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Analysis of the impact of environmental and social factors, with a particular emphasis on education, on the level of metabolic control in type 1 diabetes in children

Analiza wpływu czynników środowiskowych i społecznych, ze szczególnym uwzględnieniem edukacji na poziom wyrównania metabolicznego cukrzycy typu 1 u dzieci

Anna Stefanowicz[1, 2], Dorota Birkholz[3], Małgorzata Myśliwiec[3], Maciej Niedźwiecki[3], Radosław Owczuk[4], Anna Balcerska[3]

[1]*PhD Student, Department of Paediatrics, Haematology, Oncology and Endocrinology, Medical University of Gdańsk, Poland*
[2]*Department of General Nursing, Medical University of Gdańsk, Poland*
[3]*Department of Paediatrics, Haematology, Oncology and Endocrinology, Medical University of Gdańsk, Poland*
[4]*Department of Anaesthesiology and Intensive Therapy, Medical University of Gdańsk, Poland*

Abstract

Background: Type 1 diabetes is a chronic, incurable childhood disease. Chronically uncontrolled diabetes is associated with eye, kidney, nerve, heart and blood vessel damage and function impairment. The aim of this study was to evaluate the impact of various social and environmental factors, with a particular emphasis on education, on the level of metabolic control in diabetes.

Material and methods: The survey research was conducted in 102 children aged 0–18 years, diagnosed with type 1 diabetes. Based on the HbA_{1c} level, patients were divided into: group A (63 patients with fairly well and moderately controlled type 1diabetes mellitus) and group B (39 patients with metabolically uncontrolled type 1diabetes mellitus). The impact of various environmental and social factors on the degree of metabolic control of type 1 diabetes was analysed.

Results: No effect of typical environmental and social factors, such as: place of residence, gender, parents' education and their professional activity, on the level of metabolic control of type 1 diabetes was found. However, groups A and B significantly differed in the level of knowledge about diabetes and its treatment, in the regularity of meals, in possessing a nutrition scale and in the self-assessed preparation for taking care and custody of a child with type 1 diabetes.

Conclusions: 1. Children with type 1 diabetes and their parents require ongoing education about the disease and its treatment. 2. The regularity of meals and the use of a nutrition scale have considerable impact on the level of metabolic control of the disease.

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Key words: *health education, metabolic control, type 1 diabetes, childhood*

Streszczenie

Wstęp: Cukrzyca typu 1 jest przewlekłą, nieuleczalną chorobą wieku dziecięcego. Przewlekle niewyrównana cukrzyca wiąże się z uszkodzeniem i zaburzeniem czynności narządu wzroku, nerek, nerwów, serca oraz naczyń krwionośnych.

Celem pracy była ocena wpływu różnych czynników społecznych i środowiskowych, ze szczególnym uwzględnieniem edukacji, na poziom wyrównania metabolicznego cukrzycy.

Materiał i metody: Badania ankietowe przeprowadzono u 102 dzieci w wieku 0–18 lat z rozpoznaniem cukrzycy typu 1. Uwzględniając stężenie HbA_{1c}, wszystkich pacjentów podzielono na grupę A (63 pacjentów z dość dobrze i średnio wyrównaną metabolicznie cukrzycą typu 1) i grupę B (39 pacjentów z niewyrównaną metabolicznie cukrzycą typu 1). Przeanalizowano wpływ rożnych czynników środowiskowych i społecznych na stopień wyrównania metabolicznego cukrzycy typu 1.

Wyniki: W przeprowadzonych badaniach nie wykazano istotnego wpływu typowych czynników środowiskowych i społecznych na poziom wyrównania metabolicznego cukrzycy typu 1, takich jak miejsce zamieszkania, płeć, wykształcenie rodziców oraz ich aktywność zawodowa. Stwierdzono natomiast istotnie znamienne różnice statystyczne pomiędzy grupą A i B w zakresie poziomu wiedzy na temat choroby, metod jej leczenia, regularności spożywania posiłków, posiadania wagi do żywności oraz samooceny w zakresie przygotowania do pielęgnacji i opieki nad dzieckiem chorym na cukrzycę typu 1.

