

Hypoglycaemia fear, treatment adherence, and the quality of life in patients with type 2 diabetes and its determinants

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Abstract

Aim: This work aims to evaluate the relationship between the fear of hypoglycaemia, treatment adherence, and the quality of life in patients with type 2 diabetes mellitus (T2DM) and its determinants.

Methods: This descriptive and cross-sectional study sample recruited 1060 T2DM outpatients in a health centre between January and July 2022. The Hypoglycemia Fear Survey (HFS), Type 2 DM Treatment Patient Compliance Scale, and the 5-Level EuroQol 5-Dimension (EQ-5D-5L) were used for data collection.

Results: There was a positive correlation between age, duration of T2DM, and the scores obtained from the HFS and its subscales ($p < 0.001$). There was a positive, moderate correlation between the total HFS score and the TCS ($p < 0.001$). There was a negative correlation between the scores obtained from the HFS and the EQ-5D-5L ($p < 0.001$). The multiple regression analysis showed that the quality of life scores of the patients were significantly predicted by hypoglycaemia fear, duration of T2DM diagnosis, and age. ($F = 91.691$, $p < 0.001$). Hypoglycaemia fear, duration of T2DM diagnosis, and age explained 38.1% of the quality of life of patients.

Conclusion: We determined that the increase in hypoglycaemia fear resulted in a decrease in treatment adherence. Besides, hypoglycaemia fear increased with increasing age and duration of T2DM diagnosis.

KEYWORDS

hypoglycaemia fear, quality of life, treatment adherence, type 2 diabetes mellitus

Summary statement

What is already known about this topic?

- In a limited literature, it has been reported that patients with diabetes experience hypoglycaemia fear. However, almost all of these studies focus on the hypoglycaemia fear in type 1 diabetes mellitus patients.

What this paper adds?

- There was a positive correlation between the level of treatment adherence and hypoglycaemia fear in patients with T2DM. It was observed that adherence with treatment declined because of the increased fear of hypoglycaemia in patients with T2DM.

- Hypoglycaemia fear increased with increasing age and duration of T2DM diagnosis.
- Hypoglycaemia fear, duration of T2DM diagnosis, and age explained 38.1% of the quality of life scores of patients.

The implications of this paper:

- This study reveals a new perspective on hypoglycaemia fear, treatment adherence, and the quality of life scores in patients with T2DM and its determinants.
- In nursing practice, it was determined that it is important to control hypoglycaemia fears to increase the treatment adherence and quality of life of T2DM patients.

1 | INTRODUCTION

Type 2 diabetes mellitus (T2DM) is a chronic disease that causes glycaemic load, insulin resistance, and obesity as a result of the inability of the pancreatic islet cells to respond to rising blood glucose (Reed et al., 2021). Due to its rapid increase, T2DM has turned into one of the greatest community health problems in the world (Khan et al., 2020). Especially in low- or middle-income countries, it has become the basis of cardiometabolic disorders due to genetic predisposition as well as dietary preferences (Reed et al., 2021; Satman et al., 2013). The incidence of T2DM is increasing rapidly with an increasingly stressful, intense, and sedentary life, shortening of meal times, and changes in lifestyle such as fast food diets, high calorie intake, and obesity. In 2020, an estimated 537 million adults (20–79 years old) were living with diabetes, or one in 10 around the world. This number is predicted to rise to 643 million by 2030 and 783 million by 2045 (International Diabetes Federation Diabetes Atlas, 2022).

Treatment adherence, which may be defined as the extent to which a person's attitudes and behaviours correspond with the recommendations, is one of the important factors influencing the success of treatment for chronic diseases such as diabetes (World Health Organization [WHO], 2023). It requires regular participation in screening, completing the therapy programme, regular use of medications, and performing the recommended changes in behaviours (Bonikowska et al., 2021). Acceptance is defined as adapting to the chronic illness despite the illness and its negative consequences, commitment to life goals, positive confrontation, and coping with the negative consequences of the situation (Özkaptan et al., 2019; Schmitt et al., 2018). Disease acceptance and treatment adherence in individuals with diabetes are closely related to maintaining metabolic control, as the former play a significant role in improving the quality of life and reducing or preventing the development of complications related to the disease (Özkaptan et al., 2019; Schmitt et al., 2018).

