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THE EFFECT OF EDUCATION IN SELF-MANAGEMENT PRINCIPLES ON THE QUALITY OF LIFE OF PATIENTS WITH TYPE 2 DIABETES MELLITUS

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Background. Type 2 diabetes mellitus (T2DM) is one of the most prevalent chronic diseases, exerting a substantial negative impact on patients' quality of life (QoL). Education on the basics of diabetes self-management can improve treatment adherence and enhance QoL.

Objective. To assess the effect of diabetes self-management education on the QoL of patients with T2DM, based on the Audit of Diabetes-Dependent Quality of Life (ADDQoL) questionnaire results.

Materials and methods. The study included 140 patients with T2DM. Patients were divided into four subgroups according to cognitive status and participation in diabetes self-management education. QoL was assessed using the ADDQoL questionnaire at baseline and after 12 months.

Results. At baseline, the average weighted impact (AWI) scores were: Ia – –1.72 ± 0.41; Ib – –1.58 ± 0.40; IIa – –1.45 ± 1.61; IIb – –1.32 ± 1.49. After 12 months, a deterioration in AWI was observed in the subgroups without education (Ia: to –2.35 ± 0.43; $p < 0.05$; IIa: to –1.88 ± 1.90; $p > 0.05$), whereas patients who participated in the self–management program demonstrated a significant improvement (Ib: to –1.04 ± 0.31; IIb: to –0.79 ± 1.40; $p < 0.05$). A negative correlation was found between glycated haemoglobin (HbA1c) and QoL ($r = –0,28$; $p < 0,05$) as well as between body mass index (BMI) and QoL ($r = –0,25$; $p < 0,05$), as well as a direct correlation between cognitive functions and QoL ($r = 0,17$; $p < 0,05$).

Conclusions. T2DM has a negative impact on all QoL domains assessed by the ADDQoL questionnaire. Implementation of diabetes self-management education leads to statistically significant improvements in QoL and should be an integral part of the management of such patients.

Keywords: type 2 diabetes mellitus; self-management education; quality of life; glycemic control.

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ВПЛИВ НАВЧАННЯ ОСНОВ САМОКОНТРОЛЮ НА ЯКІСТЬ ЖИТТЯ ПАЦІЄНТІВ ІЗ ЦУКРОВИМ ДІАБЕТОМ 2-ГО ТИПУ

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У статті досліджено вплив навчання основам самоконтролю діабету на якість життя (ЯЖ) пацієнтів із цукровим діабетом (ЦД) 2-го типу. У дослідження включено 140 пацієнтів. З урахуванням наявності когнітивних порушень (КП) і участі в навчанні сформовано чотири підгрупи (Ia, Ib, IIa, IIb). Показник ЯЖ оцінювали за допомогою опитувальника «Аудит діабет-залежної ЯЖ» (Audit of Diabetes-Dependent Quality of Life, ADDQoL). Через 12 місяців у підгрупах (Ia, IIa), які не проходили навчання, спостерігалося погіршення середньозваженого показника впливу діабету (AWI) (Ia: до –2,35 ± 0,43; $p < 0,05$; IIa: до –1,88 ± 1,90; $p > 0,05$), тоді як у пацієнтів у підгрупах (Iб, IIб), які проходили навчання, відзначалося значуще покращення AWI (Iб: до –1,04 ± 0,31; IIб: до –0,79 ± 1,40; $p < 0,05$). Встановлено негативний кореляційний зв'язок між рівнем глікованого гемоглобіну (HbA1c) ($r = –0,28$; $p < 0,05$) та індексом маси тіла (ІМТ) ($r = –0,25$; $p < 0,05$) і показниками ЯЖ, а також прямий – між когнітивними функціями та ЯЖ ($r = 0,17$; $p < 0,05$). Таким чином, впровадження навчання основ самоконтролю діабету забезпечує статистично значуще покращення показників ЯЖ і має бути невід'ємною частиною ведення таких пацієнтів.

Ключові слова: цукровий діабет 2-го типу, навчання самоконтролю, якість життя, глікемічний контроль.

Introduction

Among chronic non-communicable diseases, type 2 diabetes mellitus (T2DM) occupies one of the leading positions, with its prevalence continuously increasing worldwide, including in Ukraine [1].

