The Revised Term of Compliance in Type 1 Diabetes Treatment of Children and Adolescents – A Mini Review and Evidence for Need of Psycho-Medical Training Workshops

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Abstract

Type 1 diabetes is an unusual disease to treat because of the significant role of patient in his or her own therapy. Children and adolescents, who depend on parental and/or familial support, are in an especially difficult situation: their age and rapidly changing somatic and psychological development introduces great complexity into their ability to self-manage their diabetes in an aware and responsible manner. Management of type 1 diabetes is also extremely difficult for a child’s family support team. Even the most experienced medical teams of pediatricians, nurses, dieticians and psychologists can experience difficulties in effective communication and cooperation when it comes to young patients and their families. This cooperation, commonly understood to be ‘compliance’, refers to the patient’s obedience or willingness to adhere to the doctor’s recommendations. All members of the patient’s treatment team should understand one another, trust in the accuracy of the patient’s ability to self-report, and maintain a high level of motivation – and encourage the patient to stay motivated in continuing his or her treatment plan. The present article includes both a mini-review and the authors’ observations of the complex genesis of compliance in type 1 diabetes treatment in young patients. The gathered data strongly suggest the need for revision and extension of term ‘compliance’ to include all members of the medical team and the patient’s personal support network. For young type 1 diabetes patients, his or her family members, as well as the patient’s doctors and educational nurses, the psychologist is often the most important member of the treating medical team. The authors of the present article therefore propose combined psycho-medical-group workshops for strengthening compliance to improve the patients’ motivation for success, as well as better communication and education. The authors also recommend doctors, nurses and dieticians interact with the patient’s psychologist in order to understand individual patient needs. The presented findings, following a pilot psycho-medical-workshops for diabetic youth and their parents confirm the potential of idea of ‘group compliance’ (instead patient’s individual compliance) in diabetic treatment in young patients.

Keywords: Children; Diabetes type 1; Psycho-medical; Compliance

Introduction

In order to achieve metabolic balance and control, the treatment of type 1 diabetes (diabetes mellitus 1, DM1) in children and adolescents should be developed and administered in parallel with any treatments for social, emotional and behavioral problems. Methods that improve the patients’ ability to manage their disease results in better control of the diabetes, and thus minimized risk of complications and permanent disability. Further investigation of factors influencing the motivation and consequent realization of self-management in diabetic children and adolescents is highly important. Our experience and review of the literature has led us to conclude that the description of ‘partners’, specifically those concerned for or directly involved in the health of a child suffering from DM1, needs clarification. Although the role of the patient and doctor are clearly defined in this partnership, a young patient is usually also supported by parents and/or caregivers, family members, friends, and teachers [1,2]. In addition to coordinated family support, the doctor managing the child’s diabetes treatment should also coordinate and cooperate with other specialized medical team members, including the educational nurse, dietician and psychologist. Thus, the ‘partners’ included in the treatment of a young patient with DM1 should include all of those involved in the therapeutic process, who are able to realize the therapeutic goal through cooperative compliance.

The objective of this article is to present the current state of complex therapeutic educational training for diabetic adolescents and their parents, based on current literature, and also to present the conclusions from the pilot workshops we conducted. The complex workshops we present aimed to reduce difficulties related to diabetes control and risky behaviors. To achieve this outcome, the focus of the workshops was on changing the feelings, thoughts, attitudes and actions of families and adolescents with diabetes to improve (a) the relationship between children and their parents, (b) competence for providing support, (c) acceptance and encouragement to overcome difficulties, and (d) coping mechanisms.

Emotional difficulties in diabetes

Diabetes itself is a risk factor for diverse psychiatric disorders in children [1]. In a 10-year study by Kovacs et al. [3], almost 50% of DM1 children developed psychiatric disorder, with major depressive disorder...
being the most common [2]. Other studies report that comorbid psychiatric disorders lead to a lack of good glycemic control, poor quality of life and, as a consequence, to further metabolic disorders and complications [2-5]. Barnard et al. report a high prevalence of psychosocial morbidity, clinically elevated depression, and anxiety, which was also associated with poor self-care, suboptimal glycemic control and recurrent diabetic ketoacidosis in 15-25% of adolescents with DM1 [6]. Mood disorders are of particular importance due to the increased intensity of the symptoms of depression in DM1 children and adolescents. Stewart et al. have shown that in young people with DM1, a significant number of depressive symptoms predicts increased risk of hospitalization due to diabetic complications [7]. Gask et al. concluded in their meta-synthesis that in diabetes, depression and other psychological disorders are significant barriers to effective coping with the disease [8,9]. In addition, another study demonstrated the positive link between the duration of diabetes and stress intensity [10].

The identification of patients with mood disorders should be regarded as an important aspect of pediatric diabetes care. The 2005 American Diabetes Association guidelines for DM1 children and adolescents recommends routine screening for psychiatric disorders among children who do not achieve therapeutic goals or are experiencing repeated ketoacidosis [11]. In 2014, the American Diabetes Association updated their recommendations to include routine depression screening during quarterly follow-ups for every pediatric patient with DM1 [12]. The diabetes care team, who typically assess the patient several times a year and have access to medical records and information from family, should observe changes in behavior and recognize the symptoms of psychiatric disorders [13]. However, the diagnosis of depressive symptoms is not easy, and requires specific competence, attention, and individual assessment. Some symptoms of depressive disorders are similar to the natural mood changes associated with the adolescent period, as is uncontrolled glycaemia.

There are a number of problems, in addition to psychiatric disorders, that support the argument for psychological intervention in DM1 adolescents. The adolescent period is associated with an increased number of so-called problematic or risky behaviors: rebelliousness, relationships with dysfunctional peers, early initiation of dysfunctional behavior, negative relationships with adults, impulsivity, low self-esteem and lack of self-confidence, rejecting the generally applicable values, school failure, inadequate expression of anger, and aggression. When the disease affects children and emotional difficulties impact its course, it can lead to difficulties in regulating emotions in the whole family, for example by increasing the conflicts in the case of high blood glucose. That it return generates stress in a child and can cause psychosomatic disorders [14,15].

**Diabetes and adolescence**

Developmental theories suggest therapeutic education programs in DM1 have greater efficacy if: (a) they are related to the operation of the entire family system, and (b), they reflect the importance of the peer group in motivating and reinforcing healthy behaviors [14]. As the child grows older, the time he or she spends with his or her parents is typically reduced, and this occurs concurrently with increasing emotional and behavioral autonomy. It is a difficult experience, especially for families with a teenager with uncontrolled glycaemia, as this requires monitoring and correcting. Reconciling a teenager's growing need for autonomy with support in the control of diabetes is difficult [15], so help from specialists can be very important. Growing up as a child with a chronic disease can result in a number of changes in the experience and perception of one's own illness. Self-identity development when confronted with a diagnosis of an incurable disease itself can be distorted. It also requires constant revision of the parents' expectations and behaviors [16]. During adolescence, an early diagnosis of DM1 may result in feelings of great injustice or of being different to his or her peers. In addition, it is a time when the adolescent may discover that the disease can influence future choices of profession, parenthood etc. Adolescence is also the period when the risk of eating disorders increases – this can cause additional problems with maintaining a correct diabetic diet, and may result in risky insulin manipulations. This is precisely the moment when additional therapeutic and educational care is needed.

