Assessment of Skills and Knowledge About the Disease Among Teenagers With Type 1 Diabetes Mellitus

Virginija Bulikaitė
Department of Nursing and Care, Medical Academy, Lithuanian University of Health Sciences, Lithuania

Key Words: *type 1 diabetes mellitus; teenagers; knowledge; skills.*

Summary. *The aim of this study was to compare skills and knowledge of teenagers with type 1 diabetes mellitus about the disease at 3, 6, and 12 months after diagnosis.*

Material and Methods. The study was carried out at the diabetes school of the Unit of Children Endocrinology, Clinic of Endocrinology, Hospital of the Lithuanian University of Health Sciences. The study population comprised 90 teenagers with type 1 diabetes mellitus aged 13 to 17 years. They had an initial training course consisting of 5 sessions. After the training course, a questionnaire to evaluate teenagers' knowledge was used. Each question in the questionnaire was considered separately by giving 1 point for a correct answer and no points for an incorrect answer. After 3, 6, and 12 months, the survey was repeated, and practical skills were tested.

Results. After the 5-day training course, the knowledge about the self-control of diabetes was rated by a score of 10. After 3 months, the level of knowledge remained the same, while after 6 and 12 months, the level of knowledge was rated by score of 9 and 8, respectively. There was a significant decrease in the percentage of teenagers who regularly filled out a diary: after 3, 6, and 12 months, 81.8%, 60.9%, and 34% of the patients regularly filled out a diary ($P<0.05$). The percentage of the patients who calculated the amount of carbohydrates consumed significantly decreased as well: there were 88.6%, 54.2%, and 50% of the respondents were able to calculate the right amount of carbohydrates after 3, 6, and 12 months, respectively ($P<0.05$). An examination of injection sites showed no skin changes among the respondents after 3 months. After 6 and 12 months, there were skin changes at injection sites in 6% and 31.1% of the respondents, respectively. The percentage of the teenagers involved in the prevention of hypoglycemia significantly decreased. After 3, 6, and 12 months, 86%, 64%, and 43.3% of the respondents carried a supply of carbohydrates with themselves ($P<0.05$).

Conclusions. Three months after the training course, the level of knowledge about diabetes mellitus among patients was estimated to be excellent and very good, while after 6 and 12 months, it was considered to be good or average. Three months after the training course, the teenagers demonstrated the best skills. Most of the respondents regularly filled out the self-control diary, calculated the right amount of carbohydrates, and had glucose tablets to prevent hypoglycemia.

Introduction

Nearly 200 children a day develop diabetes mellitus worldwide, and the number of children and teenagers diagnosed with diabetes mellitus is growing by 3% per year (1). Education of patients diagnosed with diabetes mellitus started together with the discovery of insulin; however, the techniques of patients' education were not described and there was no training for doctors and nursing staff. At the end of the 20th century, more attention was given to patients' education, and educational programs were developed. Children and teenagers with diabetes mellitus as well as their family members have to be constantly reminded of disease control principles, their skills and knowledge have to be tested, their mistakes have to be identified, and they should be encouraged to avoid them (2–4). Education is divided in 2 stages, namely, initial and continued. It is recommended to start the initial education immediately after the diagnosis is confirmed. Continuing education lasts throughout the patient's life as new glycemic control devices are invented, insulin treatment schemes are changed, and insulin delivery devices are improved. Patients have to be educated and acquainted with innovations, and encouraged to apply them in disease control in order to avoid or postpone the complications of diabetes (5–7). In Lithuania, children and teenagers with diabetes have been educated since 1990. An educational program for children and teenagers with diabetes was adopted in 2003. In October 2008, an inventory of requirements for the provision of nursing services

Correspondence to V. Bulikaitė, Department of Nursing and Care, Medical Academy, Lithuanian University of Health Sciences, Eivenių 2, 50161 Kaunas, Lithuania
E-mail: bulikaitevirginija@yahoo.com

Adresas susirašinėti: V. Bulikaitė, Lietuvos sveikatos mokslų universiteto Medicinos akademijos Slaugos ir rūpybos katedra, Eivenių 2, 50161 Kaunas, Lietuva
El. paštas: bulikaitevirginija@yahoo.com

was approved by the order of the Lithuanian Minister of Health No. V-982, which reports that a nursing diabetologist has to teach patients with diabetes mellitus how to take care of themselves as well as to monitor their feet (8). The function of a nursing diabetologist is not only to provide information and examine patient's knowledge and practical skills, but also to find out what are educational difficulties, to assess patient's attitudes toward health, and to motivate a patient. In many European countries, a psychologist and a social worker participate in the treatment and educational process of a patient with diabetes mellitus; through assistance in solving psychological and social problems, they may motivate patients to take care of their health.