The course of T2DM is accompanied by persistent metabolic disorders, a high risk of macrovascular and microvascular complications, and a significant impact on all aspects of patients' lives [2]. The results of numerous clinical studies demonstrate that achieving glycemic control is essential for preventing the development of diabetes complications [3; 4]. At the same time, the modern management strategy for patients with T2DM should take into account not only glycemic control but also ensuring an adequate quality

of life (QoL) as one of the key indicators of treatment effectiveness [5].

According to the World Health Organization, QoL is an individual's perception of their position in life in the context of the culture and value system in which they live, and in relation to their goals, expectations, standards, and concerns. The main components of QoL include physical, emotional well-being, independence, social relationships, environmental conditions, and spiritual aspects. Some authors also include the sense of satisfaction and personal happiness within the QoL concept structure. C. Bradley, one of the recognized experts in QoL research, notes in a brief annotation to the ADDQoL questionnaire for patients that QoL is "how good or bad your life is, according to your own feelings" [6].

QoL questionnaires are classified into general ones, i.e., universal instruments applicable to various diseases, and disease-specific ones developed for particular nosologies or medical fields [7].

In patients with T2DM, QoL deterioration occurs not only due to the manifestations and complications of the disease itself, but also due to the need for constant self-monitoring, adherence to a healthy diet, regular medication intake, lifestyle restrictions, as well as the development of chronic anxiety, depression, and reduced self-esteem [8].

Symptoms of hypo- or hyperglycemia and the presence of late complications of T2DM may lead to emotional exhaustion, anxiety-depressive disorders, and, consequently, reduced treatment adherence [9].

In turn, non-adherence to therapeutic recommendations leads to worsening glycemic control, an increased risk of complications, hospitalizations, and further deterioration in QoL. Thus, there is a bidirectional relationship between diabetes and QoL: diabetes reduces QoL, while decreased QoL complicates disease management and impairs self-control [9].

Therefore, QoL issues are fundamentally important in managing patients with T2DM. They play a key role in shaping treatment adherence, the ability to control the disease course, and maintaining sustained physical and psychosocial well-being.

The aim of the study was to evaluate the impact of education in diabetes self-management principles on the quality of life of patients with type 2 diabetes mellitus using the ADDQoL questionnaire.

Materials and Methods

The study was conducted at the Department of Family Medicine, General Practice, and Outpatient Therapy of the Odesa National Medical University. All patients provided informed consent to participate in the study, which was conducted in accordance with the principles of the Ethical Code of the World Medical Association (Declaration of Helsinki). The Bioethics Committee of the Odesa National Medical University approved the study (Protocol No. 29 dated 12.04.2021).

During the study, the results of psychometric testing, clinical and laboratory examinations, and anamnesis data of 140 patients with a primary diagnosis of T2DM and obesity were analyzed.

Participants were assigned to study groups according to cognitive status and participation in a self-management education program. Group I (n = 81) included patients with mild to moderate cognitive impairment. Group II (n = 59) comprised patients without cognitive impairment (CI). Within each group, subgroups were formed according to participation in diabetes self-management education. Subgroup Ia (n = 40) included patients with CI who received standard treatment only, whereas Subgroup Ib (n = 41) consisted of patients with CI who, in addition to standard therapy, completed self-management education. Subgroup IIa (n = 29) comprised patients without CI who received standard treatment without educational intervention, and Subgroup IIb (n = 30) included patients who, alongside standard therapy, participated in the diabetes self-management education program.

The study was conducted according to inclusion and exclusion criteria. Inclusion criteria: informed consent; a prior endocrinologist-verified diagnosis of T2DM not requiring insulin therapy; HbA1c level up to 9.5%; age 25–60 years; availability of a glucometer. Exclusion criteria: refusal to participate; acute or exacerbated chronic comorbidities; T2DM requiring insulin therapy; type 1 diabetes and other diabetes types; mental disorders, dementia; hormonal disorders contributing to weight gain; intake of medications affecting weight gain; pregnancy.

All patients underwent a questionnaire survey and a general clinical examination. To assess QoL, the standardized ADDQoL questionnaire was used. Permission to use the Ukrainian-language version of the questionnaire was obtained from C. Bradley, and License Agreement No. SV 1247 was signed.

The ADDQoL questionnaire was developed by C. Bradley in 1999 [6]. It consists of 2 general and 19 specific domains that cover key aspects of life potentially affected by diabetes. Scores in each domain may range from −9 (the most negative impact) to +9 (the most positive impact); 0 indicates no impact.