In an effort to prevent potential complications before they arise, establishing a good relationship with the managing doctor and the therapeutic and educational support team is vital. Follow-ups should be conducted at several critical periods in their lives: e.g., the beginning of attendance to preschool infancy and after that next step into the school life, the period of accelerated growth and beginning of puberty, an advanced adolescence with overestimation of own independence in parallel to psychological weakness. Pediatric diabetologist should imply the knowledge about developmental prognostic factors associated with the experience of the child's chronic illness into a therapeutic procedure. The parenting style to which the DM1 child is exposed is also key to effective diabetes self-management; specifically, an attitude that is supportive of youth autonomy has been shown to help to control diabetes [17]. On the other hand, overprotective and apprehensive parenting has been shown to result in the child displaying learned helplessness, anxiety and demanding behavior in relation to others, including medical staff [17,18]. This may in turn result in a lack of motivation to take responsibility for the disease, as well as problems coping with the disease and increased risk of psychosomatic complications [17,18]. Henggeler et al. [19] have previously demonstrated the importance of a multisystem environment (family, peer group) in youth therapy; thus, the inclusion of family and peers in the process of therapy and education may be an effective strategy. Similarly, it is important to help parents of teenagers with DM1 in understanding the mechanisms of development of the disease, in order not to impose increase pressure on normal parent–child conflict. It is the time to educate parents and youth in predicting problems and dealing with them from multiple perspectives. Successful and effective treatment of diabetes requires constant supervision and attention, and at the same time should be flexible and open to modification. It requires the acceptance and cooperation of the DM1 child, such that the therapy is personalized and implemented parallel to the child's needs and psycho-mental capacity at each stage of development.

**Psychological difficulties in diabetes: Identification and prevention of risks**

DM1 is a condition requiring self-management; as such, DM1 children and adolescents have to learn to use the selfExperience of the disease in the management and treatment of their disease. To be able to get involved in the process, they must accept the presence of diabetes in their lives and believe that it can be effectively controlled. This control will protect their present health, and will allow them to live like their healthy peers in the future [20]. Psychological difficulties associated with DM1 depend mainly on the age of children and adolescents, on their life experience, and individual psychological features. When young patients do not manage their psychological well-being, or their parent/carer is unable to recognize when help is needed, problems with diabetes management arise [21]. The most commonly observed social, emotional and behavioral problems observed by
parents of young diabetic patients are oppositional behavior, anxiety, depression, social withdrawal and cheating about glycaemia control and insulin administration. Some of these symptoms are also normal developmental behaviors, so when exactly to commence therapeutic intervention is called into question – it is not an easy decision for both parents and doctors. According to our pilot study (results detailed below), the implementation of education and therapeutic workshops into the DM1 treatment plan could make this decision easier by helping to separate those behaviours that are development and those that are psychological difficulties associated with the disease.

**Family support for the diabetic child**

The next important issue is the targeting of the therapy. The environment of the child and the child’s relationships with parents, friends, siblings, teachers, as well as with his or her school are important factors influencing his or her disease coping style. The dependence of children on adults makes them particularly vulnerable to influences over which they have little control. Unfavorable conditions (high levels of stress, conflict between parents, bad socioeconomic conditions, etc.) may affect the therapeutic process, the scope for improvement, as well as the time for which beneficial changes persist [22,23]. The family environment is one that may cause and maintain adverse psychological symptoms or may offer a safe environment to carry out therapeutic change. A major challenge in DM1 treatment is maintaining the motivation of the child and parents to continue the therapy. Proper communication between partners in therapy demands trust, determination, and full acceptance from patient’s side. Such therapy is associated with work on spheres difficult for the patient, often associated with anxiety and feeling of helplessness, the new requirements of him or herself and others, changing the way of communication with doctor and parents. Parents should support the motivation to continue therapy and education in diabetic children. They should also support their children to meet the requirements of the treatment, because they have better ability to anticipate and plan health-related behaviors. Parents of teenagers with DM1 will also likely experience anxiety, fatigue and discouragement, and so they too will require support and education [24-27].

**Partnership and shared responsibility**

There is an ethical dilemma when cooperation between the doctor and patient fails. It may be that a lack of involvement of the patient in the treatment process frees the doctor from his or her responsibilities, or it may be that the patient excludes him or herself from the relationship with the doctor. Another issue in this relationship is the matter of record-keeping related to doctor–patient cooperation. Although this falls outside the formal boundaries of disease care, it addresses the extent to which the patient is responsible for his or her own health.

**Support groups**

Psychological background, and its role in DM1, has many aspects. It changes with the time of disease duration and it exceeds the direct relationship between doctor and patient; therefore, the medical team and the patient must be prepared and open to change. This can be achieved by exposing parents and teenagers to therapeutic groups designed to deepen their knowledge of diabetes and psychological skills related to coping with the disease. It seems that a group made up of parents and teenagers meets a number of goals: (a) it increases the involvement of parents in their children's treatment in a manner appropriate to the context of development; (b) it consolidates the cooperation of parent with a teenager at home; and, (c) it increases the parents’ understanding of the mechanisms of development and the difficulties in communicating with the child. Moreover, in the case of adolescent patients, it may help them to open up to their peers and ask them for help with everyday difficulties outside home. Peer groups often have a strong influence on health-promoting behaviors. Parents of adolescents with diabetes may also find these therapeutic groups to be a good opportunity to meet other parents in similar situations. This will allow them to: see that other parents have similar problems so they can regain self-confidence; hear about problems and complications with other children, which may help them to understand their own child from a different perspective; and, receive group support, which may give them the strength and motivation to continue to manage their child's diabetes [28].

**Relationship Between the Child, Diabetes and Doctor**

During visits of patient to the doctor's clinic, a repetitive scheme of issues to discuss is recommended. It not only allows the young patient to be better prepared for each meeting with the doctor, it also provides the child with the sense of security that comes with situational familiarity. In pediatric diabetology, a repetitive reporting scheme – first starting with the parent, and eventually the child in the presence of a parent – is a method to encourage the child to be an active participant in his or her disease management, in partnership with the medical team. This is the best way to prepare the child to be fully independent, in the future responsible contact with doctor. Adolescents spend a lot of time in school and in another situation outside home and without parental care. It is also time which needs a proper control of their diabetes, however, they should be previously well trained for appropriate evaluation of all factors which influence on their metabolic status. So, their decisions about meals, physical activity and insulin dosing are really difficult. Doctor, educatory nurse, dietion and psychologist try to educate child not only about biological facts but also how to make responsible steering of own disease for now and for future effects. Doctor, child and his or her parents must to establish common language for precise description and evaluation of all important events which are observed in life with diabetes. Moreover, this language should be easily recognized and understood by another doctors and medical staff. It is like to learn unprepared child and parents about a piece of practical medicine. This needs also great confidence and trust as well as continued group efforts to cooperate well for maintaining conditioned health of child / adolescent with diabetes. This may be named ‘group compliance’ because members of medical staff must also adjust their expression of knowledge and empathy to patient’s capability. The same is about patient's parents. All these conditions are changing together with the progress of patient's somatic and psychological development.