Wnioski: 1. Dzieci z cukrzycą typu 1 i ich rodzice wymagają ciągłej edukacji na temat choroby i jego leczenia. 2. Decydujący wpływ na stopień wyrównania metabolicznego ma regularność spożywanych posiłków oraz wykorzystanie wagi do żywności podczas przygotowania posiłków. **(Endokrynol Pol 2012; 63 (1): 34–41)**

Słowa kluczowe: *edukacja zdrowotna, wyrównanie metaboliczne, cukrzyca typu 1, wiek dziecięcy*

Anna Stefanowicz, MD, PhD Student, Department of Paediatrics, Haematology, Oncology and Endocrinology, Medical University of Gdańsk, ul. Dębinki 7, 80–952 Gdańsk, Poland, e-mail: ania-stefanowicz@gumed.edu.pl

Introduction

Type 1 diabetes is a chronic, incurable childhood disease. Chronically decompensated diabetes entails damage, dysfunction and consequently failure of various organs, such as eyes, kidneys, nerves, heart and blood vessels. Impairment of the cellular glucose transport is a basis for type 1 diabetes development [1, 2].

The treatment of type 1 diabetes aims to achieve normal glycaemia levels, to provide a proper metabolic control, as well as to ensure an appropriate somatic development and psychological welfare to a child and to prevent acute and chronic complications. Early and aggressive treatment with a strict glycaemia control can be used for prevention of long-term diabetes complications [3].

The aim of this study was to assess the impact of various social and environmental factors on the degree of metabolic control in type 1 diabetes, with the particular emphasis on education, as well as to establish which of these factors determine the level of metabolic control in patients with type 1diabetes.

Material and methods

The study included 102 children, aged 0–18, diagnosed with type 1 diabetes. It was based on a survey filled in by parents and/or children and conducted among the patients of the Paediatric Diabetes Clinic of the Academic Clinical Centre in the Hospital of the Medical University of Gdansk and the patients of the Department of Paediatrics, Haematology, Oncology and Endocrinology of the Medical University of Gdansk. Altogether, 102 questionnaires were gathered between July 2007 and February 2008, out of 120 issued. The level of glycosylated haemoglobin (HbA_{1c}) constituted the criterion for diabetes control. According to the recommendations of the Polish Association of Diabetes, in children and adolescents it is advisable to maintain haemoglobin A1c level ≤ 6.5% with stable glycaemic control and minimised episodes of hypoglycaemia [4]. In accordance with the criteria cited in the literature, the range of haemoglobin A1c between 6.5% and 7.5% is considered a fairly good glucose control, while levels below 8.5% are regarded as poor metabolic control [5]. The patients were divided into two groups: group A with fairly good and moderate level of type 1 diabetes control, and group B with decompensated diabetes. The highest accepted level of glycosylated haemoglobin for compensated diabetes was 8.5%.

In designing the survey, social and environmental factors that affect the metabolic control of type 1 diabetes in children were mainly taken into account. The survey included the following information:

— child's age;
— child's gender;
— parents' age;
— place of residence;
— parents' education;
— economic status of the family;
— incidence of other chronic diseases in a child;
— frequent infections in a child;
— meal patterns;
— child's body weight and height;
— parents' body weight and height;
— the use of a nutrition scale.

Special charts developed by the Department of Children and Youth Development of the Mother and Child Institute in Warsaw were used for children's body weight assessment [6]. Adult body weight was estimated on the basis of Quetelet index (body mass index — BMI). Body mass index is defined as the body mass divided by the square of the height [BMI = mass (kg)/height $(m)^2$].

BMI for adults was used as a criterion for clinical classification of a measure of body weight set by the WHO [7].

Statistical analysis

Clinical data was collected into a database constructed in Microsoft Excel for Windows XP (Microsoft). Statistical analysis was performed using Statistica for Windows, version 7 (StatSoft, Tulsa, OK, USA). The relationships in qualititative scales were analysed by Pearson's chi-square test with Yates' correction. Initially, an attempt was made to determine the factors influencing the metabolic control of type 1 diabetes in the examined group using the analysis based on univariate logistic regression method for estimation by Rosenbrock and quasi-Newton. Then selected parameters were subjected to multivariate analysis with the same method. The test probability of $p < 0.05$ was accepted as the level of significance.

