Evaluation of the Effectiveness of a 26-Week Multidisciplinary Patient Education Program for Subjects with Type 2 Diabetes in Poland

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A – research concept and design, B – collection and assembly of data, C – data analysis and interpretation, D – writing the article, E – critical revision of the article, F – final approval of article

ABSTRACT

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Introduction. *Diabetes education is an integral element of diabetes therapy, implemented based on a properly prepared education program. All individuals with diabetes should participate in diabetes education about the importance of blood glucose management, lifestyle changes including diet control and physical exercise to acquire knowledge and skills for diabetes self-management and to avoid complications associated with diabetes.*

Objective. *To determine the effectiveness of a 26-week, multidisciplinary diabetes education program among patients with type 2 diabetes attending outpatient clinics in Ostrowiec Świętokrzyski. The program's effect on biochemical and anthropometric parameters, as well as impact of education on the level of knowledge and attitude towards diabetes, were evaluated.*

Methods. *The study included 174 adult patients with type 2 diabetes, divided into two groups: a study group (113 patients) who participated in a 26-week diabetes education program, including physical activity classes, and a control group who only attended routine visits at the diabetes clinic. Of the 113 subjects in the control group, 52 did not report for the follow-up examination and were removed from the program, so the final analysis was based on data from 61 control individuals. All patients underwent biochemical and anthropometric tests (fasting glucose, HbA_{1C}, total cholesterol, LDL, HDL, triglyceride levels, body weight, BMI, waist and hip circumference, WHR, systolic and diastolic blood pressure) at the beginning and end of the program (0 and 26 weeks). The study group also completed two questionnaires regarding educational needs, behaviors, and attitudes related to diabetes (at 0, 13, and 26 weeks).*

STRESZCZENIE

Ocena skuteczności 26-tygodniowego programu edukacyjnego prowadzonego przez zespół interdyscyplinarny u pacjentów z cukrzycą typu 2 w Polsce

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Wstęp. *Nieodłącznym elementem terapii cukrzycy jest edukacja diabetologiczna, realizowana w oparciu o odpowiednio przygotowany program edukacji. Wszyscy pacjenci z cukrzycą powinni uczestniczyć w edukacji na temat kontroli glikemii, modyfikacji stylu życia obejmującej zasady prawidłowego żywienia i regularnej aktywności fizycznej, by zdobywać wiedzę i umiejętności w zarządzaniu cukrzycą oraz by uniknąć powikłań cukrzycowych.*

Cel pracy. *Celem podjętych badań było sprawdzenie skuteczności 26-tygodniowej kompleksowej edukacji zdrowotnej prowadzonej przez zespół interdyscyplinarny u pacjentów z cukrzycą typu 2, leczonych w poradniach diabetologicznych w Ostrowcu Świętokrzyskim. Skuteczność edukacji oceniana była na podstawie wyników badań biochemicznych i antropometrycznych pacjentów oraz ich poziomu wiedzy i postawy wobec choroby.*

Materiał i metody. *Badanie przeprowadzono wśród 174 pacjentów z cukrzycą typu 2, podzielonych na dwie grupy. Grupa badana obejmowała 113 osób, które przez 26 tygodni uczestniczyły w kompleksowym programie edukacji diabetologicznej, połączonym z zajęciami aktywności fizycznej. Do grup kontrolnej zakwalifikowano również 113 osób, które nie uczęszczały na edukację. W czasie trwania obserwacji, 52 osoby z grupy kontrolnej nie zgłosiły się na badania, więc analizowano dane jedynie 61 osób. Wszystkich pacjentów poddano badaniom biochemicznym i antropometrycznym (glukoza na czczo, cholesterol całkowity, LDL, HDL, trójglicerydy, HbA_{1C}, masa ciała, obwód tali, obwód bioder, BMI, WHR oraz ciśnienie tętnicze krwi) w 0 i 26 tygodniu programu. Pacjenci z grupy badanej wypełniali dodatkowo dwie ankiety dotyczące potrzeb edukacyjnych oraz*

To assess the educational program's effectiveness, the study and control groups were compared through appropriate statistical methods at 26 weeks, and the study group before and after the program (at 0 and 26 weeks).