**Self-control logbook**

The self-control logbook should provide another channel of communication between patient and doctor. The age of the child determinates how the logbook is maintained and used. Young children will require assistance from their parents, early school-age children should participate in recording their daily diabetic life, and older children should perform this recording by themselves, with parental input into the discussion and analysis of notes in order to learn how to draw conclusions. When the child is 14 years old we can expect the full authorship of the self-control logbook, as well as the subsequent post-analysis and conclusions. The doctor should teach, and regularly reiterate, to both parents and adolescents, how to report in the self-control logbook; specifically, what to record, how precise, with what kind of comments, and how to draw the conclusions from mistakes or
successes. A reliable logbook is one of the most important documents in successful diabetes management and treatment, and reflects a patient’s coping mechanisms as well as the effectiveness of the doctor–patient partnership.

Technical equipment as the support for doctor–patient communication

It is extremely important that the medical team and patient (with his or her support group) regularly assess the effectiveness of their communication strategy. Both sides can compare records in the self-control logbook with objective results recorded by electronic equipment (registers in memory of the glucose meter, or CGMS – continuous glycaemia monitoring system, HbA1c, insulin daily dose in relationship to body weight, analysis of records in memory of insulin pump) and discuss or revise earlier medical recommendations and the patient’s adherence. Finally, they can introduce new terms necessary to describe events that were not predicted earlier. This element of objective verifiability is very important when working with children and adolescents. It is often the case children with diabetes do not always follow instructions to the letter, and to not always report the whole truth on matters of their disease to parents and doctors. They do so not because of bad character, but as an attempt to escape the burdensome rules of disease control. These situations arise largely from the poor mental strength of children and youth, and disbelief in the promise of support from adults. They cannot cope with the consistent disease-related stress. This stage is a particular challenge for parents of the diabetic children, their medical team, and other support people. They must work to build the trust of the children, and to support them in following the diabetes self-control rules [29].

Common terminology in doctor–patient communication

The language and terminology used in the communication between patients, doctors and the medical team should be common and precisely describe terms according to the diabetology rules, while taking into account the patient's mental stage. This rule prevents communication problems in case of change of the managing doctor. Potential moments for change and adapted language arise at each new stage of a child’s development, as this leads to changes in the terminology or and vocabulary her or she may choose to use. In addition, as the child matures, her or she experiences many new phenomena in life, including accelerated growth, increased night glycaemia, maturation of the somatic features, more frequent dawn phenomena, and the impact of menstruation on glycemic control. During adolescence, many patients start new activities; some may start intensive sport, others may begin to use drugs and stimulants, and others may begin to partake in sexual activities. This is a time of new challenges in doctor–patient communication. Pediatricians and internists, diabetologists and gynecologists will experience this stage differently: pediatricians have to prepare their growing patients for this change, whereas diabetologists have to work with these “new adult” patient on their language and communication.

Education

The educational material available to a diabetic patient is very difficult and broad; learning and understanding this material cannot be realized during a single session or after a few days. The teaching process should be divided into allocated times and stages, and the knowledge should be refreshed and embedded during each visit to the clinic, with reference to observations made by patients about their own disease management. A DM1 patient’s target glycaemia level is an example of a factor that changes during diabetes management through the lifespan. For young children, a higher range is acceptable, e.g., 90–200 mg/dl, but for adolescents this changes to 80–160 mg/dl. The patient has to know that the reference values of glycaemia differ for day and night, for sportsmen, for pregnant women, etc. The recommended insulin dose, diet, and exercise also change with time and with the course of the disease. Sometimes the patient and his or her family have doubts about a doctor's knowledge and/or competence, because of those changes. They should be informed that recommendations have to reflect the changing responses and conditions of the patient's body, and that the treatment is adapted to the situation of the lack of natural insulin secretion based on glycaemia levels and symptoms.

Natural variability of therapy

DM1 patients, including pediatric patients, must be made aware of the consequences of modifying his or her therapy. He or she must understand:

- Therapy is not a stable, invariable rule; in DM1, it has to be adaptable;
- Before modification of therapy by the patient, or after consultation with the doctor, the reason/s for any previous failure must be analyzed (the patient's observations and records in the self-control logbook are essential);
- The patient's duty is to document his or her activities and its consequences, especially during changes to the therapy;
- Modifications to the therapy should occur in stages, so that the one element is changed in the time to analyze its influence on the disease course and health.

Patient responsibilities

A diabetic patient and his or her parents have to know that the responsibility for successful treatment lies on the shoulders of the patient, the parents, the doctor and the medical team. Key to success is the full cooperation of the patient. Such information can be prepared in writing, so that the patient and/or his or her caregivers can confirm, via signature, that they will do all they can to this end. This agreement should then be added to the medical documentation. In the case of conflict about failed therapy, when a doctor and patient have different ideas about the course of diabetes treatment, an unequivocal agreement simplifies such a problem. In Poland, the National Health Fund requires full cooperation of the patient and medical team to refund the cost of the personal insulin pump. It is a practical example of formalizing the requirement of a consistent cooperation of the patient in the treatment of diabetes.

Complex group psycho-medical education

We would like to propose the concept of combined psycho-medical group workshops for strengthening compliance by improving a patient's motivation for success, better communication, and acceptance of diabetological education. Our most important goal was to encourage people running workshops with evidence-based therapy [30], and to focus on the work with families of DM1 children [31-36]. Based on social learning theory, systemic therapy, group process and behavioral techniques, social and individual psychological competencies were trained. The main goal was to teach parents and children correct behaviors. Such training gives adolescents and their parents the opportunity to improve self-esteem, self-acceptance, social cognition and acceptance, as well as interpersonal relationships with people.
with the same disease and similar experiences. After psychological workshops, medical workshops took place. Medical workshops covered medical and technical knowledge about DM1, the efficacy of glycaemia control, modifications of insulin doses, and methods to avoid acute diabetes complications. The workshop was conducted by an educational nurse and a psychologist/psychotherapist.

Patients and Research Methods

Individuals participating in educational and therapeutic activities were youth between the ages of 15 and 17 suffering from DM1 and their parents. All patients were under the care of the Department of Pediatric Diabetes and Obesity in Poznan. Individuals eligible for the classes did not suffer from any diseases other than DM1. Criterion for patient selection was based on the lack of progress in previous efforts to improve diabetes control. The classes lasted for 12 months and participation was voluntary. Clinical indicators of disease course and psychological questionnaires were collected at the beginning and after completion of classes. Initially, 14 children with their parents (28 individuals) were invited to participate in the program. This group of 10 children and 11 parents (5 girls and 5 boys, 8 mothers and 3 fathers) attended. Psychological tests completed before and after set of workshops were returned by all 21 individuals (10 children and 11 parents); complete diabetes tests were obtained from 9 children. Four parents and their children discontinued the classes after two or three meetings for various reasons.

