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THE EFFECT OF DIABETES SYMPTOMS ON QUALITY OF LIFE IN INDIVIDUALS WITH TYPE 2 DIABETES

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Abstract

Objective. This study aimed to investigate the effect of symptoms of diabetes on the quality of life of individuals with Type 2 diabetes.

Method. The study used a cross-sectional design. No sampling procedure was employed in the study; instead, 410 individuals presenting to the Balikesir Atatürk City Hospital Endocrinology and Internal Medicine Polyclinics between December 2016 and July 2017, diagnosed with Type 2 diabetes, and meeting the inclusion criteria were enrolled in the study sample. The study data were collected with a "Socio-demographic Characteristics Questionnaire", the "Diabetes Symptom Checklist", and the "SF-36 Quality of Life Questionnaire".

Results. The participants obtained the highest mean scores from the hyperglycemia subscale of the Diabetes Symptoms Checklist (3.35±0.60) and the mental health subscale of the SF-36 Quality of Life Questionnaire (50.65±8.10). The hypoglycemia, cardiology, psychology, and neurology variables included in the model were statistically significant and predicted 35% of the mental subscale score of the SF 36 questionnaire. SF 36 physical subscale score increased as the hypoglycemia, cardiology, psychology, and neurology scores decreased ($p<0.05$).

Conclusion. The participants obtained high scores from the hyperglycemia subscale of the diabetes symptom checklist and mental health subscale of the quality of life questionnaire. Diabetes symptoms were found to affect the quality of life of individuals with diabetes.

Keywords: diabetes, diabetes symptoms, quality of life.

INTRODUCTION

Diabetes mellitus is a life-threatening complex chronic disease like heart disease, stroke, and renal failure (1-4). At present, 415 million individuals worldwide have diabetes, and this number is predicted to rise to 642 million by 2040 (5). According to the results of the Turkey Diabetes Epidemiology Study (TURDEP-I and II), the incidence of diabetes in adults aged 20 and older in Turkey between 1998 and 2010 increased from 7.2% to 13.7% (6).

Quality of life in diabetes is accepted as an important indicator of the course of the disease and the patient's well-being, and evaluation of life quality in people with diabetes has become important in recent years (7). Quality of life in individuals with type 2 diabetes varies depending on complications, presence of other diseases, and the duration of the disease (8-10). While there are studies in the literature often evaluating symptoms of diabetes and patients' depression, pain, and fatigue levels, there is limited research into the quality of life of patients (11-13).

Defining the life quality of people with diabetes, determining the factors that affect the quality of life, guiding and giving support to patients with diabetes, reducing the complications of the disease, and determining the quality of life and determinants of the quality of life are important in improving the quality of health services, increasing patient satisfaction, and especially reducing health expenditures.

This study aimed to investigate the relationship between the symptoms of diabetes and quality of life in individuals with Type 2 diabetes who presented to the hospital in Balikesir province located in the Southern Marmara Region of Turkey.

METHODS

Designed in the cross-sectional type, the study was carried out in two state hospitals in the central county of Balikesir Province.

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Study Group

The central county of Balikesir province has a population of 350.000 people, and there are four hospitals in the city including two state hospitals, a private hospital, and an university hospital. The sample size required for the study was calculated on G*POWER 3.1.9.2 statistical analysis software based on a 5% type I error, 85% power, and 4% effect size. As a result, the sample size was calculated as 388 subjects. The study was carried out with 410 individuals who presented to the Endocrinology and Internal Medicine Polyclinics of the two public hospitals in the central county of Balikesir province between December 2016 and July 2017, received treatment in the internal medicine clinic, were diagnosed with Type 2 diabetes, and met the inclusion criteria.

Study Variables

The variables of the study consisted of quality of life score (SF-36) as the dependent variable and the Diabetes Symptom Checklist as the independent variable.

Data Collection

The research data were collected through face-to-face interviews by using a 10-item Socio-demographic Characteristics Questionnaire, the Diabetes Symptom Checklist-Revised (DSC-R) scale, and SF-36 Quality of Life Questionnaire.