The ADDQoL questionnaire includes the following life domains: "leisure," "work," "journeys," "holidays," "physical," "family life," "friendship and social life," "personal relationship," "sex life," "physical appearance," "self-confidence," "motivation," "reactions of other people," "feelings about the future," "financial situation," "living conditions," "depend on others," "freedom to eat," and "freedom to drink" [10].

Statistical analysis was performed using licensed software Microsoft Excel 2019 and Statistica 23.0.0.0. Quantitative variables were described using the mean (M) and standard deviation (±SD). Changes in indicators (Δ) were presented as mean values and standard error of the mean (±SE). The significance of differences in categorical variables was assessed using Pearson's χ^2 test, and differences in mean values were evaluated using Student's t-test. A p-value < 0.05 was considered statistically significant. Correlations were assessed using Pearson's correlation coefficient (r).

Research results and their discussion

The study included 140 patients with type T2DM, with a mean age of 53.99 ± 4.14 years. The mean duration of

the disease at enrollment was 8.08 ± 6.05 years. Women accounted for 61.43% of the study population. The mean HbA1c level was 7.61 ± 1.06%.

Approximately half of the participants had higher education (45.70%). At the time of examination, 66 patients (47.14%) had permanent or temporary employment.

Most patients included in the study rated their diabetes-unrelated QoL (the first general question of the ADDQoL questionnaire) as "good" or "neutral" ("neither good nor bad") (Table 1). In Subgroup Ia, the mean ADDQoL score at baseline was 0.28 ± 0.91 and −0.06 ± 1.39 – after 12 months ($p > 0.05$); in Subgroup Ib – 0.51 ± 0.95 and 0.92 ± 1.09, respectively ($p > 0.05$); in Subgroup IIa – 0.21 ± 0.98 at baseline and −0.20 ± 1.19 – after 12 months ($p > 0.05$); in Subgroup IIb – 0.20 ± 1.06 and 1.07 ± 1.03, respectively ($p < 0.05$).

When analyzing the responses of patients to the second general question of the ADDQoL questionnaire, it was found that the presence of diabetes significantly worsened their QoL. Before the intervention, most respondents believed that their life would be "a little better" (Ia – 47.50%; Ib – 53.66%; IIa – 55.17%; IIb – 60.00%) or "much better" without diabetes (Ia – 45.00%; Ib – 39.02%; IIa – 31.03%; IIb – 26.67%) (Table 2). At baseline, the mean score in Subgroup Ia was −1.38 ± 0.63, and after 12 months of follow-up −1.19 ± 0.82 ($p > 0.05$). In Subgroup Ib, the changes were statistically significant: −1.32 ± 0.61 at baseline and −1.15 ± 0.59 after 12 months of diabetes self-management education ($p < 0.05$). In Subgroup IIa, the scores were −1.17 ± 0.66 and −1.28 ± 0.61, respectively ($p > 0.05$), and in Subgroup IIb −1.13 ± 0.63 and −1.10 ± 0.77 ($p > 0.05$).

Thus, in patients who had diabetes self-management education, an improvement in diabetes-related QoL was observed after 12 months.

For a more detailed assessment, the Average Weighted Impact (AWI) score of diabetes on QoL was calculated using the ADDQoL questionnaire. The findings confirmed the negative impact of T2DM on QoL in all patients. At baseline, the mean AWI in Subgroup Ia was −1.72 ± 0.41,

Table 1

Dynamics of responses of patients with type 2 diabetes mellitus to the first general question of the ADDQoL questionnaire over a one-year period (%)

Overall, my quality of life now is:	Ia		Ib		IIa		IIb	
	Before	After 12 months	Before	After 12 months	Before	After 12 months	Before	After 12 months
excellent (+3 points)	0	0	0	0	0	0	0	0
very good (+2)	5.00	13.89	14.63	33.33*	10.34	4.00	13.33	41.38*
good (+1)	42.50	30.56	39.02	41.03	27.59	28.00	26.67	37.93
neither good nor bad (0)	27.50	11.11	29.27	15.38	34.48	32.00	26.67	6.90
bad (−1)	25.00	25.00	17.07	5.13*	27.59	16.00	33.33	13.79
very bad (−2)	0	19.44**	0	5.13	0	20.00*	0	0
extremely bad (−3)	0	0	0	0	0	0	0	0

Note: * – $p < 0.05$; ** – $p < 0.01$ – between indicators before and after 12 months within each subgroup.