Individuals with diabetes may experience one or more situations that require emergent intervention (Muneer & Akbar, 2021). Hypoglycaemia is one of the complications with negative impacts on the quality of life in patients with T2DM. The literature has shown a significant association between hypoglycaemia and negative quality of life outcomes, including poor health, impaired sleep quality, greater

hypoglycaemic fear, and decreased work productivity (Polonsky et al., 2018; Sakane et al., 2015). Fear of hypoglycaemia is directly related to the frequency of hypoglycaemic symptoms (Polonsky et al., 2018). The worries of T2DM patients, who experienced hypoglycaemia, include the inability to realize the hypoglycaemia attack, experiencing hypoglycaemia while alone, sleeping, or a long-continued activity, making a mistake, losing control, having an accident during an attack, dizziness, and fainting in public space (Anderbro et al., 2018; Polonsky et al., 2018; Sakane et al., 2015).

1.1 | Theoretical framework

Fear of hypoglycaemia may lead to nonadherence and impair optimal glycaemic control in patients with T2DM (Yuksel & Bektas, 2021). Fear of hypoglycaemia seen in patients with T2DM leads to behaviours such as changes in dietary habits, insulin dose, physical activity level, and restriction in activities of daily living (Polonsky et al., 2018; Yuksel & Bektas, 2021). Ultimately, nonadherence in patients with diabetes means poor glycaemic control and long-term health complications such as retinopathy, neuropathy, and nephropathy (Polonsky et al., 2018). Although hypoglycaemia is widespread among individuals with type 1 diabetes, it may occur in individuals with T2DM with varying severity and frequency (Erol & Enc, 2011). The average percentage of hypoglycaemia problems reported by the T2DM patients in the study of Baykal et al. was 27.4%, and 25.6% of these patients expressed that the problem occurred at least once in the last month (Baykal & Kapucu, 2015). The reasons for hypoglycaemia in the study included insulin overdose (20.9%), skipping a meal (34.9%), and eating less than needed (23.3%). Another study by Polonsky et al. reported that 86% of T2DM patients experienced nonsevere hypoglycaemia in the last 2-year period (Polonsky et al., 2018). It was found that the incidence of hypoglycaemia reached 44.7% in the 5-year follow-up of T2DM patients (Zoungas et al., 2010). Although it is such an important issue, studies on this subject are limited in number with T2DM. Therefore, there is a need for studies evaluating fear of hypoglycaemia, treatment adherence, and quality of life together in individuals with T2DM. This study aimed to determine the correlation between the fear of hypoglycaemia, treatment adherence, and quality of life in patients with T2DM.

2 | METHODS

2.1 | Study design and sample

This descriptive and cross-sectional study was conducted at a health centre in Istanbul, Turkey, between January and July 2022 to evaluate the relationship between the fear of hypoglycaemia, treatment adherence, and quality of life in patients with T2DM. This study was carried out with 1060 patients with T2DM.

The sample size was determined to be 400 on the G-Power statistical software package based on a 0.05 Type 1 error, 95% power, and a medium effect size (Faul et al., 2007). The study aimed to include all the patients who were diagnosed with T2DM, met the inclusion criteria, and agreed to participate. The study was conducted on a total of 1060 adult patients with T2DM, with a final number of participants. The inclusion criteria were as follows: (a) diagnosed at least 1 month before the study, (b) received diabetes treatment at the health centre, (c) agreed to participate, and (d) could read-write and had no communication problems (auditory or speaking) and had no cognitive or physical obstacles to reply questions. Illiterate patients, patients who refused to participate, and patients who received corticosteroid therapy were excluded from the study. Nine patients refused to participate due to time constraints, six patients due to fatigue, and 48 patients due to unwillingness.

2.2 | Data collection

The Personal Information Form, Hypoglycemia Fear Survey (HFS), Type 2 DM Treatment Patient Compliance Scale, and the 5-Level EuroQol 5-Dimension (EQ-5D-5L) were used for data collection. Participants self-reported the duration of diabetes, but HbA1c percentage and hospitalizations were obtained from clinical records.

2.2.1 | Personal information form

The form was prepared by the researcher after a literature review and included questions on sociodemographic characteristics such as age, gender, level of education, employment, and income status, as well as clinical characteristics, including the duration of T2DM, HbA1c percentage, smoking habits, and hospitalization rates due to complications related to diabetes.