The Diabetes Symptom Checklist-Revised (DSC-R)

Developed by Grootenhuis *et al.* (1994) and adapted to Turkish by Terkes (2016), the Diabetes Symptom Checklist-Revised (DSC-R) is a 34-item scale with six subscales including Hypoglycemia, Hyperglycemia, Cardiology, Ophthalmology, Psychology, and Neurology (14, 15). It is a 6-point Likert type scale with responses ranging between "0 - Not at all" and "5 - extremely troublesome". Cronbach's alpha coefficient of the original scale varies between 0.70 and 0.90. The alpha value was found as 0.84 in this study.

The Quality of Life Questionnaire

The scale was developed by Ware (1987) to examine health status and quality of life. It was adapted to the Turkish context by Pinar (1995) (16, 17). It is a multi-item scale that consists of 36 statements. It assesses eight health concepts (physical function, limitation in the physical role, limitation in the emotional role, vitality (energy/fatigue), mental health, (social functioning, pain, and general health) under two main dimensions (physical and mental dimensions). The scores that can be obtained from the scale range between 0 and 100. High scores from the scale show a high quality of life, while low scores from the scale show a low quality of life.

Inclusion Criteria

- Being diagnosed with type 2 diabetes,
- Having no mental or physical disability to answer questions,
- Presenting to the related health institutions within the dates when the study was being carried out, and
- Agreeing to participate in the study.

Statistical Analysis

Numbers, percentages, mean scores, and standard deviation values were used for presenting the descriptive characteristics of the data. Since the normal distribution of continuous variables was ensured, Pearson's correlation analysis was used to determine whether there was a relationship between the scale scores. The causality between the physical and mental subscales of the SF 36 scale and the subscales of the diabetes symptoms scale was analyzed using multivariate regression analysis. SPSS 25.0 statistical software package was used for the analyses, and the type I error level was accepted as 0.05.

Ethical Approval

At the outset, the institutional approval of the Balikesir Public Hospitals Association and the ethics committee approval of Balikesir University Faculty of Medicine Clinical Research Ethics Committee (2016/07) were obtained.

RESULTS

Of the study group, 62.4% were female, 44.4% were primary school graduates (8 years of education), 44.1% were living in the city center, 49.3% were using oral antidiabetic drugs, 66.3% had diabetic complications, and 42.7% were people who perceived their compliance with diabetes treatment as good. The mean scores of the participants for the subscales of DSC-R were hypoglycemia (2.07 ± 0.27), hyperglycemia (3.35 ± 0.60), cardiology (2.15 ± 0.42), ophthalmology (2.11 ± 0.18), psychology (2.66 ± 0.21), and neurology (2.36 ± 0.16). On the other hand, mean

scores of the participants for the subscales of SF 36 were physical function (36.09 ± 3.27), limitation in the physical role (27.50 ± 6.12), limitation in the emotional role (28.86 ± 4.30), vitality (energy/fatigue)(40.63 ± 5.27), mental health (50.65 ± 8.10), social functioning (45.85 ± 2.67), pain (46.85 ± 3.28), general health (33.65 ± 4.61), physical dimension (36.02 ± 5.57), and mental dimension (41.50 ± 6.10) (Table 1).

The examination of the relationship between the subscales of DSC-R and the subscales of SF 36 in Table 2 indicated that there was a moderate correlation varying from -0.17 to -0.87 and that the correlation between the scales was high in the physical and mental health subscales. The highest correlation was found between the neurology subscale score of DSC-R and SF 36 physical subscale (r = -0.87, p = 0.001), and SF 36 mental subscale scores (r = -0.75, p = 0.001).

There was a moderate and significant negative correlation between physical subscale and hypoglycemia, a weak and significant negative correlation with hyperglycemia, a good and significant negative correlation with cardiology, a moderate and significant negative correlation with ophthalmology, a good and significant negative correlation with

Table 1. Some of the characteristics of the study group and their scores for the quality of life scale and diabetes symptom checklist scale (n=410)