Results. *Before starting the educational program, the study group did not differ statistically significantly from the control group, except for HDL and blood pressure levels. At the end of the program, patients in the study group achieved significantly better results for fasting glycemia, triglyceride levels, HbA$_{1C}$, body weight, waist and hip circumference, and diastolic blood pressure than the controls. The educated group also demonstrated significantly improved behavior and attitudes towards diabetes, including awareness of diabetes management, self-control, compliance with the therapeutic team's recommendations, and coping with the disease.*

Conclusions. *Comprehensive diabetes education, including regular physical exercises, delivered by a multidisciplinary care team, significantly improves biochemical and anthropometric parameters in patients from the study group compared to patients from the control group. Diabetes education also positively impacts patients' knowledge and awareness of diabetes management. Participating in an educational program brings greater benefits to patients compared to attending traditional visits at an outpatient clinic alone.*

Ongoing comprehensive education is needed to maintain the long-term effectiveness of interventions.

zachowań i postaw związanych z cukrzycą (w 0, 13 i 26 tygodniu programu). W celu oceny skuteczności przeprowadzonej edukacji, za pomocą odpowiednich metod statystycznych, porównano grupę badaną i kontrolną w 26 tygodniu programu edukacyjnego oraz grupę badaną przed i po edukacji (w 0 i 26 tygodniu programu).

Wyniki. *Przed rozpoczęciem programu edukacyjnego grupa badana nie różniła się istotnie statystycznie od grupy kontrolnej (poza HDL i ciśnieniem tętniczym). W 26 tygodniu programu edukacyjnego pacjenci z grupy badanej osiągnęli znacznie lepsze wyniki w zakresie: glikemii na czczo, trójglicerydów, HbA$_{1C}$, masy ciała, obwodu talii i bioder oraz rozkurczowego ciśnienia tętniczego krwi.*

Po 26 tygodniach programu edukacyjnego u pacjentów z grupy badanej nastąpiła istotna statystycznie poprawa prawie wszystkich parametrów (poza HDL) w porównaniu ze stanem w 0 tygodniu. Ponadto, w grupie badanej nastąpiła również poprawa zachowań i postaw wobec choroby: poprawiła się świadomość postępowania, samokontrola, stosowanie się do zaleceń zespołu terapeutycznego, postawa wobec choroby.

Wnioski. *Kompleksowa edukacja diabetologiczna prowadzona przez zespół interdyscyplinarny, uwzględniająca regularny wysiłek fizyczny, wpływa znacząco na poprawę wskaźników biochemicznych i antropometrycznych u pacjentów z grupy badanej w porównaniu z pacjentami z grupy kontrolnej. Edukacja diabetologiczna korzystnie wpływa również na wiedzę pacjentów oraz ich świadomość postępowania w cukrzycy jako chorobie przewlekłej. Udział w programie edukacyjnym przynosi większe korzyści pacjentom w porównaniu do odbywania samych tylko tradycyjnych wizyt w poradni diabetologicznej. Ciągła kompleksowa edukacja diabetologiczna jest konieczna, aby utrzymać długoterminową skuteczność interwencji.*

Introduction

Type 2 diabetes (T2D) is a complex metabolic disorder characterized by chronic hyperglycemia, leading to both microvascular and macrovascular complications. It poses a significant health, economic, and social challenge worldwide, as the associated disabilities not only reduce the quality of life but also escalate medical expenses. According to the International Diabetes Federation, diabetes has reached epidemic proportions globally. In Poland, the adult prevalence of diabetes was reported at 7% in 2021, affecting approximately three million people, including about one million undiagnosed cases.[1] The morbidity associated with diabetes in Poland varies by province, with the highest percentages recorded in the Śląskie (5.5%) and Łódzkie (5%) Voivodeships.[2] In the Świętokrzyskie Voivodeship, where this study was conducted, the prevalence was 4.6%.[2]

Education on lifestyle modifications is crucial for all diabetes patients to help manage their blood glucose levels. Obese patients, in particular, should be encouraged to lose weight, engage in physical activity, and follow a healthy diet. Self-monitoring of blood glucose levels is a vital component of diabetes self-management, enabling patients to take responsibility for their diabetes management. Healthcare professionals should educate patients how to manage and live with diabetes. However, in the USA, less than 50% of individuals with diabetes receive educational services,[3] and in Poland, access to qualified diabetes educators remains a challenge, with diabetes education underutilized.