2.2.2 | HFS

The HFS was developed by Cox et al. in 1987 and was adapted into Turkish by Erol and Enc (2011). The 32-item questionnaire was composed of two subscales: the behaviour subscale (HFS-B), which measured the behaviour aimed at avoiding hypoglycaemia and its negative consequences (15 items), and the worries subscale (HFS-W), which measured the worries about hypoglycaemia and its negative

consequences in the last 6 months (17 items). Responses range from 0 points (*never*), 1 point (*rarely*), 2 points (*sometimes*), 3 points (*often*), to 4 points (*always*) on a 5-point Likert scale. HFS scores are calculated by summing all scale item scores and dividing by the total number of items. Higher scores indicate a higher level of fear of hypoglycaemia. Cronbach's alpha of the Turkish version of the HFS and our study were 0.95 and 0.91, respectively.

2.2.3 | Type 2 DM Treatment Patient Compliance Scale

The Type 2 DM Treatment Patient Compliance Scale was developed by Demirtaş and Akbayrak (2017). The scale had 30 items with 13 positive and 17 negative statements, which were loaded on seven factors, namely, emotional difficulties in adherence, physical difficulties in adherence, changing difficulties of habits in adherence, acceptance difficulties in adherence, awareness difficulties in adherence, diet difficulties in adherence, and denial difficulties in adherence. Total scores ranged between 30 and 150, with lower scores indicating higher adherence with treatment. A low score on the subdimensions of the scale indicates that the individual exhibits positive and expected behaviours during the treatment process. A high score indicates that the individual is incompatible with his treatment and cannot show the expected emotions and behaviours. Cronbach's alpha on the original scale and in our study were 0.77 and 0.91, respectively.

2.2.4 | EQ-5D-5L

The EuroQol 5-Dimension (EQ-5D) was developed by the EuroQol Group in 1990 and adapted into Turkish by Eser et al. (2007). The EuroQol Group introduced the EQ-5D-5L in 2009 to improve the instrument's sensitivity (The EuroQol Group, 2009). The EQ-5D-5L consisted of two sections: the EQ-5D descriptive system and the EQ visual analogue scale (EQ-VAS). The EQ-5D-5L Quality of Life Assessment questionnaire includes questions about walking ability, self-care, daily activity, pain or discomfort, and anxiety or depression. In 5-point Likert scoring, the answers given to each dimension have five options: *no problem*, *slight problem*, *moderate problem*, *severe problem*, and *extreme problem*. An index score ranging from 0 to 1 is calculated using the five-item responses on the scale. A score closer to 1 indicates a good quality of life. The EQ-VAS, on the other hand, records the patient's self-rated health on a vertical VAS. The scores range from 0 to 100, with higher scores indicating better health (The EuroQol Group, 2009).

2.3 | Data analyses

The data obtained within the scope of the study were analysed with SPSS version 26.0. The descriptive statistics of continuous variables were presented as mean and standard deviation, and the descriptive

statistics of categorical variables were shown as frequency and percentage. The study did not have any missing data. The normality of the distribution of the data, which was evaluated with the Kolmogorov–Smirnov test, showed that the data did not meet the normal distribution. The Kruskal–Wallis H test was used to compare four independent groups, and Student's t test was used for two independent groups. The relationships between the mean scores obtained from the HFS and the Type 2 DM Treatment Patient Compliance Scale were analysed with Pearson's correlation test. The prediction of quality of life by levels of hypoglycaemia fear, treatment adherence, duration of T2DM years, and age variables was evaluated with multiple linear regression analyses. The inclusion or exclusion of variables in the model was decided according to the multicollinearity test. The existence of multicollinearity among hypoglycaemia fear, treatment adherence, duration of T2DM years, and age was evaluated with VIF and tolerance. Variables with a tolerance value greater than 0.2 and a VIF value less than 10 were included in the regression analyses (Midi et al., 2010). Multicollinearity between variables was not determined. Because multicollinearity was not determined between variables, hypoglycaemia fear, treatment adherence, duration of T2DM years, and age were included in the regression analysis. The significance level was accepted as 0.05 (Tabachnick & Fidell, 2014).

2.4 | Ethical consideration

This study was approved by the Istanbul Aydin University Ethical Committee (Approval No: 2022/06, Date: 03.01.2022). An application was made to the Scientific Research Platform of the General Directorate of Health Services of the Ministry of Health, and Ministry of Health permission was obtained on 2 December 2021. The participants were informed about the research process and data collection tools before the implementation of the study, and their informed consent was obtained. Data collection started after ethics committee permission. The study was carried out in conformity with the principles of the Declaration of Helsinki.