		n (%)
Age	18-29	18 (4.4)
	30-64	222 (54.1)
	65+	170 (41.5)
Gender	Female	256 (62.4)
	Male	154 (37.6)
Level of Education	Illiterate	74 (18.0)
	Literate	69 (16.8)
	Elementary	182 (44.4)
	High school or higher	85 (20.7)
Place of residence	Village	172 (42.0)
	County	57 (13.9)
	Province	181 (44.1)
Treatment method	Oral anti-diabetic drug	202 (49.2)
	Insulin	81 (19.8)
	Insulin + oral anti-diabetic drug	127 (31.0)
Complication	Yes	272 (66.3)
	No	138 (33.7
Perceived compliance with the treatment	Good	175 (42.7)
	Medium	201 (49.0)
	Bad	34 (8.3)
		Mean ±SD
Diabetes Symptom Scale	Hypoglycemia	2.07±0.27
	Hyperglycemia	3.35±0.60
	Cardiology	2.15±0.42
	Ophthalmology	2.11±0.18
	Psychology	2.66±0.21
	Neurology	2.36±0.16
SF 36	Physical function	36.09±3.27
	Limitation in the physical role	27.50±6.12
	Limitation in the emotional role,	28.86±4.30
	Vitality (energy/fatigue)	40.63±5.27
	Mental health	50.65±8.10
	Social functioning	45.85±2.67
	Pain	46.85±3.28
	General health perception	33.65±4.61
	Physical dimension	36.02±5.57
	Mental dimension	41.50±6.10

SD: Standard deviation.

psychology, and a perfect and significant negative correlation with neurology.

On the other hand, there was a moderate and significant negative correlation between the mental subscale and hypoglycemia, a weak and significant negative correlation with hyperglycemia, a moderate and significant negative correlation with cardiology, a moderate and significant negative correlation with ophthalmology, a good and significant negative correlation with psychology, and a perfect and significant negative correlation with neurology.

A significant negative correlation was found between the subscales of DSC-R and the subscales of SF-36. Regarding the power of the correlation, the strongest correlation was between physical function and the neurology subscale of DSC-R (r = -0.57), and the weakest correlation was with the hyperglycemia subscale (r = -0.20). The strongest correlation between physical role difficulties and DSC-R subscales was with the neurology subscale (r = -0.40), and the weakest correlation was with hyperglycemia (r = -0.16). The strongest correlation between emotional role difficulties and DSC-R subscales was with the cardiology subscale (r = -0.41), and the weakest correlation was with hyperglycemia (r = -0.13). The strongest correlation between energy/vitality and psychology subscale and DSC-R subscales was with the psychology subscale (r= -0.55), and the weakest correlation was with hyperglycemia (r = -0.18). The strongest correlation between mental health and the DSC-R subscales was with the psychology subscale (r = -0.42), and the weakest correlation was with hyperglycemia (r = -0.19). The strongest correlation between the social functionality and DSC-R subscales was with the psychology subscale (r = -0.49), and the weakest was with hyperglycemia (r = -0.23). The strongest correlation between pain and DSC-R subscales was with the neurology subscale (r = -0.56), and the weakest correlation was with hyperglycemia (r = -0.12). The strongest correlation between overall health perception and DSC-R subscales was with the psychology subscale (r = -0.54), and the weakest correlation was with hyperglycemia (r = -0.20) (Table 2).

Table 3 shows that the model (F = 50.710, p = 0.001, Cox & Snell R2 = 0.43, Nagelkerke R2 = 0.42) was significant, and explained 42% of the SF 36 physical dimension score.

Of the four variables remaining in the model, the physical dimension of the quality of life was mostly affected by psychology (β: -0.307), neurology (β: -0.299), cardiology (β: -0.155), and hypoglycemia (β: -0.027), respectively. Also, there is a negative relationship between the SF 36 physical dimension and hypoglycemia, cardiology, psychology, and neurology scores. In other words, as the participants' hypoglycemia, cardiology, psychology, and neurology symptom scores increase, their quality of life decreases. On the other hand, although there was a correlation between the quality of life and hyperglycemia and ophthalmology scores, it was observed to be not significant.

Table 2. Correlation coefficients between DSC-R scores and SF-36 scale scores (n= 410)

	SF 36									
	Concepts								Sub-dimensions	
DSC-R domains*	Physical function	Limitation in the physical role	Limitation in the emotional role	Vitality (energy/fatigue)	Mental health	Social functioning	Pain	General health perception	Physical	Mental
Hypoglycemia	-0.31	-0.26	-0.29	-0.39	-0.34	-0.27	-0.17	-0.30	-0.30	-0.37
Hyperglycemia	-0.20	-0.16	-0.13	-0.18	-0.19	-0.23	-0.12	-0.20	-0.20	-0.21
Cardiology	-0.54	-0.38	-0.41	-0.41	-0.39	-0.47	-0.42	-0.46	-0.52	-0.49
Ophthalmology	-0.34	-0.23	-0.19	-0.36	-0.23	-0.27	-0.32	-0.24	-0.33	-0.30
Psychology	-0.51	-0.39	-0.38	-0.55	-0.42	-0.450	-0.54	-0.54	-0.58	-0.53
Neurology	-0.57	-0.40	-0.40	-0.46	-0.40	-0.49	-0.56	-0.45	-0.87	-0.75

*Pearson correlation, p < 0.001 for all correlations examined. p<0.001 DSC-R, Diabetes Symptoms Checklist-Revised; SF-36, Short-Form 36.