Diabetes education, delivered through well-prepared educational programs, is an essential part of diabetes therapy. It is expected that by improving their knowledge of diabetes, patients will gain a better understanding of their condition, develop improved coping skills, and thus have a more significant impact on disease progression and its complications. Numerous studies have demonstrated that structured education programs on diabetes self-management can enable patients to navigate barriers associated with the disease and address real-life challenges, leading to marked improvements in various diabetes outcomes, including glycemic control.[4-7]

In Poland, the majority of implemented diabetes education programs are informal and often comprise short-term courses conducted by diabetes nurse educators and diabetologists during routine outpatient clinic visits or hospital stays in diabetes wards. To confirm the value of longer-term formal courses, this study aims to assess

the effectiveness of a comprehensive 26-week course delivered by a multidisciplinary care team among patients with T2D. The effectiveness of education was evaluated based on changes in the biochemical and anthropometric parameters of the patients, as well as their knowledge and attitude towards their disease.

Research Design and Methods

Subjects and Basic Information about the Study

The research was conducted and completed before the onset of the COVID-19 pandemic. It involved 174 adult patients with T2D from three outpatient diabetes clinics in the Świętokrzyskie Voivodeship, Poland. Eligible participants had been diagnosed with diabetes for at least one year. The participants were divided into two groups: those who attended the course and those who did not.

Initially, 226 individuals were enrolled and divided into a study group and a control group, each comprising 113 people. Study group members attended the diabetes education program for 26 weeks, while control group members did not participate in the program. Due to a lack of follow-up (at weeks 13 and 26), 52 participants from the control group (4 treated with insulin and 48 treated only with oral antidiabetic drugs) were excluded, leaving 61 individuals in the control group for the final analysis, which was based on data from 174 participants. The diagnosis of diabetes conformed to the guidelines of Diabetes Poland and the American Diabetes Association.[8,9]

Ethical Approval

All procedures in studies involving patients were conducted in accordance with the ethical standards of the institutional and/or national research committee, as well as with the 1964 Helsinki Declaration and its later amendments and comparable ethical standards. The research protocol received approval from the Bioethics Committee of the Faculty of Health Sciences at Jan Kochanowski University, Kielce, Poland.

Preparation of the Patient Education Program

The program was designed based on the recommendations of the Polish Diabetes Association regarding education, with particular focus on the following principles: patient education should support self-management and lifestyle modifications according to a recommended diet and physical activity; the program should aim to develop practical skills that could influence the disease progression, not just impart knowledge alone; and program should involve members of various medical professions.[8]

Based on these guidelines, an original 26-week comprehensive education program for people with T2D attending diabetes outpatient clinics was created: "Szkoła edukacji dla pacjentów z typem 2 cukrzycy" (*School of Education for Patients with Type 2 Diabetes*). This program was implemented by a multidisciplinary team of three diabetologists, three diabetic nurse educators, a nutritionist, a psychologist, a physical activity instructor, and a public health specialist (who also coordinated the project). The intervention focused on group education sessions, combined with face-to-face time with specialists for patients who required additional support.

The educational program consisted of theoretical and practical sessions (once a week for 120 minutes) intended to improve patients' knowledge and skills regarding diabetes management, and physical activity sessions (twice a week, 120 minutes in total) to emphasize patients' role and impact on the course of diabetes. Each week, a different member of the multidisciplinary team led the theoretical component. The educational program covered a wide range of diabetes-related topics, including the *pathophysiology of diabetes*, *diabetes control through diet and exercise*, *patient self-care behaviors* (dietary habits, physical activity levels), *self-management skills* (medication administration, use of equipment, glucose self-monitoring), *compliance with the therapeutic team's recommendations*, *diabetes complications*, *foot care*, *motivation and behavioral strategies*, *psychological problems*, *quality of life* and *health service utilization*.

The physical activity component was tailored to the individual patient needs and capabilities. Sessions included a warm-up, proper training and stretching, and relaxation exercises at the end, conducted either indoors or outdoors by a certified physical activity instructor.

Data Collection and Outcome Measures

Participants were recruited from outpatient clinics over a two-week period, with none having previously attended any diabetes education program. Written informed consent was obtained from all participants prior to their involvement in the study.