Adolescence is a difficult period. When a teenager is more occupied, diet becomes irregular, there are changes in the need of insulin, and various psychological and social problems arise. It is very important for a teenager not to be different from others. The influence and authority of parents is decreasing; therefore, it becomes more difficult to manage the blood glucose level (9). The transfer of knowledge to a patient not necessarily affects his or her behavior. Theoretical knowledge about the principles of healthy nutrition, importance of glycemic self-control, rules of insulin delivery and dosage is not always applied in practice by a patient with diabetes mellitus. In order not to be different from their healthy peers, teenagers may disobey the rules even if they have the required knowledge. The aim of this study was to compare skills and knowledge of teenagers with type 1 diabetes mellitus about the disease at 3, 6, and 12 months after diagnosis.

Material and Methods

The study was carried out from 2005 to 2008. The study population comprised 90 teenagers with type 1 diabetes mellitus, who were hospitalized to the Unit of Children Endocrinology, Clinic of Endocrinology, Hospital of the Lithuanian University of Health Sciences. They had an initial training course consisting of 5 sessions. With the help of various training techniques, the patients were informed about self-control, nutrition, insulin therapy, and acute and late complications caused by diabetes. During the training course, incorrect answers given by patients were analyzed and discussed. After the training course, a questionnaire to evaluate the knowledge was used. After 3, 6, and 12 months, the survey was repeated, and the practical skills were tested.

A questionnaire "Questions on Diabetes Mellitus" was selected for the study from the training program for persons with diabetes mellitus adopted by the Clinic of Endocrinology. This questionnaire is composed of 40 questions divided into 4 categories. Ten questions are devoted to such areas as general knowledge of diabetes mellitus, nutrition/diet, insulin therapy, and acute and late complications. Each survey question was provided with 4 different answers, with 1 answer being the correct one. The questionnaire was tested and adapted to assess the knowledge of patients in our country. In order to assess the level of knowledge, each question was considered separately by giving 1 point for a correct answer and no points for an incorrect answer. Knowledge was rated as follows: if patients gave a score of 10, knowledge was considered excellent; if a score of 9, very good; 8, good; 7, average; 6, satisfactory; 5, poor; and 4, unsatisfactory. Researchers recorded the data reflecting the patient's practical skills. It was recorded if a teenager filled out the self-control diary, could calculate the right amount of carbohydrates, made insulin injections correctly, and had glucose tablets or other sources of carbohydrates to prevent hypoglycemia.

Statistical Analysis. The SPSS 17 program was used in the data analysis. The aggregated average score was compared in the process of knowledge assessment. The Wilcoxon's related samples test was employed for the purposes of establishing differences between dependent samples. Differences in data were considered statistically significant when $P<0.05$.

Ethical Considerations. The ethical permission (No. BE-2-39; 2005) was granted by the Kaunas Regional Ethics Committee for Biomedical Research.

Results

General Knowledge About Diabetes Mellitus and Self-Control

During the training course, the patients were informed about causes, symptoms, treatment, and self-care features related to type 1 and 2 diabetes mellitus. The patients were instructed how to check their blood glucose level at the right time, to assess the results, and to fill out the self-control diary. There were 10 questions related to the self-control of diabetes. After the 5-day course, the knowledge of respondents about the self-control of diabetes mellitus was evaluated by a score of 10. When the survey was repeated after 3 months, the level of knowledge remained the same. After 6 and 12 months, the level of knowledge was rated by scores of 9 and 8, respectively.

