which arithmetic mean was performed, calculated by the sum of the results recorded daily and divided by the number of tests taken, in the week before the first collection of data and the 90- and 180-days return, through the glucometers of each child. These data are presented descriptively in the study.

Based on the findings from the transcribed interviews and the focus group observations, as well as the information described in the data collection form, qualitative data were grouped, proceeding to the codification and analysis of this material, originating the following thematic categories: Self-care and routine activities in living with DM1; Health education and changes in the management of DM1.

To keep anonymity, children and companions chose fictitious names, as follow: Sara (12 years old), Fernanda (44 years old); Maitê (nine years old), Maria1 (52 years old); Adriana (11 years old), Maria2 (46 years old); Gabriela (eight years old), Evelin (44 years old).



The research was performed following the required ethical standards from Resolution 466/2012 – 510/2016 – 589/2018, of the Ministry of Health, approved by the Ethics Committee under protocol 59413816.0.0000.0107, opinion nº 1.836.139, on November 25<sup>th</sup>, 2016.

## Results

### Characterization of participants

Chart 1 shows the sociodemographic and clinical characteristics of each child-caregiver dyad.

**Chart 1** – Sociodemographic and clinical characteristics of children and caregivers. Cascavel, PR, 2017.

Characteristics	Child	Caregiver
Sara (child) - Fernanda (mother)	12 years old, 7 <sup>th</sup> grade of ES*, found out about DM1 three months ago, in a routine consultation at the health unit	44 years old, FI** 3MW***, married
Adriana (child) - Maria2 (grandmother)	11 years old, 5 <sup>th</sup> grade of ES, diagnosed DM1 at the age of three in diabetic ketoacidosis, when she was hospitalized in the intensive care unit	46 years old, married, without permanent FI, she quit her job to take care of her granddaughter, took custody when the girl was three years old, as the mother was a teenager and could not manage the problem
Maitê (child) - Maria (grandmother)	9 years old, 4 <sup>th</sup> grade of ES, diagnosed DM1 6 years ago, when she had diabetic ketoacidosis and was hospitalized	52 years old, FI 2 to 3 MW, takes care of the granddaughter while the parents work
Gabriela (child) - Evelin (mother)	3 <sup>rd</sup> grade of ES, 1 year and 10 months ago diagnosed DM1	44 years old, married, FI 2 to 3 MW

Subtitles: \* ES= Elementary School; \*\*FI = Family Income; \*\*\*MW = Minimum Wages

Children and their caregivers are portrayed by women, where the children's mothers or grandmothers become the caregivers. For two participants, the DM1 diagnosis was in a situation of worsening of the condition that triggered diabetic ketoacidosis, because of the lack of glycemic control. These data point to the idea of how the condition in childhood is perceived by primary care professionals, in both cases the children were hospitalized due to the non-identification of hyperglycemia beforehand.

The thematic categories encompass the management of DM1 before and after the educational activity because the data from the form applied before and after this activity were included in the corpus of analysis for the elaboration of the thematic categories, described below.



## Self-care and routine activities in living with DM1

The changes that chronic disease requires on the life of the child and family require adjustments and coping strategies, in this study, children use long- and fast-acting insulin, according to the capillary blood glucose test. However, the rotation of the injection sites was not routine for all.

*Sara injects herself since the day she started taking insulin, she won't let me, nor her father, and she does it the right way.* (Fernanda, Sara's mother)

*I learned to inject [insulin] on my doll, I have a doll, I had a fake syringe, I would turn it on her back and inject it.* (Adriana, 11 years old)

*Also, where to inject it, we didn't know where to inject it, we only knew it was here on the leg, and the belly, but I didn't know that I could inject it on the buttocks.* (Evelin, Gabriela's mother)

Associated with intensive insulin therapy and the testing routine, diet-related care is a challenge for children and families. Asked if they followed the diet indicated for DM1, they reported achieving completely, partially, or not being able to stick to the diet, eating sweets once a week and even daily. The risks of malnutrition were not known by all children, but they named complications such as blindness, changes in organs and hospitalizations.

*When I found out I had diabetes, I learned how to take care of my diet, I understood that I couldn't eat candy because it harms organs, cause blindness, leads to leg amputation and every day you have to inject insulin when you go to eat and also take the test [HGT - hemoglucotest], and always be monitoring to keep the disease under control.* (Sara, 12 years old).