The program coordinator, Katarzyna Agnieszka Kowalska, collected patient data using case report forms. The collected data included: patient demographic, socio-economic profile (urban vs rural residence, occupation), duration of diabetes, current treatment (oral antidiabetic drugs, insulin or combination of both), glycemic control (fasting glucose and HbA_{1c}), lipid profile (total cholesterol (TC), high density lipoprotein (HDL), low density lipoprotein (LDL), triglyceride levels (TG)) and physical measurements: height, weight, waist and hip circumferences, body mass in-

dex (BMI), waist-to-hip ratio (WHR), and blood pressure.

Blood for biochemical tests was collected from the participants in the morning after fasting overnight. The biochemical tests and physical measurements were performed at the program's start (week 0), and conclusion (week 26). In addition, the patients in the study group completed two questionnaires on their educational needs, behaviors, and attitudes related to diabetes (at week 0, 13 and 26).

Questionnaire No. 1: Educational Needs

Patients from the study group rated their interest in the following 11 diabetes-related topics: (1) risk factors for type 2 diabetes, (2) pathogenesis, (3) treatment methods, (4) self-control and self-management strategies, (5) dietary principles, (6) physical activity in diabetes, (7) complications of diabetes, (8) prognosis, (9) psychological support, (10) pharmacological treatment, and (11) herbs and dietary supplements in diabetes. Interest in each topic was assessed on a 10-point scale, where 1 indicated the lowest interest and 10 the highest.

The survey results allowed the therapeutic team to tailor the class topics to meet patients' needs and expectations.

Questionnaire No. 2: Patient Awareness, Behaviors and Attitudes Related to Diabetes

This questionnaire aimed to evaluate participant behaviors concerning diabetes management, self-control, compliance with the therapeutic team's recommendations, and coping with the disease. It comprised 18 questions (see supplemental material), with responses rated on a five-point scale: "no" (1 point), "not really" (2 points), "it is difficult to say" (neither yes nor no) (3 points), "I think so" (4 points), and "definitely" (5 points). In most cases the answer "definitely" gave the highest score and indicated the best health choices.

Statistical Analysis

All case report forms were digitized and analyzed using SPSS Statistics 22 (IBM). Descriptive statistics (mean ± SD, minimal and maximal values) were calculated for age, diabetes duration, and biochemical and anthropometric characteristics. Treatment type, gender distribution, place of residence and occupation were summarized as percentages.

Differences in biochemical and anthropometric parameters (including age, gender distribution, fasting glucose, HbA_{1c}, TC, LDL, HDL, TG, body weight, BMI, waist and hip circumference, WHR, blood pressure) between the study and control groups, as well as within the study group before and after the education pro-

gram, were evaluated using an unpaired t-test. The Greenhouse-Geisser test with the Bonferroni correction was employed to compare various parameters in the study group at weeks 0, 13, and 26 of the program: educational needs (questionnaire no.1), attitude toward diabetes, awareness of diabetes management, self-control, compliance with the therapeutic team's recommendations and coping with the disease (questionnaire no.2).

A probability value of <0.05 was considered statistically significant.

Results

Comparison of the Study and Control Groups at the Start of the Program

The study group comprised 113 patients, while the control group included 61, following the exclusion of 52 control participants. A significantly higher proportion of the study group was female (n = 79; 69.9%) than the control group (n = 30; 49.2%) (p = 0.007). In addition, a significantly larger percentage of the study group lived in an urban setting compared to control group (98.2% vs 73.8%; p<0.001). The mean (±SD) age of the participants was 65.7 (±7.3) years in the study group and 65.2 (±10.4) years in the control group (p = 0.643).

The mean (±SD) duration of diabetes was 11.52 (±7.3) years for the study group and 9.7 (±6.6) years for the control group (p = 0.122). Regarding treatment, 17.7% of the study group (n = 20) were receiving insulin, 27.4% (n = 31) insulin and oral antidiabetic drug (OAD), and 54.9% (n = 62) only OAD. In contrast, 31.1% of the control group (n = 19) were treated only with insulin, 41% (n = 25) with insulin and OAD, and 27.9% (n = 17) only OAD. In total, a significantly lower proportion of the study group (n = 51; 45.1%) took insulin alone or in combination with OAD than the control group (n = 44; 72.1%) (p = 0.001). Statistical differences in the therapy method between the study and control groups resulted from the exclusion of 52 participants from the control group (4 patients receiving insulin and 48 patients treated only with OAD). No statistically significant differences were found between the study and control groups in terms of age, occupation, or diabetes duration.