Knowledge About Nutrition

Our purpose was to find out what teenagers know about nutrition. There are various widespread myths in society such as patients of diabetes should not eat sweets that special "diabetic" products have to be chosen. There were 10 questions related to eating habits, the importance of sweets, vegetables, fats, and carbohydrates to health, and their influ-

ence on the levels of blood glucose. Immediately after the training course, the knowledge of the respondents about nutrition was evaluated by a score of 10. When the survey was repeated after 3 months, the level of knowledge remained the same. After 6 and 12 months, it was rated by a score of 8.

Knowledge About Insulin Therapy

The respondents had to answer 10 questions in order to rate their knowledge about insulin. Before insulin injections are indicated, a physician or a nurse explains the effects of this product and the necessity to take it to patients' parents and patients. After the 5-day training course, knowledge about insulin therapy was rated by a score of 10. When the survey was repeated after 3 months, the level of knowledge was rated by a score of 9, while after 6 and 12 months, a score of 8 was given.

Knowledge About Acute and Late Complications Caused by Diabetes Mellitus

Once the insulin therapy has been started and if recommendations are not followed, the blood glucose level may increase or decrease too much. Patients are taught to recognize the symptoms of hypoglycemia and hyperglycemia, to understand their cause, to learn how to avoid them, and what to do once they start. Not learning how to manage the blood glucose level may lead to the development of late complications after a few years. The teenagers had to answer 10 questions about hyperglycemia and hypoglycemia as well as late complications. After the 5-day course, knowledge about complications was rated by a score of 9. When the teenagers were asked how they evaluated their knowledge about diabetes, 76.6% of the respondents considered their knowledge to be excellent; 11.1%, good; 5.5%, satisfactory; and 6.6%, poor.

When the survey was repeated 3 months later, the level of knowledge decreased and was estimated by a score of 8. After 6 months, the level of knowledge remained similar, while after 12 months, it improved and was rated by a score of 9.

Study of Self-Control Skills

Self-Control Skills. It is recommended for patients with diabetes mellitus to fill out the self-control diary every day. It is necessary to record the levels of blood glucose, doses of insulin, and amount of carbohydrates that were consumed. During consultations with doctors or nurses, any recommendations may be provided only after the analysis of these data. The study showed that there was a significant decrease in the number of teenagers who regularly filled out a diary compared with the initial state just after diagnosis ($P<0.05$). Three months after the training course, 81.8% of the patients regularly filled out a diary, 6.8% filled it out irregularly, and 11.3% did not fill it out at all. When the survey was repeated after 6 months, it was found that 60.9% of the patients continued to fill out a diary regularly, while after 12 months, only 34% of the patients did it on a daily basis, 54.4% filled out in irregularly, and 11.6% did not fill it out at all.

Nutrition Skills. The study showed that the number of patients who calculated the amount of carbohydrates consumed significantly decreased. Three months after the training course, when an assignment to calculate the amount of carbohydrates in the breakfast meals was given, 88.6% of the respondents were able to do it correctly. The remaining 12.3% made mistakes during calculation or admitted that they did not remember how to do it. When the survey was repeated after 6 months, 54.2% of the respondents correctly calculated the amount of carbohydrates, while after 12 months, this percentage decreased to 50%. As the duration of disease gets longer, the number of teenagers who diligently continued to calculate the amount of carbohydrates in the meals decreased ($P<0.05$).

Skills Related to Insulin Therapy. The regular replacement of insulin injection needles and injection sites makes skin changes less likely. An examination of injection sites showed no skin changes among the respondents. After 6 months, there were skin changes at injection sites in 6% of the respondents, and after 12 months, this percentage increased to 31.1%. Most frequently patients reported that when they were in a hurry they did not change the place for an injection.