Results

Group A included 63 patients with fairly good and moderate level of type 1 diabetes control, while group B included 39 children with decompensated diabetes. The percentage of children with fairly good and moderate level of type 1 diabetes control, as well as those with decompensated diabetes, is presented in Figure 1.

It was demonstrated that in the 13–18 years age group, the numbers of children with fairly good/moderately compensated and decompensated type 1 diabetes were comparable, whereas in the 0–12 years age group, children with fairly good/moderately controlled dia-

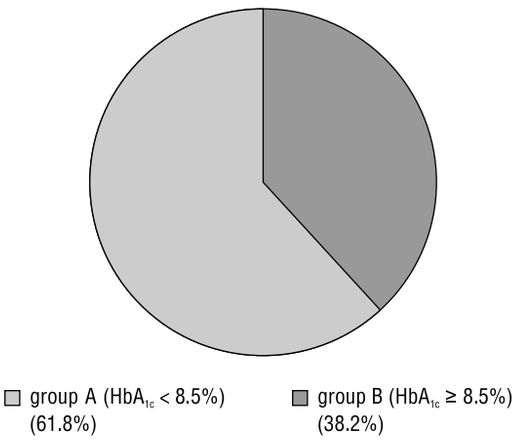

Figure 1. *The percentage of children in the examined groups*
Rycina 1. *Odsetek dzieci w badanych grupach*

betes clearly dominated, making up 88.3% and 76.2% respectively (Table I).

Table I shows a detailed comparison of the groups regarding the demographic data, children's and parents' BMI, parents' education and physical activity.

There were no statistically significant differences between the groups in terms of: the nature and the course of pregnancy, the feeding method in infancy (natural/artificial/mixed), the occurrence of frequent infections or the incidence of other chronic diseases in a child, including celiac disease, participation in school and after-school physical education classes, adopted methods of therapy in a child (pump/insulin pen), nor in the incidence of chronic complications.

A comparison of the groups, based on the questionnaire, in terms of their knowledge level is shown in Table II.

Table I. ***Factors influencing the metabolic control of type 1 diabetes — comparison of the analysed groups***
Tabela I. ***Czynniki wpływające na wyrównanie metaboliczne cukrzycy typu 1 — porównanie badanych grup dzieci***

Factor		Group B ($HbA_{1c} \geq 8.5\%$) (n = 39)	Group A ($HbA_{1c} < 8.5\%$) (n = 63)	p-value
Sex	Female	21 (53.9%)	32 (50.8%)	0.76
Child's age	0–12 years	11 (28.21%)	37 (58.73%)	0.01
	13–18 years	28 (71.79%)	26 (41.27%)	
Child's BMI	Normal weight	30 (76.9%)	51 (83.6%)	0.42
	Underweight	4 (10.3%)	7 (11.5%)	
	Overweight	3 (7.7%)	1 (1.6%)	
	Obesity	2 (5.1%)	2 (3.3%)	
Mother's BMI	normal weight	24 (63.2%)	37 (59.7%)	0.97
	Under weight	1 (2.6%)	1 (1.6%)	
	Overweight	9 (23.7%)	16 (25.8%)	
	Obesity	4 (10.5%)	8 (12.9%)	
Father's BMI	Normal weight	5 (14.3%)	22 (36.7%)	0.07
	Underweight	0	0	
	Overweight	14 (40%)	21 (35%)	
	Obesity	16 (45.7%)	17 (28.3%)	
Place of residence	Town	20 (51.3%)	38 (60.3%)	0.37
Mother's education	Primary and vocational education	15 (38.5%)	23 (36.5%)	0.2
	Secondary	21 (53.8%)	27 (42.9%)	
	High	3 (7.7%)	13 (20.6%)	
Father's education	Primary and vocational education	19 (48.7%)	27 (42.9%)	0.15
	Secondary	17 (43.6%)	22 (34.9%)	
	High	3 (7.7%)	14 (22.2%)	
Professional activity	Both parents work	18 (46.2%)	29 (46%)	0.52
	Both parents do not work	10 (25.6%)	11 (17.5%)	
	One parent works	11 (28.2%)	23 (36.5%)	