Table 1 summarizes baseline metabolic and anthropometric characteristics of the study and control groups (week 0). No differences were observed between the study and control groups with regard to fasting glucose, HbA_{1c}, TC, LDL, TG, body weight, BMI, waist and hip circumference, or WHR. However, the study group exhibited significantly higher HDL levels and both systolic and diastolic blood pressure readings.

Results of Questionnaire No. 1

The initial educational needs of the study group are presented in Table 2. Prior to the education program, the most favored diabetes-related topic was the principles of "nutrition in diabetes" (mean = 9.99 out of 10 points), followed by "treatment methods" (mean = 9.95), "physical activity" and "diabetes complications" (both mean = 9.92), "self-control" (mean = 9.89), "psychological support" (mean = 9.87), "pathogenesis" (mean = 9.85), "risk factors" (mean = 9.84) and "prognosis" (mean = 9.81). According to the questionnaire, "pharmacology", and "herbs and dietary supplements" were of the least interest (mean = 9.74 and 9.65, respectively).

At the program conclusion, the most popular topics were "dietary principles" and "physical activity in diabetes," underscoring the Polish Diabetes Association's emphasis, [8] proper nutrition and physical activity are crucial in improving the overall health outcomes, and in preventing and treating chronic complications of diabetes. All diabetics should be educated on the general principles of nutrition and regular physical activity at each visit.

Results of Questionnaire no. 2

Table 3 demonstrates changes in patients' attitudes toward diabetes management over the course of the program, with overall scores for behavior and attitude towards diabetes rising from baseline 3.633 out of five points to 3.860 points by week 26 (p = 0.004). Compared to baseline, notable improvements were observed in all aspects tested, including attitude toward diabetes: "awareness of diabetes management" increased from 3.794 to 3.993 points (p = 0.041), "self-control" from 3.883 to 4.465 points (p < 0.001), "compliance with the therapeutic team's recommendations" from 3.336 to 3.811 points (p < 0.001) and "coping with diabetes" from 2.480 to 2.829 points (p < 0.004).

Comparison of the Study and Control Groups at the Program Conclusion

Table 1 illustrates the clinical data of the study and control groups over 26-week period. Compared to control group, the study group participants who completed the multidisciplinary education program demonstrated significantly lower fasting glucose, HbA$_{1c}$, triglyceride, body weight, waist and hip circumference and diastolic blood pressure readings. No significant differences were observed with regard to TC, LDL, HDL, BMI, WHR or systolic blood pressure (p > 0.05).

Comparison within the Study Group before and after the Program

The clinical data of the study group before and after the diabetes program is presented in Table I. After the program, the members of the study group demonstrated significantly lower fasting glucose, HbA$_{1c}$, TC, LDL, HDL, body weight, BMI, waist and hip circumference, WHR, and both systolic and diastolic blood pressure levels compared to baseline (p < 0.05). However, no significant change was observed with regard to triglyceride levels (p > 0.05).

Discussion

This study examines the effectiveness of a long-term (26 week), multidisciplinary diabetes education program on T2D patients attending outpatient clinics in Poland, marking a novel approach to enhancing diabetes therapy efficacy. Our findings indicate that such regular, multidisciplinary interventions, consisting of a weekly theory session and twice-weekly physical activity sessions, yield beneficial outcomes for T2D patients attending outpatient clinics. The findings suggest that patients who had attended such a course demonstrated different clinical outcomes compared to a group who only participated in routine visits at the outpatient clinic, without attending the program.

In general, at the end of the 26-week course, the study group demonstrated significantly lower fasting glucose, HbA$_{1c}$, TG, body weight, waist and hip circumference and diastolic blood pressure compared to the control group. Moreover, the patients in the study group also displayed significantly improved test parameters compared to baseline (week 0), except for HDL. After completing the program, specific reductions for patients in the study group included a decrease in mean fasting glucose by about 10 mg/dl, mean total cholesterol by about 11 mg/dl, LDL by about 9 mg/dl, and triglyceride levels by about 10 mg/dl. Body weight also dropped by about 4 kg, waist circumference by about 6 cm and hip circumference by about 5 cm and BMI by about 1.5; systolic pressure fell by 4.5 mmHg, diastolic pressure by 5.5 mmHg, and WHR by 0.01. The sole parameter adversely affected was HDL, which decreased from 53.7 mg/dl to 50.3 mg/dl.