Table 2

Dynamics of responses from patients with type 2 diabetes to the second general question of the ADDQoL questionnaire over a one-year period (%)

If I did not have diabetes, my quality of life would be:	Ia		Ib		IIa		IIb	
	Before	After 12 months	Before	After 12 months	Before	After 12 months	Before	After 12 months
very much better (−3 points)	0	0	0	0	0	0	0	0
much better (−2)	45.00	44.44	39.02	25.64	31.03	36.00	26.67	34.48
a little better (−1)	47.50	30.56	53.66	64.10	55.17	56.00	60.00	41.38
the same (0)	7.50	25.00*	7.32	10.26	13.79	8.00	13.33	24.14
worse (1)	0	0	0	0	0	0	0	0

Note: * – $p < 0.05$ – between indicators before and after 12 months within each subgroup.

in Subgroup Ib −1.58 ± 0.40, in Subgroup IIa −1.45 ± 1.61, and in Subgroup IIb −1.32 ± 1.49 (p > 0.05) (Fig. 1).

After 12 months of observation, the AWI in Subgroup Ia significantly decreased from −1.72 ± 0.41 to −2.35 ± 0.43 (p < 0.01), indicating a deterioration in QoL. In contrast, in Subgroup Ib a statistically significant increase in AWI was registered after 12 months of diabetes self-management education – from −1.58 ± 0.40 to −1.04 ± 0.31 (p < 0.01). In Subgroup IIa, AWI remained almost unchanged and stayed low throughout the entire follow-up – from −1.45 ± 1.61 to −1.88 ± 1.90 (p > 0.05). In Subgroup IIb, a statistically significant improvement was observed, with AWI increasing from −1.32 ± 1.49 to −0.79 ± 1.40 after 12 months of diabetes self-management education (p < 0.05).

Figures 2 and 3 present the analysis of changes in individual QoL domains in patients of Subgroups Ia and IIa, who received standard treatment without diabetes self-management education for one year. A tendency toward deterioration was observed in most QoL domains assessed by the ADDQoL scale.

Over 12 months, Subgroup Ia demonstrated a significant decline in 10 out of 19 domains (p < 0.05), whereas in Subgroup IIa statistically significant changes were observed only in several domains, although most parameters showed negative trends.

In Subgroup Ia, the most pronounced deterioration was detected in domains related to emotional and psychological well-being, namely: “self-confidence” (from −1.00 ± 1.50 to −2.11 ± 1.74; p < 0.05), “motivation” (from −1.25 ± 0.98 to −2.47 ± 2.10; p < 0.05), “reactions of other people” (from −0.38 ± 0.84 to −0.86 ± 1.40; p < 0.05), as well as “feelings about the future” (from −2.18 ± 1.85 to −2.89 ± 2.38; p < 0.05) and “depend on others” (from −3.13 ± 2.08 to −3.81 ± 1.95; p < 0.05).

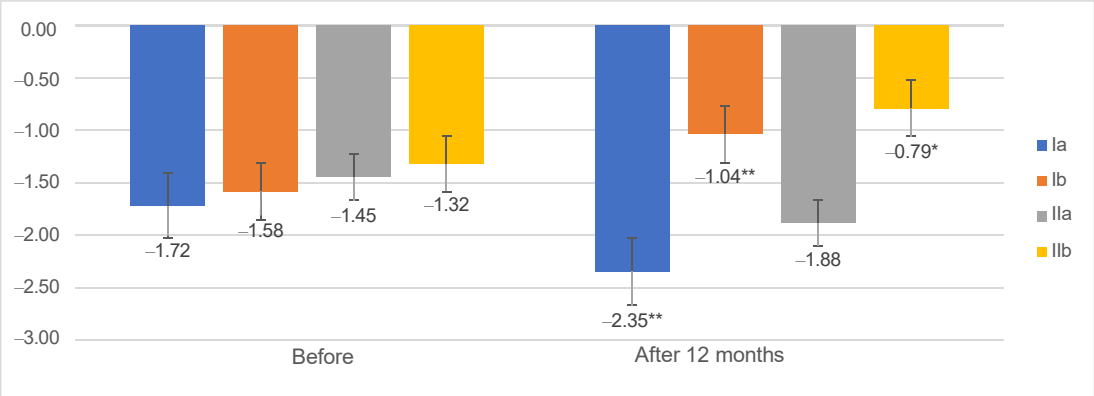

Fig. 1. Dynamics of the Average Weighted Impact of diabetes on patients’ quality of life according to the ADDQoL questionnaire at baseline and after 12 months of follow-up

Note: * – p < 0.05; ** – p < 0.01 – between baseline and 12-month measurements within each subgroup.