3 | RESULTS

The post hoc power analysis of the study was calculated using the G* Power 3.1.9.7 program (Faul et al., 2007). As a result of the calculation performed using the data of the study with a sample size of 1060, the effect size of the study was calculated as medium ($f = 0.615$) and the power of the study ($1 - \beta$) was calculated as 0.99 with a 5% margin of error ($\alpha = 0.05$) for multiple regression analysis.

The mean age of the participants was 50.26 years, 55.6% were female, 56.3% were employed, and 53.8% had a moderate income level. The mean duration of T2DM was 10.57 years, and the mean HbA1c percentage was 7.81%. Finally, 69.7% received oral antidiabetic therapy in addition to standard insulin therapy (Table 1).

Table 2 presents the mean scores obtained from the HFS and its subscales. The mean scores obtained from the HFS, HFS-W, and

TABLE 1 Demographic and clinical characteristics ($n = 1060$).

Variables	Mean (SD) (50.26 ± 19.42)	
	<i>n</i>	%
Age (years)		
Gender		
Female	590	55.6
Male	470	44.4
Education		
Literate and primary school	255	24.1
Secondary school	226	21.3
High school	291	27.5
University and above	288	27.1
Income status		
High	269	25.4
Moderate	570	53.8
Low	221	20.8
Employment status		
Employed	597	56.3
Unemployed	249	23.5
Retired	214	20.2
Smoking		
Current	474	44.8
Never	484	45.6
Former	102	9.6
Duration of T2DM (years)	10.57 ± 11.18	
HbA1c (%)	7.81 (1.4)	
Received oral antidiabetic therapy		
Yes	739	69.7
No	321	30.2
Hospitalization in the last 12 months due to complications related to diabetes		
Yes	249	23.5
No	811	76.5

Abbreviation: SD, standard deviation.

HFS-B were 0.99 ± 0.71 , 0.94 ± 0.77 , and 1.02 ± 0.72 , respectively. Table 2 presents the mean scores obtained from the Type 2 DM Treatment Patient Compliance Scale and its factors. The mean total score obtained from the scale was 71.48 ± 21.00 . The mean scores obtained from the factors of emotional difficulties, physical difficulties, changing difficulties of habits, acceptance difficulties, awareness difficulties, diet difficulties, and denial difficulties in adherence were 18.58, 14.53, 7.27, 7.96, 9.08, 6.91, and 7.21, respectively.

Table 2 presents the mean scores obtained from the descriptive systems of the EQ-5D-5L and the EQ-VAS. The mean score for general health status was 1.66. The mean score obtained from the EQ-VAS was 65.51 (min: 0; max: 100). Finally, the mean score of current health status was 5.83 (min: 0; max: 10).

Table 3 presents the correlations between the scores obtained from the HFS and the Type 2 DM Treatment Patient Compliance

Scale. There was a positive and statistically significant correlation between age, duration of T2DM, and the scores obtained from the HFS and its subscales ($p < 0.001$). Besides, we found a positive, moderate, and statistically significant correlation between the total HFS score and the total score obtained from the Type 2 DM Treatment Patient Compliance Scale ($p < 0.001$). Additionally, there was a

positive and statistically significant correlation between the scores obtained from the HFS-W, HFS-B, and all factors of the Type 2 DM Treatment Patient Compliance Scale ($p < 0.001$). Finally, we found a negative and statistically significant relationship between the scores obtained from the HFS-W, HFS-B, HFS total scores, and the EQ-5D ($p < 0.001$) (Table 3).

TABLE 2 Mean HFS, Scale for Treatment Compliance, and EQ-5D-5L scores ($n = 1060$).

HFS scales	Mean (SD)
HFS-B	1.02 (0.72)
HFS-W	0.94 (0.77)
HFS total	0.99 (0.71)
Scale for Treatment Compliance	71.48 (21.00)
Subscales	
Emotional difficulties	18.58 (6.28)
Physical difficulties	14.53 (4.86)
Changing difficulties of habits	7.27 (2.73)
Acceptance difficulties	7.96 (2.24)
Awareness difficulties	9.08 (3.40)
Diet difficulties	6.91 (2.62)
Denial difficulties	7.21 (2.72)
EQ-5D-5L General Health Status	1.66 (0.72)
Mobility	1.44 (0.66)
Self-care	2.04 (1.12)
Usual activities	1.85 (0.99)
Pain/discomfort	2.12 (1.24)
Anxiety/depression	1.95 (1.08)
EQ-VAS (min: 0; max:100)	65.51 (23.96)
Current Health Status (min: 0; max: 10)	5.83 (2.18)

Abbreviation: SD, standard deviation.