Educational workshops were conducted for patients, who were receiving insulin using a personal insulin pump and were connected to personal continuous glucose monitoring system. Data were collected using CareLink software (Medtronic) twice (1 term of tests – In the second month of meetings; II term of tests – after 12 months). The reports showed how much insulin was administered during the day at a primary dose (base) and using boluses, and the results of blood glucose level reported over time, allowing for the identification of the causes of low and high blood glucose levels. The target blood glucose level was established between 70 and 140 mg/dL. Blood was collected by finger-prick and the concentration of ketones subsequently determined using an Optium Xido glucometer (Abbott); acceptable levels were deemed to be <0.6 mmol/l.

To evaluate metabolic control of DM1 individuals, glycosylated hemoglobin (HbA₁c) was measured using capillary blood by NycoCard tests certified by the National Glycohemoglobin Standardization Program. A HbA₁c of <7% was deemed to represent very good metabolic control.

Psychological tests were carried out during the first and last workshops. The aim of the tests was to better understand the psychological parameters of the study group. This would allow the team to better identify problem areas, and evaluate whether the therapeutic were effective.

Psychological tests used:
1) Coping Inventory for Stressful Situations (CISS)
2) State-Trait Anxiety Inventory (STAI)
3) Emotionality, Activity, Sociability (EAS)
4) Multidimensional Health Locus of Control Scale (MHLC)
5) Multidimensional Self-Esteeem Inventory (MSEI) according to O’Brien and Epstein (1998) in Fecene adaptation (2008)

Questionnaire of general health, selected parameters of diabetes and the family situation

Pilot workshops program

The program of training involved one 3 hour meeting per month for 10 months for each group (adolescents and parents). Each meeting consisted of a 1.5 hour education session followed by 1.5 hours of therapeutic activities. Every meeting aimed to develop and broaden the knowledge of and abilities related to the management of the disease. Patients and their parents underwent these therapeutic workshops in separate groups, however in the same time.

Topics of workshops with psychologist included:
1. Deepening of the abilities of communication;
2. Learning how to express feelings and identify emotions (own and others);
3. Paying attention to what helps and what hinders contact with another person;
4. Learning of active listening;
5. Explaining the mechanisms of symptom somatization and the concept of increased symptom manifestation in stressful situations;
6. Exercises of confronting one's own difficulties, pain, fatigue, anger and frustration; and, learning how to recognize ones' self-destructive and health-promoting activities;
7. Development of knowledge and the impact of emotions and thoughts on the perception of events; and, presentation and practical techniques of relaxation;
8. Perceptions of differences between aggressive, submissive and assertive behavior;
9. Learning to express feelings, needs, opinions in a firm and fair way, while respecting the feelings and attitudes of another person;
10. Assessment of self-acceptance and self-confidence;
11. Understanding other people's behavior;
12. The meaning of tolerance and kindness;
13. Learning how to take responsibility for the atmosphere in the family and in relation to medical staff;
14. Determination of life plans and direction of personal development;
15. Increasing the knowledge about further diabetes care and its meaning in adult life;
16. Creation of affirmations (“I can...”, “I am...”, “My success is...”).

As mentioned before, the language and terminology used in the communication between patients and doctors must be understandable for both sides. Diabetic terminology is not easy; for example, when a pediatrician has to explain to children what is going on in their bodies, or to show the difference between normal health and uncontrolled diabetes. Even "common" diabetic words like glucose, glycaemia, glycosuria, hypo- and hyperglycemia, glucose target, glycated hemoglobin, may cause difficulties, because a patient must recognize the meaning of similar words. He or she must not only know the
definition of each word, and then understand the differences and the meaning in health and disease. The patient must understand that although glycaemia levels must be checked so often, that action in itself is not the sole purpose of treatment; rather, it is an indicator of insulin action, and is dependent on many factors, including diet, fatigue etc. He or she should know how to interpret hyperglycemia after a "dietetic mistake" and hyperglycemia together with ketosis because of insulin deficit. Other symptoms like nausea or concomitant disease also have to be taken into consideration.

Topics of medical education workshops:
1. What you should know about type 1 diabetes. The role of insulin in the body and the effects of its absence;
2. Self-management in type 1 diabetes – essential and necessary element of treatment;
3. Acute complications in diabetes. Proceeding in hypo- and hyperglycemia;
4. Proceeding in unusual situations – stress, concomitant disease, and hyperglycemia after meal. Calculation of corrective insulin dose;
5. The influence of healthy diet on metabolic control in type 1 diabetes;
6. Preparing meals – the use of carbohydrate and protein, fat exchanges;
7. Stages of determining energetic and nutritional value of menus for diabetics;
8. Methods of insulin therapy. Functional insulin therapy;
9. Continuous subcutaneous insulin infusion using a personal insulin pump;
10. Physical activity in patients with diabetes.

Effects of comprehensive psychological and diabetes education

The data obtained were subjected to psychological and diabetic analyses. In the first part, descriptive statistics of psychological tests were provided. Results were divided in several ways: youth and their parents before and after therapeutic and educational classes, as well as patient–parent pairs. In the second part, a more detailed analysis focused on youth in terms of the effectiveness in following diabetic instructions.

Results and Discussion

Characteristics of stress in the course of type 1 diabetes

Stress-coping strategies are engaged in difficult and critical situations. In families with a child suffering from DM1, severe stress is often associated with poor compliance with treatment and poor metabolic control [37,38]. The higher the score in the Coping Inventory for Stressful Situations (CISS) test, the greater the tendency to choose a particular way of dealing with a difficult situation, referred to as task-oriented style, emotional style and the evasion style. Based on the normalized results, within the study group, the most common response to stress in both groups-children and parents was to focus on the task/problem and attempt to solve it (before and after workshops: 6.14 ± 1.79 and 1.46 ± 6.33, respectively).