Diabetes education is a crucial component of diabetes therapy. Echoing the words of Elliot P. Joslin, a 19th-century diabetology pioneer, "the diabetic who know the most, live the longest".[10] However, the success of a diabetes awareness-raising program hinges on its careful preparation, which should include an initial assessment of participants' knowledge and preferences. This approach enables the therapeutic team to tailor the course content and approach to meet the patients' needs and capabilities. Our study aimed to

evaluate the diabetes-related educational needs and attitudes in the study group at the course's outset, midpoint, and conclusion.

According to the American Diabetes Association, nearly 50% of diabetes patients do not achieve the recommended HbA_{1c} levels of < 7%,[11] and only 14.3% manage to reach target levels for HbA_{1c}, blood pressure, and LDL.[12] Much of the costs related to diabetes arise from the occurrence of serious long-term complications such as coronary heart disease, stroke, blindness, limb amputations, and kidney disease.

While T2D is more prevalent in people aged 40 years and older, it is important to highlight that its prevalence is increasing in younger populations due to a rise in obesity and physical inactivity in this group. Data from the United Kingdom Prospective Diabetes Study (UKPDS) suggests that tight glycemic control can significantly reduce the risk of developing serious complications in T2D patients.[13]

Our present findings corroborate those of previous studies performed in many countries, showing that participation in diabetes education courses is associated with improved clinical outcomes among patients, including glycemic control, HbA_{1C}, BMI, lipid profile, and blood pressure.[14-17] These improvements are also associated with reduced treatment costs,[14,15] enhanced patient knowledge and metabolic control,[16-19] fostering of patients' psychological well-being,[17-19] reduced risk of complications, and improved quality of life.[18,19] Furthermore, previous research indicates that patients with suboptimal or poor glycemic control derive even greater benefits from self-management programs.[20]

Diabetes management is generally acknowledged to be a complex process, requiring extensive patient involvement alongside support from a multidisciplinary care team. Patients, therefore, face considerable challenges in managing the physical, emotional and psychological aspects of living with diabetes. Despite individual differences in patients' coping needs, there is a consensus on the necessity of educational and supportive programs for diabetes patients. While traditional programs were based on didactic models, aiming at improving knowledge of the disease, current models utilize behavioral approaches, focusing on equipping patients with the skills needed to promote and change their behavior.[21]

In Poland, however, there is no standardized diabetes education model for people with T2D. In addition, few scientific studies have evaluated the effectiveness of diabetes education in the country, and most of these dealing with the issue have analyzed short diabetes education programs, i.e. those lasting only one or several days and containing no more than two hours of contact time with the patient.[22-24]

A key strength of our study is the fact that the education program was implemented by a multidisciplinary care team over a six-month period (26 weeks). The Świętokrzyskie Voivodship was chosen for the present study as this area has demonstrated the greatest interest in diabetes education programs among diabetes patients and their families (94.6%) compared to the rest of the country (mean interest 74%).[25]

Limitations of this study include significant differences in treatment methods between the study and control groups, with more patients in the control group being treated with insulin than in the study group; this may explain the more favorable clinical data observed in patients from the study group at the end of the program.

Additionally, after the program was concluded, it was not possible to conduct a follow-up study to assess the long-term sustainability of the education program's effects, e.g., 6 months after its completion. Assessing the durability of the observed changes in health behaviors over time would be a valuable complement to this study.

Conclusion

Our study demonstrates that participation in a 26-week multidisciplinary diabetes education program may be associated with improved patient outcomes compared to traditional outpatient clinic visits alone. The observed improvements, including reductions in fasting glucose, HbA_{1c}, triglyceride levels, and body weight, may contribute to a decreased risk of chronic complications in T2D.

Such education programs are vital in diabetes management, especially in its early stages, before the late complications of diabetes can develop. Consistent with previous research, comprehensive diabetes education is crucial for increasing and sustaining the long-term effectiveness of such interventions.[26]

Consequently, Polish health authorities are encouraged to enhance access to structured education programs for patients with T2DM to optimize treatment outcomes and prevent development of chronic complications.

