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„ASSESSMENT OF THE IMPACT OF VARIOUS FORMS OF NUTRITION EDUCATION ON THE EFFECTIVENESS OF INSULIN PUMP TREATMENT AND THE QUALITY OF LIFE IN CHILDREN AND ADOLESCENTS WITH TYPE 1 DIABETES"

Abstract

Introduction. Type 1 diabetes is one of the most common chronic diseases of the developmental age. The treatment process is complex and includes pharmacotherapy and lifestyle modification, primarily in the field of diet and physical activity. It is worth noting that developing type 1 diabetes affects all aspects of patients' functioning, including their quality of life. The necessity to provide changes in previous lifestyle constitutes a huge challenge, especially for adolescents during puberty. It should be emphasized that despite the constant development of technology and the progress in the field of pharmacotherapy, many patients still have difficulties in achieving good metabolic control. Patient education, including nutrition education, is the key to successful diabetes management. However, the condition for success is the use of an appropriate form of education that should be patient-oriented and tailored to patient's needs.

Objective. The purpose of the initial study was to assess the effectiveness of current nutrition education implemented in the Diabetology Department.

The primary objective of the main study was to verify the effectiveness of two different nutrition education methods and compare their impact on selected clinical parameters, level of nutritional knowledge and diet quality, as well as the quality of life in children and adolescents with type 1 diabetes.

Other objectives of the main study were: to analyze the dietary habits and assess the impact of patients' diet quality on insulin dosage and selected clinical parameters, as well as to assess patients' quality of life and identify its other determinants.

Material and methods. The initial study compared the nutritional knowledge of 60 patients hospitalized in the Pediatric Diabetology Department and their 60 healthy peers from selected schools in Warsaw. A modified version of the Nutrition Knowledge Survey (NKS) was used.

The main study (noninvasive, interventional, randomized, single-blind) was conducted from October 2017 to April 2019. The study involved 209 patients of the Diabetology Department at the Children's

Clinical Hospital in Warsaw. The criteria for inclusion in the study group were: diagnosis of type 1 diabetes at least a year before the start of the study, implementation of insulin pump therapy, and no concomitant chronic diseases requiring dietary modification or having a potential impact on the quality of life (e.g. celiac disease). All necessary information was collected during individual interviews with patients during their hospitalization. Clinical data, i.e. current results of anthropometric measurements, blood pressure and lipidogram values as well as glycated hemoglobin (HbA1c) concentration were supplemented on the basis of medical documentation. Three questionnaires were used in the study: a modified version of the KomPAN questionnaire to assess the dietary habits and the diet quality, a modified version of NKS to assess the level of nutritional knowledge, a validated Pediatric Quality of Life Inventory (PedsQL) - Diabetes Module 3.0 to assess the quality of life. Patients from the study group were randomly assigned to two groups: control (C) and experimental (E) differing in terms of applied nutrition education methods (stage I). In group C, education was performed using only informative methods - traditional education in the form of a lecture on the principles of proper nutrition and counting carbohydrate exchanges (CE) and protein-fat exchanges (PFE). In group E, interactive methods were additionally applied - modern education using the present authors' 'true-false' quiz which included examples of correctly or incorrectly composed meals, and the VitaScale multimedia application dedicated for counting CE and PFE. The effects of the implemented educational intervention were verified after 3 and 6 months (stage II and III) during follow-up visits at the hospital Diabetology Clinic or subsequent hospitalization.

Results. The initial study reported a significantly higher percentage of correct answers given by patients with type 1 diabetes regarding: general knowledge about the principles of proper nutrition (59% vs 45%), nutritional issues related to type 1 diabetes (51% vs 16%) and practical skills regarding the interpretation of information provided on the food product label (72% vs 34%).

Three months after the intervention applied in the main study, a significant improvement in HbA1c concentration was observed in group E (−0.47%). A significant increase in the Standard Deviation Score-Body Mass Index (SDS-BMI) was also observed in groups C and E (0.09 vs 0.16). Moreover, in both groups there was a significant decrease in Standard Deviation Score-Systolic Blood Pressure (SDS-SBP) (-0.88 vs -0.89) and Standard Deviation Score-Diastolic Blood Pressure (SDS-DBP) (-1.10 vs -0.94). However, the differences between the groups were not statistically significant.

After the next 3 months, the change in HbA1c concentration in group E was no longer significant, but improvement compared to baseline values was still observed (-0.14%). It is worth noting that in the control group no improvement in HbA1c levels was noted at any stage of the study. The previously

observed trends in the values of SDS-BMI, SDS-SBP and SDS-DBP in both groups persisted after 6 months. However, the differences between the groups were still not statistically significant.