Table II. *Analysis of the answers given to the questions regarding the knowledge on type 1 diabetes (number and % of the incorrect answers) — comparison of the groups*

Tabela II. *Analiza udzielonych odpowiedzi na pytania sprawdzające wiedzę na temat cukrzycy typu 1 (liczba i % nieprawidłowych odpowiedzi) — porównanie badanych grup*

Questions checking knowledge of	Group B ($HbA_{1c} \geq 8.5\%$) (n = 39)	Group A ($HbA_{1c} < 8.5\%$) (n = 63)	All patients	p-value
Etiology factors	21 (53.9%)	20 (31.8%)	41 (40.2%)	0.02
Hypoglyceamia definition	6 (15.4%)	2 (3.2%)	8 (7.8%)	0.02
The causes of hypoglyceamia	16 (41%)	5 (7.9%)	21 (20.6%)	0.00006
The causes of hyperglyceamia	18 (46.2%)	9 (14.3%)	27 (26.5%)	0.00039
The ability to practice sport	4 (10.3%)	0%	4 (3.9%)	0.009
General rules for safe sport	18 (46.2%)	9 (14.3%)	27 (26.5%)	0.0003
Chronic complications	13 (33.3%)	7 (11.1%)	20 (19.6%)	0.006
Definition of diabetes	9 (23.1%)	9 (14.3%)	18 (17.6%)	0.25
The place of insulin synthesis	6 (15.4%)	8 (12.7%)	14 (13.7%)	0.7
The rules of type 1 diabetes diet	6 (15.4%)	4 (6.4%)	10 (9.8%)	0.13
The definition of the carbohydrate exchange	4 (10.3%)	2 (3.2%)	6 (5.9%)	0.13
The definition of fiber	28 (71.8%)	45 (71.4%)	73 (71.6%)	0.98
The number of meals and the time between meals with intense insulin treatment	11 (28.2%)	8 (12.7%)	19 (18.6%)	0.05
The places in the body where insulin can be injected at home	9 (23%)	11 (17.5%)	20 (19.6%)	0.48
The acute metabolic problems in diabetes	5 (12.8%)	2 (3.2%)	7 (6.9%)	0.06
The definition of hyperglycaemia	6 (15.4%)	4 (6.4%)	10 (9.8%)	0.13
The recommended physical activity in diabetes	2 (5.1%)	3 (4.8%)	5 (4.9%)	0.93

Statistically significant differences were demonstrated between groups A and B in the following parameters: parents' knowledge regarding aetiological factors for type 1 diabetes (p = 0.02), the definition of hypoglycaemia (p = 0.02), the causes of hypoglycaemia (p = 0.00006), the causes of hyperglycaemia (p = 0.00039), capability to do sports in controlled type 1 diabetes (p = 0.009), general principles of playing sport safely (p = 0.0003) and the chronic complications of the disease (p = 0.006).

The groups were also analysed in the context of the source of knowledge, the best way of training, and the willingness to train (Table III).

Furthermore, the examined groups differed in terms of meals regularity (p = 0.03), possessing a nutrition scale (p = 0.005) and self-assessed level of preparation for taking care of a child with type 1 diabetes (p = 0.00046) (Tables IV and V).

All of the analysed parameters were used to find the independent factors influencing the metabolic control in type 1 diabetes. Multivariate logistic regression allowed the identification of two independent factors affecting the metabolic control in type 1 diabetes, namely: regularity of meals and having a nutrition scale (Table VI).

Discussion

The involvement of patients and their families in the treatment process is of paramount importance in treating diabetes. The treatment of this disease requires, from both the patients and their carers, broad theoretical knowledge and practical skills. Nowadays, the education of patients and their families is highly valued worldwide. Such education commences once the diagnosis is made, and continues ceaselessly. Education is an essential component of the treatment of type 1 diabetes. It enhances the effectiveness of medical actions, improves quality of life and the survival rate, as well as lowers the cost of treatment [8–11].

The experience of many medical centres has demonstrated that group work conducted in teams comprising physicians, diabetologists, diabetes and educational nurses, dietitians, psychologists, other specialists (ophthalmologists, neurologists, etc.) and social workers, makes education most effective [9, 12].