Acute Complications Caused by Diabetes Mellitus. In case of a hypoglycemic attack, an identification sign (a card or a chain) indicating a patient with diabetes mellitus might help people provide assistance. During the training course, a nurse explains the importance of an identification sign to patients with diabetes mellitus and provides with a card that is recommended to have. Patients may order and acquire a chain or a bracelet. Three months after the training course, only 19.5% of the teenagers had such a sign. After 6 months, 54% of the respondents had an identification sign (most frequently it was a card), while after 12 months, this percentage decreased to 42% ($P<0.05$). There was a significant decrease in the number of patients involved in the prevention of hypoglycemia. Having checked whether the respondents had glucose tablets or other sources of carbohydrates with them in order to prevent hypoglycemia, it was found that 86% of the respondents carried glucose tablets or other sources of carbohydrates. After 6 and 12 months, only 64% and 43.3% of the respondents, respectively, had glucose tablets or other sources of carbohydrates with them ($P<0.05$). Changes in these skills are shown in Fig.

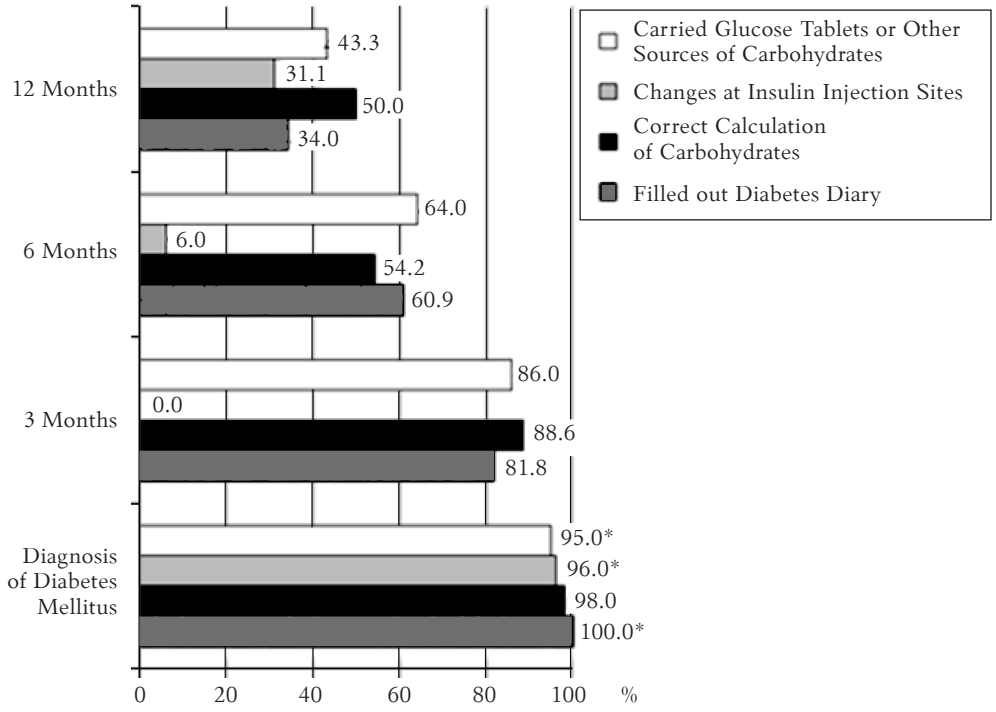

Fig. Skills and knowledge about the disease among teenagers with type 1 diabetes mellitus at 3, 6, and 12 months after diagnosis

*$P<0.05$ as compared with 3, 6, and 12 months after the diagnosis of diabetes mellitus.

Independent Search for Information

It was interesting to find out whether the teenagers with type 1 diabetes mellitus independently searched for information about the disease 12 months after diagnosis. Less than half (40%) of the respondents searched for addition information. Only 17.7% of the teenagers read the recommended literature, and 15.5% of the respondents searched for information about diabetes on the Internet. In case of questions related to diabetes care, 83.3% of the respondents or their parents consulted with a physician or a nurse by phone. More than half (58.8%) of the patients became members of the Diabetes Society and shared information among themselves, while 40% of the teenagers studied and rested at diabetes camps.