As seen in Table 4, the model (F=37.807, p=0.001, Nagelkerke R2=0.36) was significant and it predicted 36% of the mental subscale score of SF 36 scale.

Of the four variables remaining in the model, the mental dimension of the quality of life was mostly affected by psychology (β:-0.274), neurology (β: -0.216), cardiology (β: -0.142), and hypoglycemia (β: -0.105), respectively. Besides, there was a negative correlation between the physical subscale of the SF 36 scale and hypoglycemia, cardiology, and psychology, neurology scores. In other words, SF 36 mental dimension score increases as the score of hypoglycemia, cardiology, psychology, and neurology decreases. Briefly, as the participants' hypoglycemia, cardiology, psychology, and neurology symptom scores increase, their quality of life decreases. On the other hand, although there was a correlation between the quality of life and hyperglycemia and ophthalmology scores, it was not significant.

DISCUSSION

Individuals diagnosed with diabetes experience both psychological exhaustion and cognitive problems. In this study, the correlation between the Diabetes Symptoms Checklist scale and the SF-36 Scale was analyzed. Accordingly, hypoglycemia, cardiology, psychology, and neurology variables were found to be statistically significant. The literature review covering the past 20 years indicated that there was a limited number of studies carried out on this topic. In their study investigating individuals with Type 2 diabetes (n = 184), Groothenius *et al*. found results similar to the findings of the present study. In the study, which was the only study on the topic in the literature, they reported that the mean scores of individuals using insulin obtained from all subscales were high. Also, the difference between the mean score of the cardiology subscale and diabetes-specific symptom severity was reported to be statistically significant (15).

In our study, as hypoglycemia, cardiology, psychology, and neurology symptom scores increased, the quality of life was observed to decrease. On the other hand, although there was a correlation between the quality of life and hyperglycemia and ophthalmology scores, it was found to lose its significance in further analysis. Indeed, the correlation analysis indicated that both hyperglycemia and ophthalmology subscales had the lowest correlation with the subscales of SF 36. The review of the literature indicated that research into the correlation between all diabetes symptoms and quality of life was limited. Instead, the studies were observed to evaluate the quality of life and hyperglycemia.

In the present study, hyperglycemic symptoms were found to be poorly correlated with the physical

Table 3. The results of multivariate regression analysis regarding the extent to which subscale scores of diabetes symptom checklist scale predicted the physical dimension of SF-36 (n = 410)

Dependent variable: Scores for Physical sub-dimension of SF 36							
	β	**SE**	**Std.β**	**t**	**p**	**95% CI**	
Constant	86.955	3.905		22.270	0.001	Lower	Upper
Hypoglycemia	-0.702	1.201	-0.027	-0.584	**0.001**	-3.66	-0.42
Hyperglycemia	-0.564	0.951	-0.024	0.594	0.553	-1.30	2.43
Cardiology	-5.305	1.928	-0.155	-2.752	**0.006**	-9.09	-1.51
Ophthalmology	-0.781	1.136	-0.031	-0.687	0.492	-3.01	1.45
Psychology	-8.968	1.588	-0.307	-5.649	**0.001**	-12.09	-5.85
Neurology	-7.330	1.339	-0.299	-5.475	**0.001**	-9.96	-4.70

CI: Confidence Interval SE: Standard Error, F=50.710 (p=0.001), Corrected R2 = 0.42.