The multiple regression analysis showed that the quality of life scores of the patients were significantly predicted by hypoglycaemia fear, duration of T2DM diagnosis, and age ($F = 91.691$, $p < 0.001$). Hypoglycaemia fear, duration of T2DM in years, and age explained 38.1% of the variance in the quality of life score of patients (Table 4).

Table 5 presents the distribution and correlation of the HFS, the Type 2 DM Treatment Patient Compliance Scale, and Quality of Life Scores according to the demographic and clinical characteristics of the patients. The mean HFS scores of patients with secondary school level, retired patients, smokers, and hospitalized patients were statistically higher than the others ($p < 0.05$). When the Type 2 DM Treatment Patient Compliance Scale scores were examined, the mean scores of males, those with secondary school education level, who were retired, smokers, and hospitalized patients were higher than the others ($p < 0.05$). When the mean EQ-5D-5L General Health Status scores of the patients were examined, the mean scores of those with university and above education levels, in employment, smokers, and those without hospitalization were higher than the others ($p < 0.05$). There was also a statistically significant positive correlation between the mean age of the patients and their mean EQ-5D-5L General Health Status scores ($p < 0.001$) (Table 5).

4 | DISCUSSION

This study found that as difficulties with treatment adherence in patients with T2DM decrease, they are more likely to report increased fear of hypoglycaemia and behaviours aimed at avoiding it. Existing

TABLE 3 Correlation between the scores obtained from the HFS and the Assessment Scale for Treatment Compliance ($n = 1060$).

	HFS-B		HFS-W		HFS total	
	<i>r</i>	<i>p</i>	<i>r</i>	<i>p</i>	<i>r</i>	<i>p</i>
Age	0.251	<0.001	0.165	<0.001	0.230	<0.001
Duration of T2DM	0.175	<0.001	0.087	0.005	0.114	<0.001
Assessment Scale for Treatment Compliance Total	0.469	<0.001	0.431	<0.001	0.463	<0.001
Emotional difficulties	0.405	<0.001	0.383	<0.001	0.408	<0.001
Physical difficulties	0.426	<0.001	0.400	<0.001	0.425	<0.001
Changing difficulties of habits	0.419	<0.001	0.382	<0.001	0.413	<0.001
Acceptance difficulties	0.152	<0.001	0.085	<0.001	0.122	<0.001
Awareness difficulties	0.425	<0.001	0.407	<0.001	0.429	<0.001
Diet difficulties	0.398	<0.001	0.374	<0.001	0.396	<0.001
Denial difficulties	0.407	<0.001	0.373	<0.001	0.406	<0.001
EQ-5D-5L General Health Status Total	-0.488	<0.001	-0.565	<0.001	-0.564	<0.001

Note: The Pearson correlation test was used.

TABLE 4 Multiple regression analysis of variables that affect the quality of life scores.

	B	Standard error	Standard beta (β)	t	p	95.0% CI
Constant	0.829	0.120		6.901	<0.001	
Hypoglycaemia fear	-0.719	0.047	-0.556	15.218	<0.001	-0.812 to -0.626
Treatment compliance	0.001	0.001	0.023	0.628	0.530	-0.002 to 0.003
Duration of T2DM (years)	-0.012	0.003	-0.141	-3.645	<0.001	-0.018 to -0.005
Age (years)	0.010	0.002	0.209	5.273	<0.001	0.006 to 0.013

Note: Dependent variable: EQ-5D-5L General Health Status Total Scores. $R = 0.617$. $R^2 = 0.381$. Adjusted $R^2 = 0.376$. $F = 91.691$. $p < 0.001$. Durbin Watson = 1.895 (1.5–2.5). VIF = 0.1–10.

TABLE 5 Distribution and correlation of the HFS, the Type 2 DM Treatment Patient Compliance, and Quality of Life Scores according to the demographic and clinical characteristics of the patients.