The aim of our study was to assess the impact of various social and environmental factors, with a particular emphasis on education, on the degree of metabolic

Table III. *Factors affecting metabolic control in type 1 diabetes — comparison between the groups*
Tabela III. *Czynniki wpływające na wyrównanie metaboliczne cukrzycy typu 1 — porównanie badanych grup dzieci*

Factor		Group B ($HbA_{1c} \geq 8.5\%$) (n = 39)	Group A ($HbA_{1c} < 8.5\%$) (n= 63)	p-value
Source of knowledge	Nurse and doctor	24 (61.5%)	32 (50.8%)	0.49
	Mass media and friends	1 (2.6%)	1 (1.6%)	
	Together	14 (35.9%)	30 (47.6%)	
The best method of training according to parents	Individual	28 (71.8%)	44 (69.8%)	0.53
	Group	11 (28.2%)	17 (27%)	
	Both	0	2 (3.2%)	
Parents' willingness to repeat or improve knowledge of the type 1 diabetes		9 (23%)	7 (11.1%)	0.1

Table IV. *Factors affecting metabolic control in type 1 diabetes — comparison between the groups*
Tabela IV. *Czynniki wpływające na wyrównanie metaboliczne cukrzycy typu 1 — porównanie badanych grup dzieci*

Factor	Group B ($HbA_{1c} \geq 8.5\%$) (n = 39)	Group A ($HbA_{1c} < 8.5\%$) (n = 63)	Together	p-value
Irregular meals for a type 1 diabetes child	8 (20.5%)	4 (6.4%)	12 (11.8%)	0.03
No nutrition scale at home	9 (23.1%)	3 (4.8%)	12 (11.8%)	0.005

Table V. *Self-assessed preparation of the parents for taking care of a child with type 1 diabetes — comparison between the groups*
Tabela V. *Samoocena rodziców w zakresie przygotowania do pielęgnacji i opieki nad dzieckiem chorym na cukrzycę typu 1 — porównanie badanych grup dzieci*

Self-assessed preparation of the parents for taking care of a child with type 1 diabetes	Group B ($HbA_{1c} \geq 8.5\%$) (n = 39)	Group A ($HbA_{1c} < 8.5\%$) (n = 63)	Together	p-value
Low	1 (2.6%)	0%	1 (1%)	0.00046
Sufficient	19 (48.7%)	11 (17.5%)	30 (29.4%)	
High	19 (48.7%)	52 (82.5%)	71 (69.6%)	

Table VI. *The results of the multivariate analysis — independent factors influencing metabolic control of type 1 diabetes in the examined population*
Tabela VI. *Wyniki analizy wieloczynnikowej — niezależne czynniki decydujące o wyrównaniu cukrzycy typu 1 w badanej populacji*

Parameter	p-value	Odds ratio	95% confidence intervals of odds ratio
Regularity of meals	0.022	5.17	1.27–21.1
Usage of nutrition scale	0.021	6.09	1.33–27.9

control and to assess the level of parental knowledge of type 1 diabetes in children. In our study, only in the 13–18 year age group was a prevalence of uncontrolled type 1 diabetes noted. This is most proably related to the multiple factors affecting the metabolic control at this particular age: i.e. adolescence, physiologic changes in the hormonal balance, gradual loss of parental control and increased influence of peer groups.

In the population analysed in our study, most of the patients reported their sole source of knowledge was the doctor and educational nurse. Other sources, such as mass media or friends, were providing knowledge only

for a small minority of respondents. These observations are in concordance with other authors' observations.

Ławska et al., in her studies of the adult type 1 diabetes population, revealed that the vast majority of the surveyed patients obtained their knowledge about the disease from a doctor and/or a nurse; only 10.6% of respondents pointed to mass media as their source of knowledge [13].

It is well accepted that education in type 1 diabetes should be life-long. One of the few questions the respondents answered reluctantly, and not very precisely, was an open-ended question: "When did you last participate in the training and who was it conducted by?" The most frequent answer was "I do not know/I do not remember". It was usually an educational nurse who conducted these trainings. The majority of the parents reported individual training to be most effective; group trainings were regarded as effective by fewer respondents.