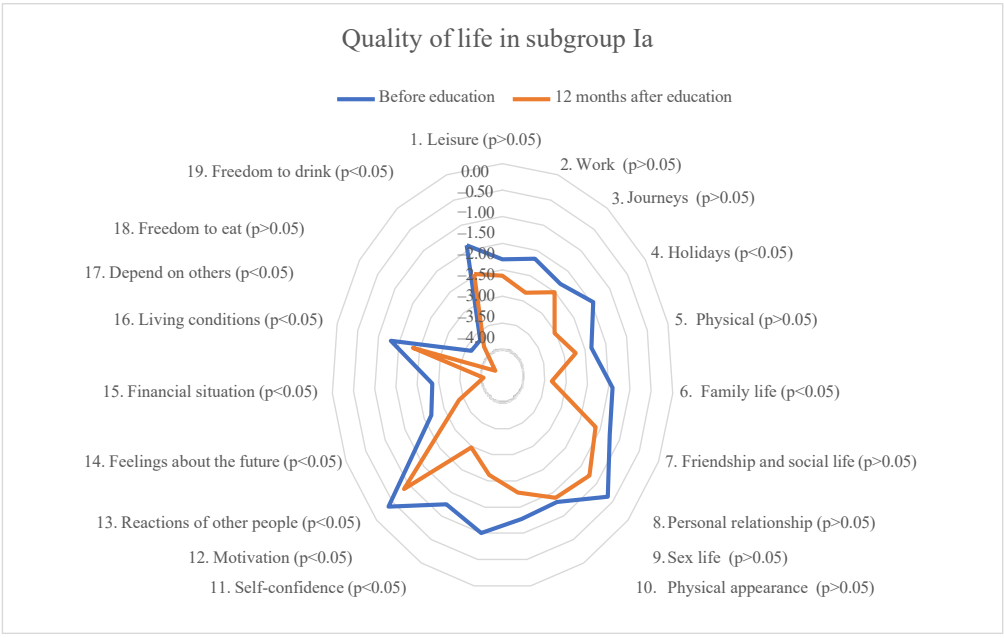

Fig. 2. Dynamics of the Average Weighted Impact scores for individual quality-of-life domains assessed using the ADDQoL questionnaire in patients of Subgroup Ia at baseline and after 12 months of follow-up

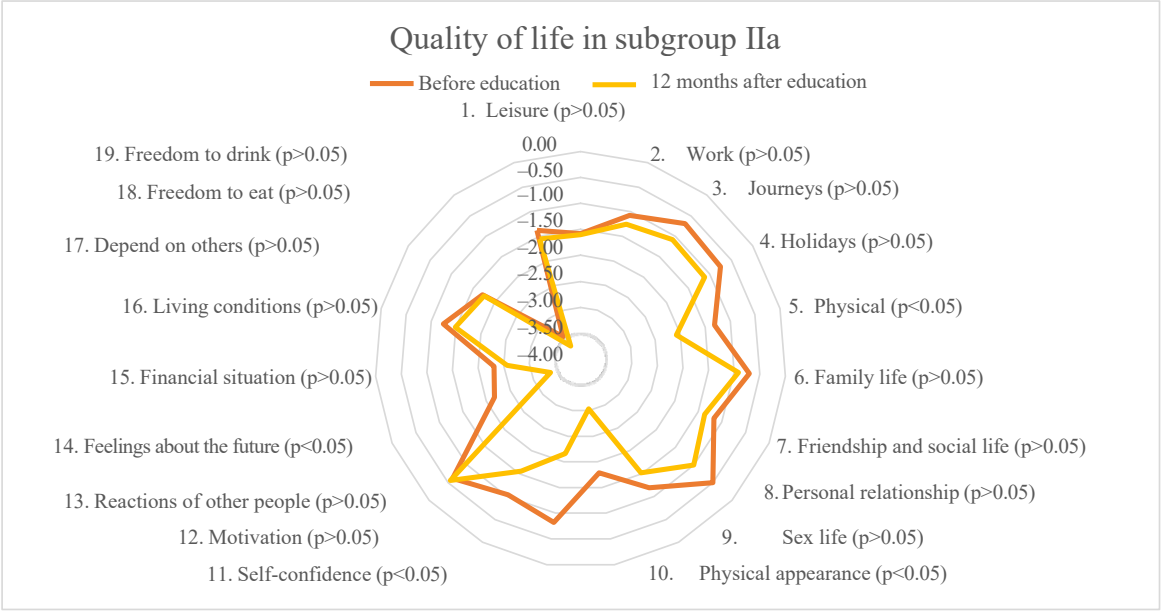

Fig. 3. Dynamics of the Average Weighted Impact scores for individual quality-of-life domains assessed using the ADDQoL questionnaire in patients of Subgroup IIa at baseline and after 12 months of follow-up