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Tables

Table 1. Metabolic and anthropometric characteristics of study and control group before (0 week) and after the program (26 week)

Characteristic	Minimum				Maximum				Mean				SD				P-value		
	Study group		Control group		Study group		Control group		Study group		Control group		Study group		Control group		Study v control 0 week	Study v control 26 week	Study 0 week v 26 week
	0 week	26 week	0 week	26 week	0 week	26 week	0 week	26 week	0 week	26 week	0 week	26 week	0 week	26 week	0 week	26 week			
Fasting glucose [mg/dl]	91	84	66	114	256	230	323	339	134.8	124.5	149.6	177.0	29.7	23.9	60.5	23.9	NS	<0.001	<0.001
HbA1C [%]	5.0	5.18	5.1	4.40	12.8	11.21	14.9	11.50	7.17	6.85	7.39	7.52	1.06	1.12	1.64	1.12	NS	0.010	0.005
TC [mg/dl]	114	105	82	130	310	264	308	303	202.4	191.1	193	197.6	39.3	35.4	44.7	35.4	NS	NS	0.003
LDL [mg/dl]	20	22	40	16	210	188	199	188	121.8	112.9	118.3	109.2	34.4	32.6	38.2	32.6	NS	NS	0.024
HDL [mg/dl]	29	32	24	37	95	82	72	74	53.7	50.3	46.3	52.3	12.7	10.7	10.8	10.7	0.001	NS	0.006
TG [mg/dl]	46	42	54	55	565	402	635	772	148	138.1	177.4	180.6	78.6	55.6	115.5	55.6	NS	0.008	NS
Body weight [kg]	54	51	55	56	135	132	119	118	82.6	78.5	84	85.7	14.3	14.5	14.1	14.5	NS	0.002	<0.001
BMI [kg/m²]	21.08	19.95	21.55	22.20	47.83	46.85	39.45	39.82	30.92	29.47	30.15	30.74	4.87	4.99	4.37	4.99	NS	NS	<0.001
Waist circumference [cm]	82	80	76	76	148	146	137	130	108.2	102.3	106.7	107.6	12.3	12.5	12.1	12.5	NS	0.008	<0.001
Hip circumference [cm]	95	93	90	90	158	157	140	140	115.3	110.6	114.3	115.5	10.5	10.9	10.8	10.9	NS	0.007	<0.001
WHR	0.74	0.74	0.79	0.79	1.15	1.18	1.14	1.13	0.94	0.93	0.94	0.93	0.08	0.07	0.09	0.07	NS	NS	<0.001
Systolic blood pressure [mm Hg]	102	95	95	85	185	182	180	180	144	139.5	129.7	144.0	19.7	15.7	18.9	15.7	0.001	NS	0.001
Diastolic blood pressure [mm Hg]	54	54	60	60	110	95	100	120	81.2	75.7	76.1	84.8	10.8	8.5	11	8.5	0.003	<0.001	<0.001

Abbreviations: TC – Total Cholesterol, LDL – Low Density Lipoprotein, HDL – High Density Lipoprotein, TG – Triglyceride, BMI – Body Mass Index, WHR – Waist-to-Hip Ratio, NS – Not Significant.