Discussion

Surveys involving people with diabetes mellitus are carried out in order to assess not only their theoretical knowledge, but also practical skills. Self-control includes patient's efforts to maintain the blood glucose level as close as possible to that of a healthy individual. It is insufficient to learn how to measure the blood glucose level, and it is necessary to be able to interpret the results and make decisions. Teenagers have to be encouraged to be more independent in the control of the disease although parents should remain responsible. It is recommended that a patient should regularly measure and record the blood glucose level, doses of insulin, amount of carbohydrates consumed, and causes of hypoglycemia into a diary. Having analyzed the survey questions that were answered incorrectly by patients, it was observed that the types of diabetes mellitus are most frequently confused. Information that patients do not apply on a daily basis is forgotten as time passes (10). As the duration of the disease gets longer, the number of teenagers who followed recommendations decreased. It was important to establish whether teenagers knew how to calculate the amount of carbohydrates in food.

Nutrition recommendations have to be adjusted to patient's abilities and habits, while inappropriate habits have to be changed gradually. It is essential that a patient starts to link the amount of carbohydrates consumed and the blood glucose level. During the training course, a patient has to learn and get used to reading information provided in product labels and to calculate the amount of carbohydrates in a packaged product. Most frequently patients were mistaken in answering the questions about sweeteners. They could not remember those sweeteners that did not increase the blood glucose level because they rarely read and analyzed product labels and were interested in the composition of food products. It is important that patients would regularly apply theoretical knowledge in everyday

life (11). During the first months of the disease (the period of remission), when the blood glucose level is within the reference range, patients may stop calculating the amount of carbohydrates by mistakenly thinking that they will keep good results without doing any calculations.

There is a widespread myth among patients that once insulin injections have been started, a person will become dependent. Most frequently patients forgot how long the insulin dose would last. It is important to draw attention to the significance of the continued education about treatment with insulin.

Most frequently patients were mistaken in answering the questions about the actions to be taken in case of fever, vomiting, or diarrhea. This may be explained by the fact that respondents did not encounter such situations before. Information about acute and late complications should constantly be repeated during the continued training course.

During the training process, a patient should understand the cause of hypoglycemia, be able to recognize its symptoms, and help himself/herself. The study showed that teenagers did not want to stand out among others by wearing a chain or a bracelet. If mild hypoglycemia is not managed by means of glucose, this condition may progress to severe hypoglycemia. Family members and relatives should become acquainted with the symptoms and treatment of severe hypoglycemia in case when the patient lost consciousness and may not be able to help himself or herself (12).

Some of the patients mistakenly thought that if there were no hypoglycemia symptoms for a long time, there was no need to carry carbohydrates. If cases of mild hypoglycemia are frequent, during the training course, it is necessary to establish its causes and to teach how to adjust the doses of insulin depending on diet and increase in physical activity. If a patient has severe hypoglycemia and especially if this happens not for the first time, it is important to discuss reasons and ways to avoid it in the future with a patient and his/her family members. During each visit to a diabetologist, it is crucial to inquire whether a patient has glucose tablets or other sources of carbohydrates. If a patient has no glucose tablets or other sources of carbohydrates, the importance of carrying them should be reminded (13).

Having analyzed skills and knowledge about the disease among teenagers with diabetes mellitus, scientists in different countries unanimously agree on the necessity of patients' continued education. According to the data of various studies, the level of patients' knowledge was different. It was noted that some researchers evaluated the level of knowledge among those with diabetes mellitus as better 3 months after, while others, 6 months after the training. There is no doubt that patients should be systematically reminded of information and new knowledge should be provided (14).

The study revealed that patients were less interested in written information, and they tended to receive recommendations during conversations and through communication with their peers who experienced the same.

Conclusions

Three months after the training course, the level of knowledge about diabetes mellitus among patients was estimated to be excellent and very good, while after 6 and 12 months, it was considered to be good or average.

The best skills of self-control were demonstrated by teenagers 3 months after the training course. During this period, most of the respondents regularly filled out the self-control diary, calculated the right amount of carbohydrates, and had glucose tablets or other sources of carbohydrates to prevent hypoglycemia.

Statement of Conflict of Interest

The author state no conflict of interest.