In Subgroup IIa, which also did not undergo diabetes self-management education, changes were less pronounced, specifically in the domains of "physical" (from −1.31 ± 1.44 to −2.08 ± 1.78; $p < 0.05$), "physical appearance" (from −1.79 ± 2.16 to −3.04 ± 2.24; $p = 0.05$), "self-confidence" (from −0.83 ± 1.56 to −2.16 ± 2.15; $p < 0.05$), and "feelings about the future" (from −2.17 ± 1.63 to −3.36 ± 1.87; $p < 0.05$).

In patients of Subgroups Ib and IIb, who completed diabetes self-management education, a pronounced improvement in QoL according to the ADDQoL scale was observed after 12 months. Figures 4 and 5 show that the most prominent positive changes occurred in the domains reflecting physical and psychological well-being. In both subgroups, significant improvements were recorded in the "physical" domain (Ib: from −1.71 ± 1.65 to −0.62 ± 1.73; $p < 0.05$; IIb: from −0.93 ± 1.36 to −0.52 ± 0.99; $p < 0.05$), "physical appearance" (Ib: from −1.07 ± 1.23 to −0.36 ± 0.90; $p < 0.05$; IIb: from −1.30 ± 1.97 to −0.52 ± 0.87; $p < 0.05$), as well as in "self-confidence" and "motivation" (both $p < 0.05$).

Significant improvement was also observed in socio-domestic domains, including "leisure," "work," "living conditions," "financial situation," and "feelings about the

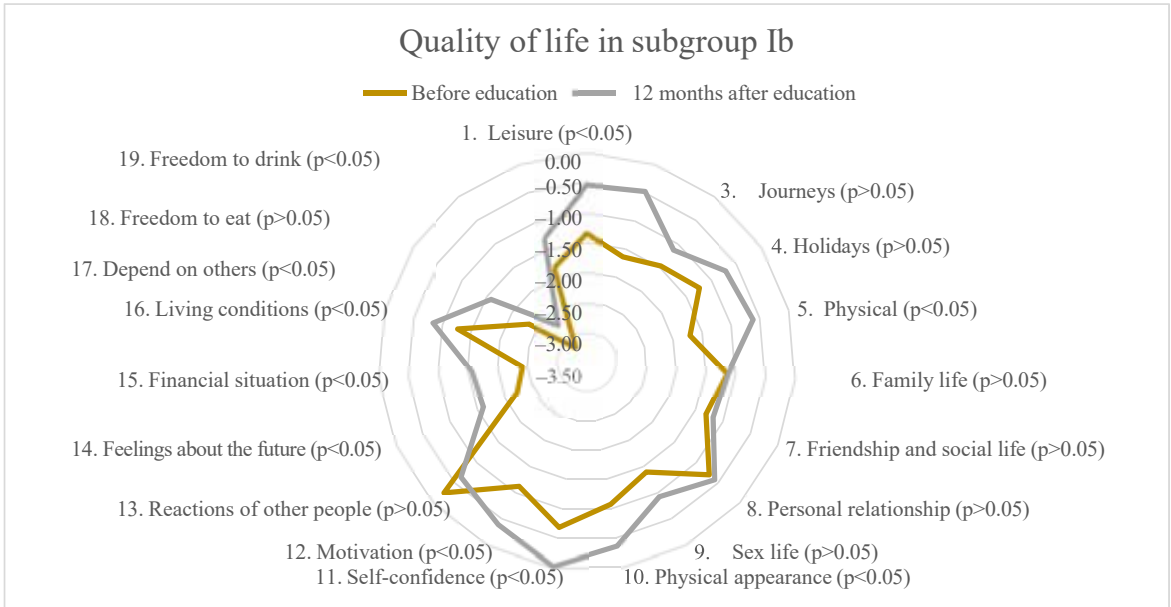

Fig. 4. Dynamics of the Average Weighted Impact scores for individual quality-of-life domains assessed using the ADDQoL questionnaire in patients of Subgroup Ib at baseline and after 12 months of diabetes self-management education