| Test  | First term of the examination (n=21) | Second term of the examination (n=21) | t-test | p-value |
|-------|-------------------------------------|-------------------------------------|--------|---------|
| CISS  | Stress task-oriented strategy        | 6.14 ± 1.79                         | 6.33 ± 1.46                          | 1.00   | 0.329   |
|       | Stress emotional strategy            | 4.80 ± 1.83                         | 4.24 ± 1.55                          | 3.00   | 0.007   |
|       | Stress avoidance strategy            | 5.24 ± 1.61                         | 4.71 ± 1.38                          | 2.32   | 0.030   |
| STAI  | Anxiety as a state                   | 4.85 ± 1.85                         | 4.90 ± 1.86                          | 0.20   | 0.847   |
|       | Anxiety as a trait                   | 5.65 ± 1.75                         | 5.15 ± 1.53                          | 2.23   | 0.038   |
|       | Indicator of temperament – discontent| 4.80 ± 1.44                         | 4.71 ± 1.23                          | 0.50   | 0.629   |
|       | Indicator of temperament – anxiety   | 4.90 ± 1.75                         | 5.19 ± 1.40                          | 0.95   | 0.355   |
|       | Indicator of temperament – anger     | 5.38 ± 2.20                         | 4.76 ± 1.84                          | 2.03   | 0.056   |
|       | Indicator of temperament – activity  | 5.47 ± 2.33                         | 6.09 ± 1.64                          | 2.28   | 0.034   |
|       | Indicator of temperament – sociability| 6.62 ± 2.58                        | 6.95 ± 2.18                          | 1.23   | 0.232   |
| EAS   | Internal control of health           | 27.14 ± 5.32                        | 28.86 ± 4.61                         | 2.11   | 0.048   |
|       | Influence of others on health        | 21.52 ± 3.63                        | 21.24 ± 4.82                         | 0.28   | 0.781   |
|       | Coincidence affecting health         | 19.33 ± 4.63                        | 18.04 ± 5.09                         | 2.36   | 0.028   |
| MSEI  | General self-esteem                  | 5.09 ± 1.79                         | 5.85 ± 1.87                          | 4.99   | 0.000   |
|       | Competence                          | 5.23 ± 1.79                         | 5.57 ± 1.57                          | 1.50   | 0.149   |
|       | Being loved                         | 5.38 ± 1.53                         | 5.80 ± 1.54                          | 2.26   | 0.035   |
|       | Popularity                          | 5.86 ± 1.35                         | 5.42 ± 1.29                          | 1.75   | 0.095   |
|       | Leadership                          | 6.09 ± 1.84                         | 6.19 ± 1.63                          | 0.53   | 0.605   |
|       | Self-control                        | 5.38 ± 1.75                         | 6.09 ± 2.07                          | 3.42   | 0.003   |
|       | Moral self-acceptance               | 5.81 ± 2.20                         | 6.00 ± 2.14                          | 0.55   | 0.592   |
|       | Physical attractiveness             | 4.33 ± 1.43                         | 5.04 ± 1.60                          | 3.10   | 0.006   |
|       | Vitality                            | 5.76 ± 2.14                         | 5.42 ± 1.96                          | 1.32   | 0.201   |
|       | Identity Integration                | 6.48 ± 2.44                         | 6.09 ± 2.05                          | 1.22   | 0.237   |
|       | Defensive strengthening of self-defense| 6.76 ± 1.76                    | 6.90 ± 1.79                          | 0.55   | 0.590   |

Table 1: Distribution of average results for particular psychological subtests in the study group “before” and “after” educational and therapeutic workshops across the entire group of adults and youth.
(Table 1). This means that the most frequently observed strategy was to make an effort aimed at solving the problem (task-oriented style) (youth – before: 5.60 ± 1.90, after: 5.90 ± 1.60) (Table 2) (parents – before: 6.64 ± 1.63, after: 6.73 ± 1.27) (Table 3). From statistical viewpoint, this ratio change was insignificant.

The lowest results in the experimental group were obtained when investigating the application of emotional strategies in response to stress

| Test | Subtests | First term of the examination (n=10) X ± SD | Second term of the examination (n=10) X ± SD | t-test | p-value |
|------|----------|----------------------------------|----------------------------------|--------|--------|
| CISS | Stress task-oriented strategy | 5.60 ± 1.90 | 5.90 ± 1.60 | -1.15 | 0.279 |
|     | Stress emotional strategy | 5.40 ± 1.84 | 4.90 ± 1.37 | 1.46 | 0.177 |
|     | Stress avoidance strategy | 4.70 ± 1.70 | 4.60 ± 1.78 | -0.31 | 0.758 |
| STAI | Anxiety as a state | 5.50 ± 1.08 | 5.20 ± 1.32 | 0.82 | 0.434 |
|     | Anxiety as a trait | 6.11 ± 1.17 | 5.55 ± 0.88 | 1.64 | 0.139 |
| EAS  | Indicator of temperament – discontent | 4.90 ± 1.85 | 5.00 ± 1.50 | -0.26 | 0.798 |
|     | Indicator of temperament – anxiety | 4.90 ± 1.85 | 5.40 ± 0.97 | -0.92 | 0.381 |
|     | Indicator of temperament – anger | 6.20 ± 2.10 | 5.70 ± 1.70 | 1.00 | 0.343 |
|     | Indicator of temperament – activity | 4.90 ± 2.56 | 6.00 ± 1.94 | -2.91 | 0.017 |
|     | Indicator of temperament – sociability | 6.40 ± 2.46 | 6.90 ± 1.85 | -1.46 | 0.177 |
| MHLCE | Internal control of health | 25.50 ± 4.06 | 27.40 ± 3.57 | -1.65 | 0.133 |
|     | Influence of others on health | 21.40 ± 3.65 | 22.10 ± 2.18 | -0.86 | 0.414 |
|     | Coincidence affecting health | 18.30 ± 3.80 | 17.00 ± 4.27 | 1.62 | 0.140 |
| MSEE | General self-esteem | 4.10 ± 1.10 | 4.70 ± 0.95 | -2.25 | 0.051 |
|     | Competence | 4.50 ± 1.35 | 4.80 ± 0.63 | -0.82 | 0.434 |
|     | Being loved | 5.00 ± 1.25 | 5.50 ± 1.51 | -1.46 | 0.177 |
|     | Popularity | 5.80 ± 1.32 | 5.30 ± 1.34 | 0.34 | 0.213 |
|     | Leadership | 5.80 ± 2.20 | 6.00 ± 1.76 | -0.56 | 0.591 |
|     | Self-control | 4.90 ± 1.52 | 5.30 ± 1.95 | -1.81 | 0.104 |
|     | Moral self-acceptance | 5.60 ± 1.43 | 5.90 ± 1.60 | -0.49 | 0.638 |
|     | Physical attractiveness | 4.20 ± 1.40 | 4.60 ± 1.65 | -1.18 | 0.269 |
|     | Vitality | 5.30 ± 2.36 | 5.00 ± 2.21 | 0.90 | 0.394 |
|     | Identity Integration | 5.90 ± 2.56 | 5.70 ± 2.11 | -0.61 | 0.555 |
|     | Defensive strengthening of self-defense | 6.80 ± 1.32 | 7.30 ± 1.50 | -0.96 | 0.363 |

Table 2: Distribution of average results for particular psychological subtests in the study group of youth "before" and "after" educational and therapeutic workshops.