Table 4. The results of multivariate regression analysis regarding the extent to which subscale scores of diabetes symptom checklist scale predicted the mental dimension of SF-36 (n = 410)

	β	**SE**	**Std. β**	**p**	**95% CI**	
Constant	88.741	3.992		0.001	Lower	Upper
Hypoglycemia	-2.621	1.228	-0.105	**0.033**	-5.03	-0.20
Hyperglycemia	-0.042	0.972	-0.002	0.966	-1.86	1.95
Cardiology	-4.705	1.971	-0.142	**0.017**	-8.58	-0.83
Ophthalmology	-0.412	1.162	-0.017	0.723	-2.69	1.87
Psychology	-7.724	1.623	-0.274	**0.001**	-10.91	-4.43
Neurology	-5.121	1.369	-0.216	**0.001**	-7.81	-2.43

CI: Confidence Interval SE: Standard Error, F=37.807 (p=0.001), Corrected R2 =0.35.

subscale score. In their study investigating Type 2 diabetics in Portugal, Tonetto *et al*. (N = 53) reported that high glucose hemoglobin levels adversely affected the quality of life (18). In the Cambridge cohort, which kept track of individuals with Type 2 diabetes aged between 40 and 69 in the UK (n = 510) for 4 years to assess the effects of glycemic variations, diabetes-specific quality of life was shown to be susceptible to glycemic variations even if the disease was well controlled (19). These differences may have been due to the characteristics of the study group and the research methodology. Indeed, in our study, the mean age was lower compared to other studies, while compliance with treatment was higher and the sample size was larger.

In a study conducted by Khuwaja *et al*. in Karachi, Pakistan on individuals with Type 2 diabetes (N = 889), hypertension was reported to be 1.5-2 times more common in diabetics (20). In the present study, the quality of life was relatively low (42%) in individuals with cardiological disease accompanying diabetes. Given these findings, the results of the current study were consistent with the literature.

In the current study, ophthalmologic symptoms were found to be not associated with SF 36 scores. In contrast to our study, Lee *et al*. found that visual impairment affected the physical subscale scores of SF-36 scale (21). This difference might have come from the methodological differences of the studies and the younger individuals in our study.

In the present study, psychological symptoms were found to be related to both physical and mental sub-dimension scores of SF-36. In a study on married women with Type 2 diabetes (n = 300) conducted by Shafiee-Kandjani *et al*. in Tabriz, Iran, 58% of the participants were determined to have mental disorders, and the physical and mental dimension scores of the SF-36 Quality of Life scale were found to be 57.30 and 60.29, respectively (22). In a study conducted by Andriaanse *et al*. (N = 569) with type 2 diabetics, deteriorating glucose metabolism was found to be associated with diabetes-bound increased psychological symptoms, and individuals with depression were determined to have more diabetes-related symptoms than those who did not have depression (23). Although a consistent correlation was not shown between glycemic control measures and depressive symptoms in the experimental studies conducted by Georgiades *et al*. (Type 1 diabetes, n = 28; type 2 diabetes, n = 62), depression was recognized to affect diabetic patients to a large extent (24). In a study conducted by Özdemir *et al*. on people with Type 2 diabetes (n=100), there was a negative correlation between anxiety and depression levels and all sub-dimensions of quality of life. Similarly, in the literature, depression symptoms, with a significant decrease in life quality scores, have been reported to be a well-known predictor of quality of life especially in patients with diabetes (25-27). In the study of Eren *et al*. (N = 104) conducted on individuals with type 2 diabetes, the quality of life was reported to deteriorate as anxiety levels increased (28).

Concerning the life quality of diabetic patients, similar to the findings of this study, many studies reported that quality of life was negatively affected in all areas including especially psychosocial areas (15, 21, 23-27, 29).

In this study, psychology and neurology variables were found to be statistically significant in multivariate regression analysis that was conducted to analyze the extent to which participants' scores obtained from the diabetes symptoms scale predicted the mental subscale of the SF 36 scale. In the case-control study (n = 200) conducted by Özdemir *et al*. on patients with Type 2 diabetes (n=200), SF-36 scale scores were found to be significantly lower in all domains in the patient group compared to the control group. In other words, the scores of the patient-group obtained from the physical function, limitations in the physical role, general health, energy, social function, limitations in the emotional role, and mental health domains were significantly lower compared to those of the control group (25). In the case-control study conducted by Kiziltaş *et al*. (n = 120) on individuals with Type 2 diabetes, the scores of the group with diabetes for psychological symptoms were higher than the scores of the controls, and there were significant differences in somatization, obsessive-compulsion, depression, and anxiety sub-domains in patients with DM with blood-sugar control compared to those with no blood-sugar control (29).