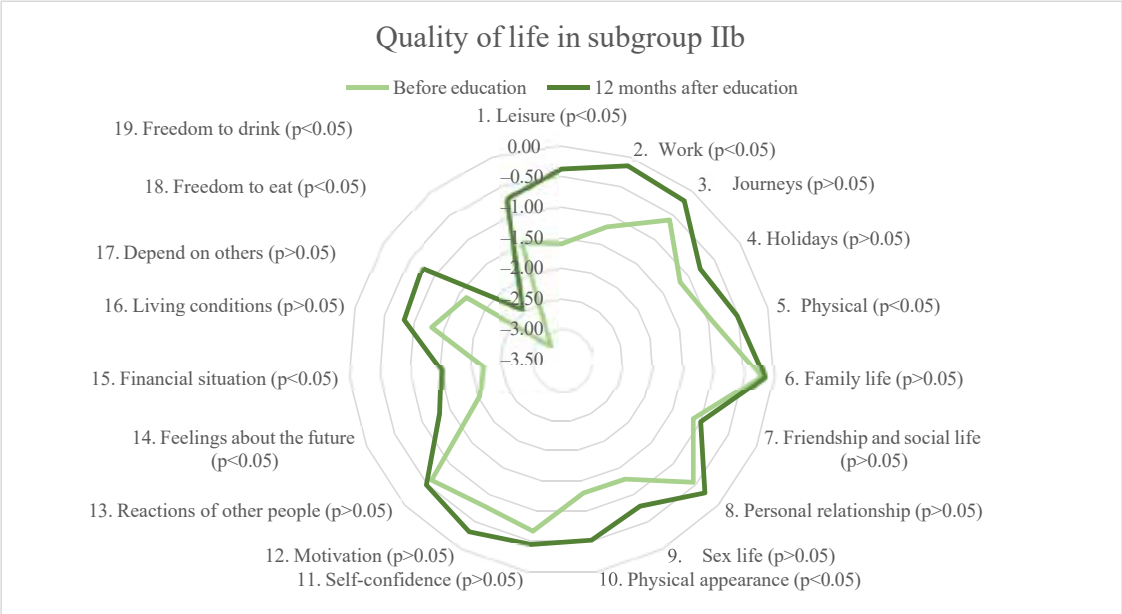

Fig. 5. Dynamics of the Average Weighted Impact scores for individual quality-of-life domains assessed using the ADDQoL questionnaire in patients of Subgroup IIb at baseline and after 12 months of diabetes self-management education

future." In Subgroup IIb, additional positive changes were noted in the domain of "freedom to eat" and "freedom to drink" ($p < 0.05$). At the same time, correlation analysis demonstrated an inverse relationship between HbA1c levels and patients' QoL: reductions in HbA1c were associated with improvements in ADDQoL scores. The strongest correlations were identified for the domains "motivation," "physical," and "self-confidence" ($r = -0.28$; $p < 0.05$). A negative correlation was also found between BMI and QoL scores on the ADDQoL questionnaire. The most pronounced associations were observed for the domains related to "physical" and "physical appearance" ($r = -0.25$; $p < 0.05$). In addition, higher cognitive function scores correlated with better QoL ratings ($r = 0.17$; $p < 0.05$).

It is important to note that the ADDQoL questionnaire includes five domains that patients may choose not to rate. If a response is not provided, the ADDQoL score is calculated without including these domains. In our study, patients expressed the least interest in the domains "work" ("not applicable" responses: 47.14%), "personal relationship" ("not applicable" responses: 39.29%), "sex life" ("not applicable" responses: 29.29%), "holidays" ("not applicable" responses: 22.14%), and "family life" ("not applicable" responses: 10.71%).

The results obtained in our study indicate that patients with type 2 DM assess their QoL related to the presence of a chronic disease as low, whereas their overall QoL not related to diabetes was good or neutral. Our data also confirm that type 2 DM exerts an adverse impact on all 19 QoL domains assessed using the ADDQoL questionnaire.