| Test | Subtests | First term of the examination (n=11) X ± SD | Second term of the examination (n=11) X ± SD | t-test | p-value |
|------|----------|----------------------------------|----------------------------------|--------|--------|
| CISS | Stress task-oriented strategy | 6.64 ± 1.63 | 6.73 ± 1.27 | -0.32 | 0.756 |
|     | Stress emotional strategy | 4.27 ± 1.74 | 3.64 ± 1.50 | 3.13 | 0.011 |
|     | Stress avoidance strategy | 5.73 ± 1.42 | 4.82 ± 0.98 | 3.19 | 0.010 |
| STAI | Anxiety as a state | 4.27 ± 2.24 | 4.64 ± 2.29 | -1.17 | 0.267 |
|     | Anxiety as a trait | 5.27 ± 2.10 | 4.81 ± 1.89 | 1.46 | 0.176 |
| EAS  | Indicator of temperament – discontent | 4.73 ± 1.10 | 4.45 ± 0.93 | 1.94 | 0.082 |
|     | Indicator of temperament – anxiety | 4.91 ± 1.76 | 5.00 ± 1.73 | -0.29 | 0.779 |
|     | Indicator of temperament – anger | 5.64 ± 2.11 | 3.91 ± 1.58 | 1.90 | 0.087 |
|     | Indicator of temperament – activity | 6.00 ± 2.10 | 6.18 ± 1.40 | -0.52 | 0.617 |
|     | Indicator of temperament – sociability | 6.82 ± 2.79 | 7.00 ± 2.53 | -0.43 | 0.676 |
| MHLCE | Internal control of health | 26.64 ± 6.05 | 24.15 ± 5.19 | -1.29 | 0.227 |
|     | Influence of others on health | 21.64 ± 3.78 | 20.45 ± 3.88 | 0.66 | 0.524 |
|     | Coincidence affecting health | 20.27 ± 5.27 | 19.00 ± 5.78 | 1.64 | 0.132 |
|     | General self-esteem | 6.00 ± 1.84 | 6.90 ± 1.92 | -5.59 | 0.000 |
|     | Competence | 5.91 ± 1.92 | 6.27 ± 1.85 | -1.31 | 0.221 |
|     | Being loved | 5.73 ± 1.74 | 6.09 ± 1.58 | -1.79 | 0.104 |
|     | Popularity | 5.91 ± 1.45 | 5.55 ± 1.29 | 1.08 | 0.307 |
|     | Leadership | 6.36 ± 1.50 | 6.36 ± 1.56 | -0.00 | 1.000 |
|     | Self-control | 5.82 ± 1.89 | 6.82 ± 1.99 | -3.03 | 0.013 |
|     | Moral self-acceptance | 6.00 ± 2.79 | 6.09 ± 2.63 | -0.23 | 0.821 |
|     | Physical attractiveness | 4.45 ± 1.51 | 5.45 ± 1.51 | -3.32 | 0.008 |
|     | Vitality | 6.18 ± 1.94 | 5.81 ± 1.72 | 0.94 | 0.371 |
|     | Identity Integration | 7.00 ± 2.32 | 6.45 ± 2.02 | 1.03 | 0.326 |
|     | Defensive strengthening of self-defense | 6.73 ± 2.15 | 6.55 ± 2.02 | 1.49 | 0.167 |

Table 3: Distribution of average results for particular psychological subtests in the study group of parents "before" and "after" educational and therapeutic workshops.
In this study, strategies focused on the task were treated as adaptive, whereas emotional and avoidant ones were regarded as non-adaptive. Emotional strategies are behaviors described as self-blame; anxiety that one cannot do something; becoming fraught; becoming very depressed; “freezing” (i.e., not knowing what to do); regret that one cannot change what happened, or what was felt at that moment; “unloading” on the others (describing difficulties in the regulation of diabetes to the extent of resulting in learned helplessness). In the case of treatment of DM1, a strategy of avoidance was not advised as it may lead to negligent behavior.

Our review of the literature indicated that more frequent use of emotional and avoidant strategies to cope with stress were associated with increased concentration of HbA1c. The ability to cope with stress via performing tasks was significantly associated with a decrease in HbA1c level [39]. In the present study, the study group displayed a reduction in the use of emotional and avoidance strategies. This change occurred mainly among parents (Table 3), which could change the means of communication within the family and indirectly result in better adaptation to therapeutic requirements. It is not possible to separate stress from coping mechanisms: effective coping reduces stress and ineffective mechanisms increase it. How the patient is able to cope with stress is determined by three factors: style, strategy, and process of dealing with stress. These factors are related to resourcefulness and cognitive and behavioral character aimed at handling the stressful situation. It represents a challenge for the psychological and medical team, as they must decide how to make an impact on the youth during the course of therapy and/or how to teach parents to help support their children in their behavior towards the problems associated with diabetes.

**Assessment of anxiety**

The test examines two types of anxiety: anxiety – state, which is characterized by high variability under the influence of different threatening factors, and anxiety – trait, which highlights the taught nature of anxiety as a permanent disposition, in which cognitive processes trigger anxiety. Research shows that individuals with high levels of anxiety – trait do not necessarily exhibit permanently higher levels of anxiety – state, despite these individuals manifesting this anxiety in highly threatening situations and/or reporting the situation as stressful. The results demonstrate that regardless of the situation, the nature (anxiety – trait) and magnitude (anxiety – state) of the response to the threat depends, to some extent, on the nature of the threat. The association is very pronounced in situations where the ego is at risk and weaker in situations of physical danger [40].

In DM1, high levels of chronic anxiety can result in a higher level of glucose in the blood. Increased patient awareness of the physiological impact of increased levels of anxiety may allow for better detection of the symptoms of hypoglycemia and more accurate assessment of blood glucose concentration [41]. In practice, this means that anxiety itself is not necessarily a bad thing, but youth must be taught to identify its source. The knowledge gained from experiencing anxiety might increase alertness and improve the ability to recognize the body’s signals of hyper and hypoglycemia. In the study group, anxiety levels ranged between the fourth and sixth state. After classes the level of anxiety remained at a similar level (before: 4.85 ± 1.85, after: 4.90 ± 1.86), whereas the anxiety – trait level (Table 1) significantly decreased (5.65 ± 1.75 to 5.15 ± 1.53). This was not statistically significant in the separate subgroups of youth and parents, although the mean values were further improved. We believe that reducing levels of chronic anxiety, which can subsequently decrease blood glucose levels and increase the motivation for careful management of the disease, is a good strategy in the treatment of diabetes (Table 1). The study involved intervention aimed at small groups (hence the difficulty in statistical evaluation) with the intention of achieving a greater impact with a psychologist and among the participants. A study of this nature results in findings that are contradictory: those that are subjective and those that are statistical. As the present study is only in the pilot phase, these findings are preliminary and are explained in greater detail below.