Paauglių, sergančių 1 tipo cukriniu diabetu, įgūdžių ir žinių apie ligą įvertinimas

Virginija Bulikaitė

Lietuvos sveikatos mokslų universiteto Medicinos akademijos Slaugos ir rūpybos katedra

Raktažodžiai: *1 tipo cukrinis diabetas, paaugliai, žinios, įgūdžiai.*

Santrauka. *Tyrimo tikslas – palyginti 1 tipo cukriniu diabetu sergančių paauglių įgūdžius ir žinias apie ligą po diagnozės nustatymo praėjus 3, 6 ir 12 mėn.*

Tiriamųjų kontingentas ir tyrimo metodai. Tyrimas atliktas Lietuvos sveikatos mokslų universiteto (LSMU) ligoninės Kauno klinikų Vaikų endokrinologijos skyriaus Diabeto mokyklėlėje. Anketinėje apklausoje dalyvavo 90 1 tipo cukriniu diabetu sergančių paauglių nuo 13 iki 17 metų. Jie lankė keturių užsiėmimų mokymo programą.

Po mokymo paaugliams pateikta žinių vertinimo anketa, kurios kiekvienas klausimas buvo vertinamas 1 balu (teisingas atsakymas) arba 0 balo (klaidingas atsakymas). Žinios ir praktiniai įgūdžiai buvo vertinami praėjus 3, 6 ir 12 mėn. po mokymo. Skirtumams tarp priklausomų imčių nustatyti taikytas Wilcoxono porinių imčių testas.

Rezultatai. Įvertinus 1 tipo cukriniu diabetu sergančių paauglių žinias apie cukrinį diabetą, paaiškėjo, kad po penkių dienų trukmės mokymo ciklo žinių apie cukrinio diabeto savikontrolę vidurkis buvo 10 balų. Apklausą pakartojus po 3 mėn., žinios išliko panašios, t.y. vidurkis 10 balų. Po 6 mėn. žinios įvertintos 9 balais, o po 12 mėn. – 8 balais. Patikrinus tiriamųjų įgūdžius, paaiškėjo, kad reikšmingai sumažėjo paauglių, reguliariai pildančių dienyną. Praėjus 3 mėn. po pirminio pacientų mokymo, 81,8 proc. ($p<0,05$) pacientų dienyną pildė reguliariai. Apklausą pakartojus po 6 mėn., paaiškėjo, kad 60,9 proc. pacientų vis dar reguliariai pildė dienyną, o po 12 mėn. – tik 34 proc. tą darė kasdien. Tyrimo metu paaiškėjo, kad reikšmingai sumažėjo skaičiuojančiųjų angliavandenių kiekį. Praėjus 3 mėn. po mokymo, teisingai angliavandenių kiekį apskaičiavo 88,6 proc. tiriamųjų ($p<0,05$). Tyrimą pakartojus po 6 mėn., angliavandenius teisingai apskaičiavo 54,2 proc. tiriamųjų, po 12 mėn. – 50 proc. paauglių. Po 3 mėn. apžiūrėjus insulino injekcijų vietas, poodžio pokyčių nerasta nė vienam tiriamajam. Po 6 mėn. apžiūrėjus insulino injekcijų vietas, poodžio pokyčių pastebėta 6 proc. tiriamųjų, po 12 mėn. – 31,1 proc. pacientų. Reikšmingai sumažėjo ir hipoglikemijos profilaktika besirūpinančių paauglių. Patikrinus, ar tiriamieji hipoglikemijos profilaktikos tikslais nešiojasi gliukozės, po 3 mėn. paaiškėjo, kad 86 proc. ($p<0,05$) turėjo pasiėmę angliavandenių atsargų. Po 6 mėn. pakartojus apklausą, pastebėta, kad tik 64 proc. tiriamųjų turėjo pasiėmę gliukozės, o po 12 mėn. jau mažiau nei pusė tiriamųjų (43,3 proc.) rūpinosi hipoglikemijos profilaktika.

Išvados. Praėjus 3 mėn. po mokymo, paauglių žinios apie cukrinį diabetą buvo įvertintos „puikiai“ bei „labai gerai“, o po 6 ir 12 mėn. – „gerai“ ir „vidutiniškai“. Praėjus 3 mėn. po mokymo, paaugliai pademonstravo geresnius įgūdžius. Daugiausia tiriamųjų reguliariai pildė savikontrolės dienyną, teisingai apskaičiavo angliavandenių kiekį maiste ir turėjo gliukozės tablečių hipoglikemijos profilaktikai.

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