These results confirm the observations of Jankowiak, who demonstrated in her study that individual training was the best form of education (62%) [14].

Self-control plays an important role in the process of intensive treatment in diabetes. It enables patients to participate actively in the treatment process as well as to observe drug action, and moreover it allows them to pinpoint the moment of the risk for hypoglycaemia or hyperglycaemia. In addition, it allows for independent assessment of the impact of lifestyle, diet, physical exercise, travel, fatigue, stress, and additional diseases on the glucose concentration in the blood. Adequately conducted self-control is effective in preventing distant complications of type 1 diabetes [15–19].

The proposed scope of knowledge for patients with type 1 diabetes includes the definition of diabetes and its causes, the need for intensive insulin therapy, insulin delivery technique, insulin activity, the goals of intensive insulin therapy, assessment of diabetes control, interpretation of the test results with glucose and acetone in the urine, permissible therapeutic modifications, symptoms and treatment in hypoglycaemia, the assessment of outbreaks of infection, recommended physical activity and its effect on the level of glycaemia, dietary recommendations, and the steps to be taken in emergency situations.

Most respondents have good knowledge of the basic concepts and are able to correctly answer the following questions: what is diabetes? where is insulin synthesised? and questions regarding all types of metabolic disturbances and the factors influencing them.

Interestingly, the studies have shown that in children with uncontrolled type 1 diabetes, there were significant gaps in knowledge concerning the aetiological factors and the definition of hypoglycaemia, and (particularly worryingly), in the knowledge of the causes of hypoglycaemia, hyperglycaemia and chronic complications.

A similar study was conducted by Krawczyk, who assessed educational work among 100 patients with type 1 and 2 diabetes. He demonstrated that education was an essential component of diabetes treatment that provided certain clinical benefits in the form of proper metabolic control of diabetes [20].

Observing a proper diet is of crucial influence in type 1 diabetes metabolic control. Proper nutrition in type 1 diabetes should take into consideration the distribution of meals throughout the day. The main principle is to have six meals a day. The main meals (breakfast, lunch, and dinner) constitute 50% of these meals, while the other 50% of food is called snacks (second breakfast, afternoon tea, supper). Meals should be consumed at fixed times adjusted to the duration of the insulin activity. The intervals between the main meals should not be more than 7–8 hours and not less than 4 hours [21].

In children treated with intensive insulin therapy, the distribution of food rations between meals is more liberal. It also allows modification of insulin doses based on the amount of carbohydrates, proteins and fats in meals [22, 23].

The studies concerning the assessment of implementation of nutritional recommendations for children aged 4–13 with type 1 diabetes were conducted by Noczyńska. She showed that the nutrition of children with type 1 diabetes was improper. She found high consumption of meat products, particularly in the youngest age groups (nearly 200% of the recommended nutritional norms), high intake of cholesterol and saturated fatty acids and a low intake of carbohydrates and dietary fibre [22, 24].

Our studies showed that the analysed groups differed in meals regularity. It was demonstrated that meal regularity is an independent factor for diabetes metabolic control (OR = 5.17). A kitchen food scale is a very important device in the household of a diabetic patient. The studies proved that using a nutrition scale turned out to be an independent factor contributing to metabolic control of type 1 diabetes (OR = 6.09).

Among other questions concerning the principles of proper nutrition, the question of fibre raised many doubts. Only 28% of respondents replied to this question correctly.

A major problem affecting the degree of metabolic control of the disease is the coexistence of type 1 diabetes and celiac disease. Celiac disease occurs in about 1.3–10% of patients with type 1diabetes, and it is more prevalent than in the general population [25, 26].

The research conducted by Mysliwiec et al. demonstrated that in the Polish province of Pomerania,

celiac disease occurred in 9.4% of children diagnosed with type 1 diabetes [27]. A gluten-free diet is a chosen lifelong treatment in celiac disease. These children eat naturally gluten-free products (rice, maize, millet, potato starch and related products). The coexistence of type 1 diabetes and celiac disease is usually associated with education on the enforcement of a strict gluten-free diet. In the examined group of patients, seven children were diagnosed with celiac disease.