*Everything was changed, the diet [...] we started eating brown rice, then we gave up, we only ate white rice, regular rice and beans, when it would go up a lot at night, we cut off the white rice and started eating the brown rice, it stopped going up [...].* (Evelin, Gabriela's mother).

The practice of some type of physical activity, such as riding a bike, swimming, leisure activities were common activities among children. They recognized the importance and revealed the benefits, such as the maintenance of glycemia, the need for lower insulin doses, and reducing anxiety.

*[...] if you practice physical activity it will help control your weight, glucose [...] and you don't have to keep taking insulin all the time.* (Sara, 11 years old)

*She [Gabriela] exercises in the morning and on the day she does, she uses less insulin,*

*for example, to every count of 20 carbohydrates she takes one unit [...]. She doesn't feel like eating so much the day she exercises [...] and she is not anxious. (Evelin, Gabriela's mother)*

*This one [Adriana] arrives from school, she eats everything in sight, then I make her take the bike and ride outside [...] so when she is kind of controlled [blood glucose] with exercise, eat less and drink less water. (Maria2, Adriana's grandmother)*

In the above-mentioned cases, two children, with underprivileged family contexts, had difficulty in self-care and glycemic control. In one case, the mother was reluctant to accept the disease; a child experienced the changes of pre-adolescence, living with her grandmother, with whom she had a conflicting relationship, and her parents were deprived of their freedom. In the last case, in educational activities, the conflict was clear, when the grandmother expressed an inability to take care of the granddaughter, who, according to her, was undisciplined. Adherence to the treatment and care demanded by DM1 is not always fully effective, since it depends, in addition to the performance of health professionals, on the decision of the subjects, affected by multiple determinants, fulfilling the explanation to the determination of health.

### **Health education and changes in the management of DM1**

With the diagnosis of diabetes, families are usually guided on how to deal with the new condition, such as changes in eating habits, care required on the practice of physical activities, handling the glucometer and insulin. However, the practices of participants were distinct, even though all children were followed up in the same referral service. They reported divergences in the guidelines received by health professionals on insulin conservation, cleaning of the injection site and injecting.

*We always carry [insulin] on ice, the doctor says that above [...] 23°C, it can get contaminated[...] at home, it stays in the refrigerator in a little container, we just take it out to use it. (Maria2, Adriana's grandmother)*

*When I go to school, I take an icebox, the insulin box and wrap it in a towel, it stays cold all day. (Sara, 12 years old)*

*When we are going to pick it up [regional health], the nurse tells us that they can leave [insulin] in the shade [out of the icebox], at home, leave it out of the fridge, to come to pick it up, we bring the ice, then afterward, when we start using, we can keep it out of the ice. (Evelin, Gabriela's mother)*

*I use a little water to clean [the injection site]. (Maitê, nine years old)*  
*Do you have to use another cotton? It's just that I usually leave a container covered with cotton with alcohol on, then she uses that three, four days [the same cotton], she uses that one and puts it there [in the container] again, unless there is blood on the cotton, then throw away. (Maria2, Adriana's grandmother)*  
*There were two nurses who taught [how to inject insulin], there was one from the Intensive Care Unit, and the other there [regional health], one said that we had to make a cushion [pleats the skin, pinching the muscle], the other said not to do it. Then I said, our head gets messy. And we also didn't know where to inject it, we only knew it was here on the leg, and the belly. (Evelin, Gabriela's mother)*

The information also diverged about the sharp waste:

*[...] when they taught me how to inject [insulin], I asked where to throw this, then they said: go to the health center and that they have the waste for it. (Evelin, Gabriela's mother)*  
*We throw [the needles] in the kitchen trash. Where else are you going to put it? [...]. They never told us to take them there [Basic Health Center] [...] there in the regional [regional health] they should tell us that, and look, I've been going there for eight years. (Maria2, Adriana's grandmother)*

After the health education activities, the participants reported the changes in the family's routine and the management of the disease.