The impact of diabetes on AWI differed across individual domains. The most unfavorable impact was observed in such aspects of life as "freedom to eat," "depend on others," and "financial situation" in patients of Subgroups Ia and Ib; and "freedom to eat," "financial situation," and "feelings about the future" in patients of Subgroups IIa and IIb. The least pronounced impact of type 2 DM was found for the domains "reactions of other people," "personal relationship," and "self-confidence" in Subgroups Ia and Ib, and "personal relationship," "reactions of other people," and "family life" in Subgroups IIa and IIb.

The results of this study are consistent with the literature data [11]. Thus, in the study by S. Krzemińska et al. (2020), which conducted a comparative analysis of the impact of type 2 DM on QoL in patients in Poland, the Czech Republic, and Slovakia, diabetes was shown to negatively affect all 19 ADDQoL domains. The most unfavorable impact was observed for the domains "freedom to eat," "freedom to drink," and "feelings about the future" in Polish and Czech patients, as well as "freedom to eat," "feelings about the future," and "freedom to drink" in Slovak patients. The least affected domains were "living conditions," "reactions of other people," and "leisure" in Polish and Czech patients, and "living conditions," "reactions of other people," and "friendships and social life" in Slovak patients.

In the study by P. Kumar et al. (2018), it was demonstrated that higher HbA1c levels in patients with type 2 DM were associated with bader QoL [12].

Our results align with current scientific evidence confirming the importance of an individualized approach to glycemic monitoring in patients with type 2 DM. In particular, Kiforenko et al. (2021) proposed an algorithm for predicting the glycemic profile based on mathematical modeling, which optimizes the frequency of measurements and increases the accuracy of assessing glycemic variability. This approach allows more precise disease control and significantly improves patients' well-being and QoL [13].

In turn, Mankovsky et al. (2021) described a clinical case of continuous glucose monitoring (CGM) use in a patient with ischemic heart disease and type 2 DM,

which demonstrated the ability of this technology to detect episodes of hypoglycemia and hyperglycemia not identifiable with traditional self-monitoring. The authors emphasize that the introduction of CGM improves the effectiveness of antihyperglycemic therapy, reduces the risk of complications, and enhances both the physical and psycho-emotional components of QoL [14].

These findings are consistent with our results, which confirm the importance of systematic glycemic control in improving patients' QoL.

Several studies [15–18] have demonstrated that the implementation of educational programs for patients with type 2 DM not only increases their awareness of the disease and self-management skills but also leads to significant improvements in QoL indicators. Our results align with these findings: in the subgroups of patients who underwent diabetes self-management education, QoL improved across all domains.

Conclusions

In our study, it was established that type 2 DM has a negative impact on all aspects of QoL, as confirmed by the ADDQoL questionnaire. The most pronounced negative impact at baseline was recorded in the domains "freedom to eat" (−3.15 ±3.08; −3.20 ± 3.07; $p > 0.05$), "depend on others" (−3.13 ± 2.08; −2.34 ± 2.10; $p > 0.05$), and "financial situation" (−2.35 ± 2.07; −2.41 ± 2.06; $p > 0.05$) in Subgroups Ia and Ib, respectively; and "freedom to eat" (−3.45 ± 2.98; −3.20 ± 2.71; $p > 0.05$), "financial situation" (−2.31 ± 1.73; −2.20 ± 1.56; $p > 0.05$), and "feelings about the future" (−2.17 ± 1.63; −2.03 ± 1.71; $p > 0.05$) in Subgroups IIa and IIb, respectively.

It was found that diabetes self-management education significantly improves patients' QoL. In Subgroup Ib, AWI increased from −1.58 ± 0.40 to −1.04 ± 0.31 ($p < 0.05$). In Subgroup IIb, AWI improved from −1.32 ± 1.49 to −0.79 ± 1.40 ($p < 0.05$). In patients who did not receive diabetes self-management education (Subgroups Ia and IIa), QoL deteriorated over the year: in Subgroup Ia, AWI decreased from −1.72 ± 0.41 to −2.35 ± 0.43 ($p < 0.05$). In Subgroup IIa, AWI changed from −1.45 ± 1.61 to −1.88 ± 1.90 ($p > 0.05$).

An inverse correlation was identified between HbA1c level ($r = −0.28$; $p < 0.05$) and BMI ($r = −0.25$; $p < 0.05$) and QoL indicators, as well as a direct correlation between cognitive function and QoL ($r = 0.17$; $p < 0.05$).

Thus, the results of the study show that diabetes self-management education has a significant impact on improving QoL in patients with type 2 DM.

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