The frequency of celiac disease was comparable in the analysed groups. Physical activity also plays an important role in the treatment of type 1 diabetes. Physical exercise leads to increased insulin sensitivity, provides better control of body weight, improves mood and reduces the risk of cardiovascular diseases [28–32].

In the conducted survey, three questions about physical activity were included. One of them was a question as to whether a child with controlled type 1 diabetes may play sports. This question was answered incorrectly by 10% of respondents from a group of children with metabolically uncontrolled type 1 diabetes. As much as 100% of patients with fairly well and moderately compensated type 1 diabetes gave the correct answer. This disproportion in the responses may have stemmed from a misunderstanding of the question.

When asked what kind of exercise was recommended in type 1 diabetes, most respondents answered correctly, similarly in both groups. Only 54% of respondents in the group with uncontrolled type 1 diabetes were familiar with the rules of how to play sports safely, while in the group with fairly well and moderately compensated diabetes, this figure was 86%.

The question concerning the assessment of parents' preparation for taking care of child patients with type 1 diabetes was an interesting issue. In children with metabolically uncontrolled type 1 diabetes, 48.7% of respondents had high self-assessment, 48.7% — satisfactory, and 2.6% — low. In the group of children with fairly well and moderately compensated diabetes, a substantial majority had high self-assessment.

In studies in adults, Jankowiak proved that more than half of the respondents assessed their preparation for self-care as good [12].

Moreover, our study attempted to demonstrate the impact of various factors on the degree of metabolic control of type 1 diabetes. Place of residence, age of mother and father, parents' education and their professional activity, the impact of multiple pregnancy, the coexistence of additional chronic diseases, including celiac disease, breastfeeding, the incidence of frequent infections, participation in physical education classes, doing additional sport, occurrence of chronic complications in a child and the implemented method of treatment (personal diabetic pump, insulin pen) were analysed.

The analysis did not reveal any significant differences between the analysed groups in the abovementioned factors.

Recently, enormous progress has been made in the treatment of diabetes. The best way to achieve a proper metabolic control of type 1 diabetes in most patients is insulin delivery which is as close as possible to the physiological secretion. This method of insulin administration is provided by intensive insulin therapy, primarily using a personal insulin pump [32–37].

In the examined population, most children were treated using a personal insulin pump. Introducing a personal insulin pump to insulin therapy entails extending the knowledge concerning the supply of insulin (basal and prandial boluses) and the principles of nutrition and acquiring new skills in terms of how to handle the pump [38]. To our surprise, we did not find the place of residence, gender, education or professional activity of parents had an impact on the metabolic control of type 1 diabetes in children. This is probably due to an improvement in the life quality of people living in rural areas and equal opportunities for people living in towns and villages, and it proves both children and parents were provided with good education, well-adjusted to their abilities. However, Szydłowski and Łopatyński, who conducted a study in 1994 at the Municipal Health Centre in Piaski, experienced something totally different. They found that patients in rural areas were characterised by lower levels of education compared to those who came from the urban environment. This reflected the existence of large differences in the structure of education between rural and urban areas in Poland in those days [39].

The rest of the study attempted to answer the questions as to whether there were independent factors for metabolic control of type 1 diabetes in children, and if so, what they were. On the basis of multivariate analysis, it was established that the regularity of meals (OR = 5.17) and the use of a nutrition scale (OR = 6.09) were independent factors contributing to metabolic control of type 1 diabetes in the examined population. The research needs to be continued. In the era of such possibilities as monitoring blood glucose at home and the use of modern methods of delivering insulin (insulin pens and pumps), patients can and should make their own decisions about insulin therapy, diet and physical activity. To make this possible, a child and his or her parents must have a broad theoretical and practical knowledge of type 1 diabetes. Education should take into consideration not only patients but also their whole environment (family, friends, neighbours and teachers). For education to be effective and for the treatment of diabetes to be successful, a young patient should accept

the disease, know what it is about, and be aware of its complications. Patients should understand that they can lead a life similar to the life of healthy children [9].

Conclusions

1. Children with type 1 diabetes and their parents need ongoing education about the disease and treatment.
2. The regularity of meals and the use of a nutrition scale have considerable impacts on the level of metabolic control of the disease.

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