*Some things [changed], like, the little machine [HGT] that I didn't make the apple thing [HGT code to record blood glucose before/after eating] [...] we have a commitment [goal] to try to manage it correctly [food], fruits, which I didn't eat [now eat], exercise [how to do it correctly]. (Sara, 12 years old)*  
*For me, a lot changed, like, I would participate very little in physical education, now I'm doing more, running more, and also the thing of commitment, of achieving a goal, now I do my best. (Adriana, 11 years old)*  
*What I noticed most about Sara's changes was that she asks me when she eats something that may be not good, she asks: mom, can I eat this? [...]. She counts carbohydrates, does not stop eating, but she started to monitor it better. [...] fruit, which she didn't like much to eat, has gotten a lot better. (Fernanda, Sara's mother)*  
*[...] she can control better, even when eating, she asks us if she can, and before [eating] when she is doing a carbohydrate count, she says: mom, can I eat such a thing, fruit, or yogurt? That thing you addressed at the time of carbohydrate [how to count], I think it was very useful [...]. (Evelin, Gabriela's mother)*

Questions related to the disease management, after health education, were complemented with the interviews through the form after the educational activity, which are described below, with glycemic levels in the beginning and the levels at the end of the activities.

Sara kept the daily insulin dose and continued doing the self-injection. She kept her diet and acknowledged the risks of a bad diet, arguing that if you keep your blood sugar high, your pancreas gets worse, resulting in organ complications. She recognized the benefits of physical activity as an assisting practice in controlling the disease, helping the pancreas to produce insulin and avoiding complications.

Maitê managed to self-inject insulin from what she learned and practiced in the meetings, but when her parents are at home, she prefers them to do it. The daily insulin dose has increased. She still partially follows the diet but could acknowledge more risks of a bad diet such as blindness, and kidney problems. Concerning physical activity, after the group educational activities, she increased the practice from two to three times a week to six to seven times.

Adriana stated she started to eat less and exercise more. The daily insulin dose increased, previously she did not rotate the site of insulin injection, now she does it sometimes and explains it by saying that some places hurt a lot. She reduced the weekly intake of sweets, saying that not following the diet can result in blindness, limb amputation. Finally, she was able to recognize the benefits of physical activity, such as lowering blood glucose and keeping DM under control.

Gabriela now self-injects insulin, a task that was previously shared with her parents. There was a decrease in the dose of insulin. She continued partially following the diet but started to eat sweets weekly; she recognized the risks of a non-healthy diet as blindness and wounds on the feet. She kept with the same physical exercises and knew how to associate this practice to improved circulation and decrease in weight.

Fasting glycemia and ABG reduced in 50% of the children, when compared to the beginning of educational activities, at 90 days, and at the end of interventions; fasting blood glucose decreased for all at 90 days, however it increased between that period and 180 days after the intervention. But it was not possible to measure the ABG in this period since the subjects did not have a capillary blood glucose monitoring chart. HbA1c declined in all children at 90 days and increased within 180 days of the end of the interventions, as shown in Table 2. The evidence of reduced values may have

occurred together, by increasing the dose of daily slow insulin in two of the four children.

**Chart 2** - Progression of children's glycemic indexes. Paraná, Brazil, 2017.

	BEGGINING			90 DAYS			180 DAYS		
	Glucose fasting	Hba1c	ABG	Glucose fasting	Hba1c	ABG	Glucose fasting	Hba1c	ABG
Sara	117	7	159.25	175	6.8	*	185	7	*
Maitê	204	9.1	251.24	121	6.7	197.07	161	8.6	*
Adriana	438	12.1	337.54	136	10.6	284.5	154	10.8	*
Gabriela	153	7.3	137.65	171	6.9	168.67	311	7.5	*

Subtitles: Glucose expressed in mg/dL; HbA1c shown in%. \* indicates when there was no record of the data.

The use of an educational booklet aimed at children with diabetes as a pedagogical resource demonstrated that playfulness facilitates the learning process.

*It is great, we can clear up questions and it is also good because it is explaining everything to the child correctly.* (Sara, 12 years old)

*I learned a lot from it [booklet].* (Maitê, nine years old)

*It helps like, if we have a question, we resort to it [booklet].* (Evelin, Gabriela's mother)

*I am very forgetful [...] then I look at it [booklet] as a cake recipe, if I have any questions, I go back to it, so I have it as a relic.* (Maria2, Adriana's grandmother)

Children and family members described the booklet as support material to be used at home, in case of any questions.