Six months after the intervention, a significant decrease in the index of healthy diet was observed in group C (-2.98). Moreover, in both groups a significant improvement was noted in the total score obtained in the NKS questionnaire (3.00 vs 3.70), as well as in its individual subscales: 'Healthful eating' (1.78 vs 1.83), 'Blood glucose response to food' (0.41 vs 0.80), 'Carbohydrate counting' (0.43 vs 0.61). In addition, group E demonstarted a significant improvement in the 'Nutrition label reading' (0.46). However, a statistically significant difference between the groups was observed only for the subscale 'Blood glucose response to food'.

Six months after the intervention, no significant changes in the overall quality of life were noted in both groups. However, in the case of the 'Communication' subscale, a significant deterioration in the scores obtained by group C (-5.68) and a simultaneous improvement in results in group E (4.29) were observed.

Analyzing the other determinants of quality of life, it was observed that patients undertaking moderate physical activity were characterized by a significantly better improvement in scoring in the 'Diabetes symptoms' subscale compared to those with low physical activity profile (β=0.27). Moreover, patients whose at least one parent completed tertiary education achieved greater improvement in scores (on the border of statistical significance) in the 'Treatment barriers' subscale compared to those whose parents had vocational education (β=0.17).

Analyzing the initial diet quality of the entire study group, a very low score was noted in the index of healthy diet (27.6±11.1). However, it should be emphasized that the average score obtained by all patients in the index of unhealthy diet was comparable (22.4±11.1). After distinguishing two groups of patients differing in diet quality (G1 – poorer quality of diet, G2 - better quality of diet), it was observed that boys predominated in G1 (63.8%), while the vast majority of G2 were girls (66.9%). Patients from G1 were characterized by longer duration of the disease (6.5 vs 5.2 years), use of higher doses of insulin (0.86 vs 0.76 U/kg BW/d) and about twice as frequent occurrence of overweight (31.0% vs 17.6%) and underweight (19.0% vs 8.8%) compared to G2.

Analyzing the initial quality of life of the entire study group, a relatively low score was noted in the PedsQL questionnaire (66.1±13.69). After dividing the group by gender, it was observed that boys obtained a significantly higher total score compared to girls (70.8±11.91 vs 62.4±13.91). In addition, boys also achieved significantly better results than girls in almost all subscales of the questionnaire: 'Diabetes symptoms' (65.8±12.85 vs 59.1±14.12), 'Treatment barriers' (72.0±19.76 vs 57.5±20.44), 'Treatment adherence' (78.9±16.23 vs 68.6±20.06) and 'Communication' (78.3±21.44 vs 67.6±24.89).

In terms of other determinants of quality of life, significantly lower quality of life was observed in patients with HbA1c ≥7.5% compared to those with good metabolic control (64.2 vs 68.6). There was also a significantly lower quality of life in patients whose Waist to Height Ratio (WHtR) value exceeded the norm compared to those with its normal values (60.5 vs 66.5). Furthermore, a significantly lower quality of life was noted in patients who experienced hyperglycemia episodes daily or several times a week compared to those who did not have such episodes or only several times a month (65.1 vs 70.4).

Finally, analyzing the relationship between gender and variables that significantly affected patients' quality of life, it was observed that boys were characterized by better quality of life than girls regardless of the quality of metabolic control, correct distribution of body fat and the frequency of experiencing hyperglycemia episodes.

Conclusions. The results obtained in the initial study show a higher, however unsatisfactory level of nutritional knowledge in patients with type 1 diabetes compared to their healthy peers. This indicates the need to intensify the education process, especially in the field of practical issues.

The results obtained in the main study indicate a comparable impact of both studied nutrition education methods on the occurrence of overweight and obesity, hypertension and the level of nutritional knowledge and diet quality, as well as the overall quality of life in children and adolescents with type 1 diabetes. However, using only informative methods is less effective in improving HbA1c concentration and quality of life in terms of communication. The additional use of interactive methods seems more beneficial. Moreover, in order to maintain long-term effects, it seems necessary to intensify the frequency of patient training. However, it is necessary to conduct further studies and extend the observation time.

The results obtained also show unsatisfactory dietary habits and quality of life in children and adolescents with type 1 diabetes. Factors that may have an unfavorable impact on the quality of patients' diet include: male gender and longer duration of the disease. In addition, poorer quality of diet is associated with the use of higher doses of insulin and more frequent occurrence of overweight. Negative determinants of patients' quality of life include: higher HbA1c concentration, WHtR value above normal, and frequent occurrence of hyperglycemia episodes. In addition, female gender constitutes an independent factor which deteriorates quality of life. On the other hand, moderate physical activity and higher education of parents have a positive impact on other aspects of patients' quality of life regarding the perception of disease-related symptoms and barriers associated with the treatment.