Variables	HFS			Assessment Scale for Treatment Compliance			EQ-5D-5L General Health Status		
	Mean (SD)	Statistic value	p	Mean (SD)	Statistic value	p	Mean (SD)	Statistic value	p
Gender									
Female	1.01 (0.72)	0.345 ^a	0.730	70.11 (20.39)	-2.317 ^a	0.021	1.72 (0.82)	-1.489 ^a	0.137
Male	0.98 (0.71)			73.19 (21.64)			1.81 (0.86)		
Education level									
Literate and primary school	0.94 (0.72)	18.651 ^b	<0.001	73.71 (21.95)	14.500 ^b	<0.001	1.64 (0.81)	6.802 ^b	<0.001
Secondary school	1.23 (0.63)			76.70 (18.34)			1.71 (0.86)		
High school	1.05 (0.71)			73.98 (21.09)			1.72 (0.85)		
University and above	0.77 (0.70)			65.38 (21.11)			2.06 (0.89)		
Employment status									
Employed	0.95	8.738 ^b	<0.001	70.69 (20.88)	4.440 ^b	0.013	1.95 (0.91)	4.424 ^b	0.012
Unemployed	0.91			70.08 (22.44)			1.69 (0.74)		
Retired	1.18			75.39 (19.19)			1.73 (0.86)		
Smoking									
Current	1.08 (0.72)	8.555 ^b	<0.001	73.28 (23.26)	3.064 ^b	0.047	0.90 (0.05)	5.763 ^b	0.003
Never	0.94 (0.73)			72.89 (21.55)			0.73 (0.04)		
Former	0.78 (0.58)			69.67 (19.87)			0.98 (0.10)		
Hospitalization in the last 12 months due to complications related to diabetes									
Yes	1.34 (0.61)	8.635 ^a	<0.001	73.87 (16.13)	1.973 ^a	0.49	1.61 (0.76)	10.002 ^a	<0.001
No	0.89 (0.71)			70.74 (22.14)			2.33 (0.91)		
		r	p		r	p		r	p
Age (years)		0.230	<0.001		-0.025	0.437		0.237	<0.001
HbA1c (%)		0.015	0.650		0.008	0.802		0.060	0.103
Duration of T2DM (years)		0.114	<0.001		0.047	0.136		0.032	0.391

^aIndependent t test.

^bANOVA test was used. Pearson correlation test was used for correlations.

studies on individuals with T2DM have revealed that the fear of hypoglycaemia is one of the primary obstacles to treatment adherence. The frequency of hypoglycaemia attacks increases the fear of hypoglycaemia (Lajara et al., 2017). This fear may result in nonadherence with pharmacological therapy, physical activity, and self-monitoring of

blood glucose. Besides, the change in lifestyle and the complexity of therapy may inhibit treatment adherence. Consequently, acute and chronic complications can develop, and the costs of healthcare services and the incidences of morbidity and mortality can increase. On the other hand, a decrease in the fear of hypoglycaemia is expected

to improve treatment adherence (Ross et al., 2011; Vichayanrat et al., 2013). Parallel to our findings, Shi et al. (2014) found a positive correlation between the fear of hypoglycaemia and treatment adherence. Another study reported that the fear of hypoglycaemia constituted a serious obstacle to treatment adherence. Due to individuals' behaviours to raise their blood glucose levels to prevent hypoglycaemia, the metabolic control variables can deteriorate and treatment adherence can decrease (Cox et al., 1987). In our study, it was determined that individuals with higher educational levels had a lower fear of hypoglycaemia, higher treatment adherence, and a higher quality of life. Similarly, literature reports that low education levels increase the fear of hypoglycaemia and also reduce treatment adherence and quality of life (Curkendall et al., 2013; Kirkman et al., 2015; Polonsky & Henry, 2016; Yuksel & Bektas, 2021). Another study on patients with T2DM also found that patients with a fear of hypoglycaemia had lower treatment adherence and a higher quality of life (Yuksel & Bektas, 2021). The results of this study were found to be compatible with the previous literature.

In our study, it was observed that retirees had more fear of hypoglycaemia, and their treatment adherence and quality of life were lower. Similar results were obtained in previous studies (Erol & Enc, 2011; Yuksel & Bektas, 2021). In addition, in our study, it was determined that patients hospitalized in the last year due to diabetes-related complications had a high fear of hypoglycaemia and low treatment adherence and quality of life. In a study, it was found that fear of hypoglycaemia increased as the frequency of hospitalization due to hypoglycaemia increased (Shiu & Wong, 2000). Similar results were obtained in a different study (Yuksel & Bektas, 2021). We think that patients who have been hospitalized in the last year have more fear and anxiety about hypoglycaemia and they try to avoid hypoglycaemia and the serious consequences of hospitalization. Depending on these factors, we can suggest that these patients exhibit more frequent behaviours to prevent hypoglycaemia, avoid hospitalization, comply with treatment, and also increase their quality of life.