## Discussion

The data in this study suggested that health education brought benefits to the participants, improving their understanding of the disease. Aimed at the independence of the child and family members, health professionals should promote learning opportunities for them to develop self-care skills for insulin injection, monitoring capillary blood glucose, controlling diet and physical activity. However, educational practice must consider the cognitive development stage in which the child is to better adapt the methods to implement health education and improve the child's understanding.

Children from seven to 12 years old can gradually undertake their daily tasks related to DM1, with supervision and support from trained adults. In this age group, they achieve concrete operational development, begin to develop logical thinking, and acquire the ability to perform silent

mental operations. From understanding rules about internal objects and their relationships, they can be taught what their disease is and learn to develop specific and invasive activities, such as checking capillary blood glucose and injecting insulin.<sup>20</sup>

Taking responsibility for self-care roles inherent to disease management requires a degree of maturity and cognitive development.<sup>21</sup> To distinguish between the real and the imaginary, the child at this stage seeks resources from emotional intelligence, pursuing to motivate him/herself, even in the face of frustrations, try to control impulses by channeling emotions into other pleasant situations.

The limit in the quantity and variety of foods, the desire to eat them and the guilt for not resisting become barriers to self-care, as they emerged in the reports of this study. Despite the difficulties, dietary control is a responsibility that children should gradually begin to take responsibility, sharing it with their parents and, over time, should be under their own responsibility.<sup>22</sup>

Statements of the non-compliance with the restrictions should alert, since they are children who continuously interact with health services and, even so, the diet self-care was not followed. As observed, the families under study, although not of high socioeconomic status, were able to pick the foods to consume, because they had information. What explains, then, the failure to follow the proper diet for the disease? Other aspects impact decisions to adhere to treatment and care, such as diet, family conflicts and in these cases, the limits of educational activities are evident, as they do not overcome conflicting experiences in everyday life. Evidence points out that family life conflicts have been related to a more dispersed emotional and behavioral functioning and low adherence to medical regimes.<sup>23-24</sup> The practice of physical activity was mentioned by the participants as something incorporated in their daily lives and its effects increase calorie expenditure, reduce insulin resistance, and keep adequate body weight management, providing positive results to the health of the whole family when shared.<sup>1</sup>

Understanding the management of DM1 may allow the health team, appropriate

interventions and focused on the child and family's vulnerabilities. Considering that DM1 is a pathology of great morbidity and mortality worldwide, health education is a tool that may be used in the teaching of children with chronic diseases. Therefore, health professionals must be prepared to assess the educational, behavioral, emotional, and psychosocial factors that interfere in the development of the treatment plan and must carry out actions with the child and the family, to overcome barriers and prepare them to take responsibility for self-care.<sup>5,25</sup>

Health education programs, designed in an interactive and planned way, entertaining and creative according to the specificities of the target group, contribute with better levels of knowledge; encourage healthy habits that through adequate food and physical activity; increase the autonomy of those involved with information of specific DM control techniques, resulting in positive psychological effects.<sup>3</sup>

Care in this context must be focused on the family and the child, whose involvement in the programs is essential.<sup>26</sup> For the family, the process of diagnosing the disease and the need to learn the practices that involve the management of DM1 happen in a complex moment, which can be impaired by the discrepancy of information provided by health professionals, which results in harm to the child's health because of errors in techniques of preservation, manipulation, preparation or administration of the medication. The systematization of information, the verification of the adequate understanding of the user and the monitoring of the guidance provided are crucial to minimizing these errors.

The effects of an educational program for children with diabetes result from four phases of the learning process: immediate results (increased knowledge about the disease); intermediates (developing attitudes that promote behavioral changes); post-intermediate (clinical and metabolic improvement) and long-term (improvement of health status and quality of life, minimizing worsenings).<sup>27</sup>

When the form/questionnaire was applied again after health education, changes were observed in the family's routine, in the management of DM1 and in the information about the disease. Therefore,



it can be assumed that the educational activities carried out have reached the stage of immediate and intermediate results. The practice of physical activity was already part of the children's routine and proved to be an effective motivation option to self-care and decrease acute and chronic complications. A study showed statistically significant correlations,<sup>3</sup> before and after educational intervention with children aged four to 14 years old, reaching improvement for nutritional understanding and the practice of physical exercise variables. They observed that most participants became independent in the management of DM, with only the youngest requiring assistance.