Table 2. Assessment of educational needs in the study group

Subject	0 week				13 week				26 week				P-value
	Min	Max	Mean	SD	Min	Max	Mean	SD	Min	Max	Mean	SD	0 vs 26 week
Risk factors for T2D	5.0	10.0	**9.84**	0.62	2.0	10.0	**7.38**	2.09	1.0	9.0	**3.90**	1.56	<0.001
Pathogenesis	6.0	10.0	**9.85**	0.59	2.0	10.0	**7.19**	2.23	1.0	10.0	**3.77**	1.58	<0.001
Treatment methods	8.0	10.0	**9.95**	0.26	1.0	10.0	**7.20**	2.36	1.0	9.0	**3.97**	1.55	<0.001
Self-control and self-management strategies	7.0	10.0	**9.89**	0.45	1.00	10.0	**7.08**	2.42	1.0	10.0	**3.57**	1.60	<0.001
Nutrition in diabetes	9.0	10.0	**9.99**	0.09	4.00	10.0	**9.00**	1.47	1.0	10.0	**6.97**	2.64	<0.001
Physical activity for people with T2D	6.0	10.0	**9.92**	0.50	1.00	10.0	**8.67**	2.02	1.0	10.0	**7.79**	2.19	<0.001
Diabetes complications	8.0	10.0	**9.92**	0.33	1.00	10.0	**7.35**	2.27	1.0	10.0	**4.12**	1.46	<0.001
Prognosis	5.0	10.0	**9.81**	0.75	2.00	10.0	**7.16**	2.25	1.0	9.0	**4.04**	1.40	<0.001
Psychological support in diabetes	5.0	10.0	**9.87**	0.61	1.00	10.0	**6.50**	2.64	1.0	10.0	**3.50**	1.91	<0.001
Pharmacology	1.0	10.0	**9.74**	1.01	1.00	10.0	**6.25**	2.66	1.0	9.0	**2.87**	1.33	<0.001
Herbs and dietary supplements	1.0	10.0	**9.65**	1.45	1.00	10.0	**6.17**	2.86	1.0	9.0	**2.80**	1.40	<0.001

Table 3. Assessment of patients' attitude toward diabetes

Field	0 week	13 week	26 week	P-value	Comment
Awareness of diabetes management (questions no. 1, 13, 15, 16)	3.794 ± 0.753	3.895±0.668	3.993±0.573	0.018	1 < 3 (p = 0.041)
Self-control (questions no. 3, 8, 11)	3.883±1.232	4.026±0.857	4.465±0.748	< 0.001	1 < 3 (p < 0.001) 2 < 3 (p < 0.001)
Compliance with the therapeutic team's recommendations (questions no. 2, 4, 5, 6, 7, 9, 10)	3.336±1.083	3.461±0.974	3.811±0.801	< 0.001	1 < 3 (p < 0.001) 2 < 3 (p < 0.001)
Coping with diabetes (questions no. 12, 14, 17, 18)	2.480±0.878	2.798±0.819	2.829±0.871	0.001	1 < 3 (p = 0.004) 1 < 2 (p = 0.014)
Total mark for all questions	3.633±0.714	3.646±0.604	3.860±0.490	< 0.001	1 < 3 (p = 0.004) 2 < 3 (p < 0.001)

Supplemental Material

Questionnaire No. 2

Please choose the answer in each sentence that the best describes your thoughts and behavior:
□ no □ not really □ it is difficult to say (neither yes nor no) □ I think so □ definitely

1. I think that my behavior has a significant influence on the course of my diabetes.

2. I think it is the diabetologist's responsibility to consistently enforce their recommendations concerning my health and my diabetes.

3. I regularly measure my blood glucose level because I know it is an important element of my diabetes treatment.

4. I always adhere to dietary recommendations set by the dietitian.

5. After being diagnosed with type 2 diabetes, I regularly engage in physical exercises recommended by the diabetologist because I understand that systematic physical activity is important for managing my diabetes.

6. I follow a proper diet because I know it is an important part of diabetes management and contributes to the improvement of my mood.

7. I regularly attend check-ups at the diabetes outpatient clinic.

8. I follow my diabetologist's recommendations and regularly measure blood glucose, writing down the results in a self-monitoring diary, even when I am not inclined to do so.

9. Every day I follow the diet recommended by the dietitian because I know that it allows me to maintain my health and well-being for longer.

10. The diabetologist recommended that I do systematic physical exercises; I do them, albeit sometimes reluctantly.

11. I regularly check my blood glucose levels because my doctor has instructed me to do so.

12. At times, I deviate from the recommended diet and alter results in my self-monitoring diary, fearing the diabetologist's or nurse's reaction.

13. I make regular visits to the diabetes outpatients clinic as my health depends both on my engagement and the diabetologist's expertise. I find the doctor's recommendations and advice helpful.

14. Adhering strictly to my diet presents challenges, as I have to give up my favorite dishes. So I break the nutritional guidelines now and again to cheer myself up.

15. I try to find out as much as possible about my diabetes by reading publications on the disease.

16. My knowledge about type 2 diabetes comes exclusively from my doctor, whose advice I trust completely, so I don't have to educate myself on this subject.

17. I prefer not to seek additional information about diabetes, relying on my doctor's expertise.

18. I avoid learning about potential diabetes complications to prevent future worries.

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