**The role of personality**

Arnold H. Buss and Robert Plomin define temperament as a set of inherited personality traits, which show up in the early life of an individual. These features are genetically determined and reveal themselves in the first year of life. This temperament constitutes the basis for the formation and development of personality. Based on these assumptions and the results of the present study, the authors identified three essential features describing the structure of temperament: emotionality, activity and sociability. Emotionality includes three primary negative emotions: distress, anxiety and anger. Undifferentiated emotion – dissatisfaction – is a tendency towards ease and a strong response to anxiety; the genetically-determined component (the degree of stimulation of the sympathetic nervous system) also contributes significantly to this response. This trait is characterized by a range of emotional responses: from a lack of reaction to an intense, difficult to control or out of control reaction, or to difficulties in staying calm and high sensitivity to stimuli that cause dissatisfaction. A number of studies have examined the impact of personality and temperament on how to manage DM1 and glycemic control. The studies conducted by Skinner et al. [42] demonstrated that conscientiousness, as well as better regulation of emotions affects DM1 and its treatment. More broadly, conscientiousness appeared to be associated with better health behaviors, such as reduced levels of smoking and increased physical activity [43]. In another study, individuals with high conscientiousness performed more tests evaluating blood glucose level and exhibited higher levels of self-care [44]. In contrast, high levels of negative emotions such as anxiety, anger, and dissatisfaction are associated with high HbA1c levels [44]. In this study group, improvements in temperament were achieved after classes. This result also correlated with sociability level, which has a positive impact on the establishment and maintenance of support networks. Another indicator of temperament in the study group was anger, which was observed to be lower after classes (Table 1-3).

Statistically significant results were obtained in terms of activity, which, in the present study, was defined as energy expenditure and changes in activity state (i.e., from stillness to energetic behavior). Activity can be manifested in any type of behavior, both in rate as well as intensity (vigor). An active person shows a strong motivation towards behavior requiring high-energy input. Consequences of the classes included significantly higher activity (before: 5.47 ± 2.33, after: 6.09 ± 1.64), which may also translate into increased interest in the disease.
and its improved control (Table 1). Higher activity after classes was also observed among the youth (before: 4.90 ± 2.56, after: 6.00 ± 1.94) (Table 2). It is possible that at this point, increased activity may help to halt poor disease management behaviors, instead moving the focus to gaining new skills and motivation to deal with the difficulties associated with the disease. In this case, one cannot underestimate the parallelism of the two arms of diabetic education: medical (demonstration of threats, indication of particular routes to avoid/overcome them) and psychological (showing how to face difficulties, motivation). It is typical that these two routes of education are conducted separately (both in terms of time and place), with no clear relationship established between the two. It is for this reason that we feel our study, and the observations gained pre- and post-intervention, provides such valuable information. Psychological intervention used concrete examples discussed during medical education. Parents and youth were also able to confront these messages with their everyday practice in fighting the disease. Temperament can be one of many factors that contribute to the behavior related to the control of the disease in young people with DM1. Using the knowledge of temperament traits, we can optimize diabetes treatment for improved outcomes [44].

Place of health control

An important element in the treatment process is to study the perception of the disease by patients and their parents, as well as the willingness to promote a healthy lifestyle. The assessment of such behaviors is possible thanks to the Multidimensional Health Locus of Control Scale (MHLC). The scale has three dimensions: one internal dimension, which expresses the beliefs of the participant on responsibility for its own health condition; and two external dimensions, which includes the impact of others on the control of health and accidental events [45]. The MHLC scale is recommended for use in health education of patients with diabetes [46]. High scores in terms of internal location of health control may be associated with better glycemic control, and high scores in terms of external health control with negative results. Therefore, it is important to evaluate how the patient perceives his or her own control of health to find appropriate educational interventions. For example, patients who believe that health results are controlled by chance are likely to experience future health problems – an appropriate course of therapy must be designed for these patient types too [47]. The success of the classes is demonstrated by the fact that the study group obtained significantly higher scores in terms of internal control of health after educational classes (before 27.14 ± 5.32 and after 28.86 ± 4.61), which is a very good indicator of taking over responsibility for the disease (Table 1) and significantly lower rates in a belief that the factor determining health and illness is a coincidence (before 19.33 ± 4.63 after 18.04 ± 5.09).

Self-esteem

The life of a family with a child who suffers from diabetes is altered from the time of diagnosis. The family must quickly adapt to the demands of the disease, and this may require changes in the structure of needs, as well as frustration and disturbances in mental development. Personality is also a factor determining the effectiveness of treatment, e.g. the higher the self-esteem of the child, the better results of control of the disease [48]. The specificity of the disease and its treatment may form or enhance certain personality traits. The research shows that the functioning of children with diabetes is characterized by: low self-esteem, decreased self-respect, lack of self-acceptance, loss confidence and faith in the achievement of goals, sense of shame due to the presence of the disease, greater distance in interpersonal relationships and reduced sense of security. The Msei test is used to measure self-esteem and self-confidence in the aspects of human functioning also important in controlling diabetes: the patient's abilities and effectiveness; being loved, accepted and supported by relatives; popularity; ability to manage people affecting their behavior; self-control and perseverance; morality; appearance and attractiveness; and, health and vigor [49].

Averages calculated for individual psychological factors were compared before and after meetings. Significant changes were observed across 11 factors in four subtests: general self-esteem, being loved, self-control, and physical attractiveness. Once subjected to psychological interpretation, the results can be presented as a self-assessment of the study group as a characteristic of its behavior. Specifically, after classes the overall self-esteem and sense of self-importance of the group increased (before: 5.09 ± 1.79, after: 5.85 ± 1.87); this change mainly occurred in the parent group (before: 6.00 ± 1.84, after: 6.90 ± 1.92) (Table 1, 3 and 4).

The “being loved” subtest of the Msei measures a person’s sense of experimental social support and consequent acceptance, as well as openness to close emotional contact. In the study group, this increased after classes (before: 5.38 ± 1.53, after: 5.80 ± 1.54) (Table 1). Another parameter, which significantly increased after classes, was self-control. This parameter is important because it measures an individual’s sense of being able to control emotions in terms of perseverance and discipline, which is very important in realizing the tasks associated with the disease (before: 5.38 ± 1.75, after: 6.09 ± 2.07). Statistically significant

|                | First term of the examination (n=9) | Second term of the examination (n=9) | t-test | p-value |
|----------------|------------------------------------|-------------------------------------|--------|---------|
| Daily Insulin dose | 60.45 ± 8.67 | 58.27 ± 4.87 | 1.01 | 0.34 |
| Insulin in base   | 27.16 ± 6.11 | 23.73 ± 3.91 | 3.69 | 0.006 |
| Insulin in bolus  | 33.28 ± 7.18 | 34.54 ± 3.64 | -0.66 | 0.52 |
| Average value of glucose | 203.43 ± 50.45 | 196.55 ± 44.61 | 1.34 | 0.21 |
| Maximum blood glucose level from 6 days | 357.44 ± 64.77 | 315.88 ± 57.12 | 2.62 | 0.03 |
| Minimum blood glucose level from 6 days | 62.66 ± 12.65 | 68.44 ± 6.89 | -1.11 | 0.29 |
| Blood glucose level above 140 mg/dl (in %) | 29.02 ± 17.79 | 25.01 ± 13.90 | 1.62 | 0.14 |
| Blood glucose level below 70 mg/dl (in %) | 0.21 ± 0.18 | 0.11 ± 0.1 | 1.18 | 0.26 |
| Normal blood glucose level 70-140 mg/dl (in %) | 70.78 ± 17.81 | 73.80 ± 14.48 | -0.98 | 0.37 |
| Ketone concentration in blood (0.0–0.6 mmol/l at physiological concentration) | 0.20 ± 0.26 | 0.13 ± 0.18 | 1.15 | 0.28 |
| HbA1c glycated hemoglobin (in %) | 8.92 ± 1.35 | 8.41 ± 1.56 | 1.50 | 0.17 |

Table 4: Distribution of average results for particular factors describing self-control of patients in the study group "before" and "after" educational and therapeutic workshops.