Non-compliance to the restriction of high-calorie foods was observed, which were related to poor short-term glycemic control. Possibly, the educational activity time was not enough to achieve the post-intermediate results, in which changes in eating habits and blood glucose levels could be reached, factors explained by the lack of follow-up with an interdisciplinary team.

The glycemic levels for DM1 are the same for all pediatric age groups, being 90-130 mg/dL before meals, 90-150 mg/dL at night and HbA1c <7.5%. Lower HbA1c values (7.0%) may be considered, if there is no extreme hypoglycemia.<sup>1</sup> In the fasting blood glucose levels assessed at the beginning of the study, only Sara met the ideal parameters. At 90 days after the intervention, Maitê had a satisfactory level and at 180 days, none of the children have fasting blood glucose within the desired parameters. About Hba1c, Sara and Gabriela had satisfactory results. At 90 days, only Adriana did not meet the ideal level and, within 180 days, again Sara and Gabriela met the levels recommended for the age group.

Similar findings of an integrative review study showed that in children aged 13 and younger,<sup>28</sup> no significant association with the management of DM and reduced glycemic indexes were found. In the analysis of the effect of a structured educational program associated with support in the first year after diagnosis of DM1 in children, it showed improvements in short-term glycemic control after one year of intervention, but this effect may not persist after the end of the ongoing training.<sup>29</sup>

The use of playful resources, the educational booklet, the age-appropriate language, and the

sharing of experiences through the focus group, by dialogue and sharing in the process of building their perceptions about living with DM1, are arranged in favorable options to the accomplishment of health education. An educational guidebook promotes the educational process by changing the hypothetical in the construction of children's imaginary space, in a laid-back way, allowing socio-educational interactions between children and families as support material at home.<sup>30</sup>

Educational materials should simplify the health team's work in communication, supporting the verbal information of health professionals to children and family members and in the guidelines to be carried out on care in a systematic way, contributing to reduce the risk of conflicting explanations. It is important, that not only the printed material is distributed, but that communication between peers is efficient, with exchanges of experiences, in which the participants are active in the process of building their knowledge.<sup>14</sup>

Playful learning in health education with children with Diabetes Mellitus works as a therapeutic resource and affects the understanding of DM. Other leisure activities such as games, cartoons, the internet, books, among others can be used, since they contribute to the teaching and understanding of diabetes by both children and family members.<sup>20</sup> Health professionals, therefore, must be aware of the adoption of playful activities to carry out in health education, promoting closeness to the child, lessening their fears and desires, increasing communication (dialogicity), which can strengthen the bond, promote trust in the team and reinforce the understanding of the information offered.<sup>8</sup>

Nevertheless, the continuity of health education programs in the lives of these children is crucial, since, over time, if the experiences are not repeated, the essential information is forgotten.<sup>27</sup> In this way, achieving and maintaining ideal glycemic levels among diabetic children and adolescents requires adequate long-term health monitoring, considering, besides the drug treatment, health education supported by appropriate methodologies.

It is worth noting that for children with diabetes and their families, not being involved with health information and education actions is not an option. Even so, it is observed that they do not

reach all children equally, which may occur because of the lack of standardization of educational activities in the health service, due to particularities of children and their families.

Individual needs must be associated with complex relationships between individuals and communities. At times, the struggles of adherence may expose the necessary battles in the organization of the work process of the teams according to the guidelines, but even so it is necessary to recognize that the changes are slow, gradual and with possibilities of advances and setbacks.

As limitations of this study, we consider the number of children with DM1 who participated, as it is a longitudinal investigation, in which the participants were followed up in seven meetings. In studies of follow-up design, losses are common. Thus, children and their families claimed to discontinue it due to financial difficulties to commute.

## Conclusion

Health education for the management of DM1 in childhood, supported by an educational booklet developed for children with diabetes, associated with a playful approach, showed positive effects, especially those related to learning about the pathophysiology of diabetes, self-injection of insulin, the practice of physical activities, as well as the identification of complications of non-adherence to an adequate diet. These data can support future studies that use other pedagogical strategies of health education as tools for the maintenance of normoglycemia and adequate management of DM1 in childhood.

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