In our study, the neurology sub-dimension was observed to predict SF 36 physical dimension negatively. Similar to the findings in the literature, in the Rochester Diabetic Neuropathy cohort (n = 380) conducted in 1986, 47.3% of the participants with diabetes had symptoms associated with distal neuropathy, and 27.8% of the cohort (n = 850) joining the San Luis Valley Study had apparent neuropathy (30, 31). In a study carried out by Degu *et al*. on patients with Type 2 diabetes (n=220) in Ethiopia, the quality of life scores of patients with peripheral neuropathy pain were lower than of those without peripheral neuropathy

pain (32). In a study carried out by Dermanovic Dobrota *et al*. in Croatia on patients with (n=80) and without diabetic neuropathic pain (n=80) by using SF-36, the quality of life of patients with diabetic neuropathic pain was significantly lower than those without diabetic neuropathic pain (33). In a study conducted by Andrew *et al*. (n = 50) on Type 1 and Type 2 diabetes in South Africa, a statistically significant negative relationship was found between diabetic neuropathic pain and the quality of life. When the symptoms of pain were related to the change in blood glucose, maintaining the stability of blood glucose level was reported to be beneficial in patients with diabetic neuropathic pain (34). In other words, the results of this study showed similarities to those of the literature.

This study is among the first studies in the literature evaluating DSC-R symptoms and SF 36 quality of life together. According to the findings, the quality of life scores of the participants in the study group were below average. Approximately 40% of the participants were found to have symptoms in terms of DSC-R symptoms. Also, the multivariate regression analysis indicated that diabetes symptoms explained 35-42% of the change in the quality of life.

In the present study, the correlation between scales was high and SF 36 physical and mental subscale scores were observed to increase as the score of hypoglycemia, cardiology, psychology, and neurology scores decreased. The correlation analyses revealed that there was a weak correlation between all the subscales of SF 36 and ophthalmology and hyperglycemia subscales of the DSC-R scale, and this weak correlation was observed to lose its significance in the regression analysis. In the regression analysis, as the hypoglycemia, cardiology, psychology, and neurology scores decreased, the physical and mental subscale scores of the SF-36 Quality of Life Scale were determined to increase.

DSC-R symptoms are seen in about half of individuals with diabetes and they affect the quality of life negatively. Therefore, early detection of these people is important in terms of protecting and improving their health. We also recommend that individuals in the risk groups should be screened. This is possible primarily through the effective provision of preventive healthcare services in primary care and with the follow-up of risk groups.

Steps should be taken to improve the quality of life of people with symptoms of psychology, neurology, cardiology and hypoglycaemia as well as early detection of these symptoms, which significantly affect health-related quality of life. People with diabetes should be evaluated in many ways, individuals with poor quality of life should be provided with the necessary support and motivation so that they can spend more time and feel better physically and psychologically, and both patients and healthcare providers should pay attention to this issue. The education and counselling provided by the healthcare professional in diabetes is very important in strengthening the individual with diabetes and his family, dealing with the symptoms brought by the disease, coping with problems, providing effective metabolic control and thus increasing the quality of life.

It is necessary to take steps to improve the quality of life of individuals with symptoms of psychology, neurology, cardiology, and hypoglycemia, as well as taking measures through early detection of these symptoms, which significantly affect health-related quality of life. Individuals with diabetes should be evaluated in many ways, those with poor quality of life should be provided with the necessary support and motivation so that they can spare more time for themselves and feel better physically and psychologically, and both patients and healthcare providers should pay attention to this issue. The education and counselling on diabetes provided by the healthcare professional are very important in strengthening individuals with diabetes and their family, helping them to cope with the symptoms and problems brought by the disease, providing effective metabolic control, and thus increasing the quality of life.

Although our study evaluates the relationship between DSC-R symptoms and SF 36, it is limited to patients presenting to the health institution. For this reason, we recommended that community-based studies should be conducted.

In conclusion, diabetes symptoms are potential interchangeable predictors of HRQOL in individuals with diabetes. Identifying specific diabetes symptoms or symptom facets, which are the most important predictors in terms of the patient, facilitates a patient-centered approach in clinical research and practice designed to improve HRQOL in individuals with diabetes.

Conflict of interest

The authors declare that they have no conflict of interest.

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