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Volume 5 • Issue 5 • 1000212
results were obtained for the group of parents (before: 5.82 ± 1.89, after: 6.82 ± 1.99). The last parameter, which improved after educational and therapeutic classes, was perceived physical attractiveness (before: 4.33 ± 1.43, after: 5.04 ± 1.60; parents’ group – before: 4.45 ± 1.51, after: 5.45 ± 1.51) (Table 1 and 3). Paradoxically, a greater willingness to change self-perception was observed in the parents in comparison to youth. In addition, after classes, contact between parents and children was improved, and both groups reported more confidence in facing demands against each other, in a less confrontational way and with a reduced intensity of negative emotions. The group also reported greater openness and flexibility in decision-making associated with controlling the disease, including in stressful and difficult situations. The changes observed in psychological parameters may seem discrete, but they undoubtedly translate into a better mutual understanding of the situation – both in terms of youth being understood by their parents, and youth understanding their parents’ situation.

Medical effects after psychological intervention

Effectiveness of compliance during the classes was evaluated using a number of different tools allowing for the objective control of diabetes treatment. Continuous monitoring of blood glucose level allowed us to trace glucose levels across 6 consecutive days. The results obtained in the first term of the examination indicated that the average blood glucose level in the study group was 203 mg/dl, whereas in the second term of the examination this decreased to 196 mg/dl. This difference is not statistically significant; however, in combination with an amplitude of measurement (difference between the lowest and the highest results of glycemia in individual patient), it is an important indicator of improved self-control. In cases of hypoglycemia (below 70 mg/dl), the first-term examination revealed 0.22% hypoglycemia, which was reduced to 0.11% in the second term. This difference was not statistically significant; however, it is an important determinant of the safety of treatment. Simultaneously, differences in the values of maximum blood glucose levels were observed. Studies have shown that the average value of the maximum glucose level in individuals investigated during the first term of the examination was 357 mg/dl; however, in the second term it was reduced to 316 mg/dl. It was reported that in the second term of the examination, the maximum blood glucose level decreased by 41 mg/dl. This result proved to be statistically significant at p=0.031 compared to the status prior education. These recent findings demonstrate much better results than just juxtaposition of the average values of glucose levels. Diagnostic values of glycated hemoglobin, as an indicator of metabolic balance based on the analysis of results performed among youth, showed that the mean concentration of HbA1c for the first test was 8.9%. In the second examination, the concentration of glycated hemoglobin decreased to 8.4%. This change, when evaluated separately, is not substantial; however, its juxtaposition with the reduction of the amplitude of blood glucose level, in particular limiting hypoglycemic episodes and a clear reduction in the maximum values of hyperglycemia, gives a very positive picture of the progress towards better self-control. Decreased concentrations of HbA1c by 0.2–0.7% within large groups are usually statistically significant and considered to be beneficial [50–52]. In the present pilot study this change (-0.5%), although notable, is not significant due to the small number of participants. In the studies, he focus is the technical side of the supporting therapy. In our study, the technical elements of treatment were unchanged; rather, we focused on combined education and psychological training, for both youth and parents.

Daily total dose of insulin (DDI) and the relationship between basal supplementation of insulin and its supply in the so-called boluses, were assessed before and after completion of educational cycle. Within ten months the average amount of insulin in DDI decreased by 2.2 units. The obtained results show that individuals tested in the first term, were administered 27.2 units of insulin in a base on average, in the second term of examination, one reported 23.7 unit of insulin units in the base (average difference indicates reduction by 3.5 unit; p=0.006). Whereas after educational classes, the amount of insulin administered in boluses increased by 1.3 units. Our observations showed a significant reduction of the daily basal insulin supplementation. Its high value is usually associated with insulin resistance, so we prefer to keep basal insulin as low as only effective and rather insulin boluses adjust flexibly to changeable situations. Our pilot study revealed this wanted change in our patients insulin therapy. Furthermore, the maximum blood glucose level decreased by 40 mg/dl, which is a significant indicator of improvement, even though it is still too high. It was achieved without an increased risk of hypoglycemia.

These selected patients have not achieved any improvement for previous several years, despite repeated medical education and being equipped with personal insulin pumps. Thus, improved care in the course of diabetes was mainly achieved by psychological education efforts, as for the purpose of the study.

In the studies [47–50], little or no attention was given to the psychological support of the parents. It is necessary to include them according to our concept of ‘group compliance’. We believe that medical results of such a pilot study are promising to continue joint workshops for gaining knowledge and psychological skill of family groups, because they are cooperating every day in fighting against childhood / adolescence diabetes. Maybe in the next step we should find any way for implementation of results from psychological evaluation of any individual patient into the medical team to make such ‘group compliance’ as multidirectional phenomenon.

Conclusion

The objective of the present study was to consolidate psychological support and diabetes medical reeducation in one program of workshops. Following the results of our pilot study, this program shows promise as an effective way to deal with youth with DM1, for whom it is difficult to obtain the proper treatment results. The achievement of educational goals must be verified during the patient’s visits to the clinic, usually by way of the patient and/or guardian/s correct reactions and responses. It must be a continuous process, because the course of the disease changes over time, as does the knowledge and perceptual abilities of the patient. Medical team must be aware of these changes. The authors believe that conducting substantive diabetes training and psychological therapy in parallel causes the latter to be strongly rooted in the specifics of the disease; thus, it is likely these two elements become more closely aligned in the minds of patients and their parents as a result. In addition to psychological benefits, classes also had an impact on treatment compliance and better metabolic control. It is possible that classes may have a delayed effect; however, the information gathered will be very useful for the development of education and motivation of patients and their families in the future. The observed maintenance of glycated hemoglobin in the study group of teenagers was a positive result, because even a small increase in glycosylated hemoglobin level increases the risk of diabetes complications [53]. If the study was conducted using a much larger patient group, then the approximately 0.5% improvement in HbA1c would be considered to be significant positive progress [50–52]. This is another prerequisite for the continuation of the selected way to affect youth suffered from diabetes.
and their families. The information obtained from the present study will be very useful for the development of education and motivation of patients and their families.

Diabetes education and psychological support, along with elements of group therapy applied together, resulted in improved self-esteem, coping with stress, self-acceptance and communication (children and their parents) in family, at school, within peer group and when dealing with the medical team.

However, this term should be treated as one which applies not only to the doctor–patient relationship, but also to the entire medical team and the patient’s family support team. The group compliance denotes the inclusion of many people, all of whom are motivated to support and engage in the therapeutic process, engage in effective communication using the correct common terminology, and putting these into practice during education and treatment in order to improve the effects of therapy in childhood/adolescent diabetes.

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