This study found that the fear of hypoglycaemia increased as the age and duration of T2DM increased. Age exacerbates fears such as the fear of falling (Sakane et al., 2015). Similar findings have been reported by other studies. The risk and fear of hypoglycaemia can increase as the age and duration of T2DM increase (Anderbro et al., 2018; Khunti et al., 2016). Similarly, age was associated with fear of hypoglycaemia in the study by Sakane et al. (2015). The study by Shi et al. (2014) reported that a longer duration of diabetes was associated with higher levels of fear of hypoglycaemia. Omar et al. also found that the duration of diabetes was positively associated with the fear of hypoglycaemia (Omar et al., 2016). Therefore, the decrease in awareness of hypoglycaemia over time may increase the fear of hypoglycaemia. The results of this study were found to be compatible with the previous literature.

An important result of this study was that fear of hypoglycaemia, age, and disease duration were significant predictors of quality of life. The fear of hypoglycaemia in patients with T2DM leads to behaviours such as changes in dietary habits, insulin dose, physical activity level, and restriction of activities of daily living (Özkaptan et al., 2019;

Schmitt et al., 2018). Long-term complications such as poor glycaemic control, retinopathy, neuropathy, and nephropathy occur when non-adherence with treatment continues in patients with diabetes, and these complications negatively affect the quality of life of patients (Yuksel & Bektas, 2021). These literature support our study results.

4.1 | Strengths and limitations

This study has a large primary care population of patients with T2DM, which is the main strength of the current study. Furthermore, to the best of our knowledge, the present study is the first to evaluate the relationship between the fear of hypoglycaemia, treatment adherence, and quality of life in primary care patients with T2DM. However, there are also some limitations to be noted. The first limitation was that the research was conducted at a single centre. Also, it is seen as a limitation of this study because patients were voluntary and adherence with treatment, HFS, and EQ-5D-5L attitudes were based on their expression.

5 | CONCLUSIONS

We determined a positive correlation between the level of treatment adherence and the fear of hypoglycaemia, indicating that the increase in the fear of hypoglycaemia and behaviours aimed to avoid it were linked with an increase in treatment adherence. Besides, the fear of hypoglycaemia increased as the age and duration of the T2DM diagnosis increased. Finally, the participants had a moderate level of quality of life.

Based on these findings, we may suggest that further qualitative studies on the factors affecting treatment adherence and the fear of hypoglycaemia be conducted in individuals with T2DM. Finally, educational materials that take the participants' education and socioeconomic levels into consideration can be prepared, and the effectiveness of these materials can be evaluated. Based on the results of the study, it is expected that treatment adherence and quality of life will be increased by reducing the fear of hypoglycaemia. Therefore, a psychotherapeutic or psychoeducational intervention to reduce hypoglycaemia fear can be the best focus for improving treatment adherence. In the future, we think that it will form the basis for future studies evaluating the effect of educational programmes on fear of hypoglycaemia, treatment adherence, and quality of life.

Fear of hypoglycaemia may lead to nonadherence to treatment and reduce the quality of life in patients with type 2 diabetes. For this reason, it is necessary to increase awareness of hypoglycaemia and reduce the fear of hypoglycaemia with the training given by nurses to increase treatment adherence. Based on the findings, we recommend evaluating treatment adherence, quality of life, and fears of hypoglycaemia in type 2 diabetes patients as part of routine care. Regular and repetitive training should be given by nurses, taking into account the age, education, and diagnosis period of diabetes patients.

AUTHORSHIP STATEMENT

Dilek Yildirim conceived the work and reviewed relevant literature. All the authors acquired, analysed, and interpreted the data. Cennet Çiriş Yildiz, Emine Ergin, and İrem Özbay drafted the work and revised it critically for important intellectual content. All authors approved the version to be published.

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CONFLICT OF INTEREST STATEMENT

The authors have no conflicts of interest to declare that are relevant to the content of this article.

DATA AVAILABILITY STATEMENT

All relevant data and materials are available with the corresponding author and will be provided on request.

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