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Investigation of COVID-19 fear, treatment compliance, and metabolic control of patients with type 2 diabetes mellitus during the pandemic

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ABSTRACT

Aims: This study was carried out to investigate fear levels, treatment compliance, and metabolic control of type II Diabetes Mellitus patients during the COVID-19 pandemic.
Methods: The study employed a single-center, observational design and was conducted between January and April 2021. The study consisted of 303 patients who attended the internal medicine outpatient clinic of a university hospital in Turkey. For data collection, the Patient Identification Form, COVID-19 Fear Scale, and the Type II Diabetes Treatment Compliance Scale were used. The study complied with the Helsinki Declaration criteria. IBM SPSS v25.0 statistics package program was used for data analysis.
Results: The mean age of the patients was 45.8 ± 7.5 years, the mean duration of illness was 8.2 ± 3.6 years. Moreover, 40.6% of patients presented with poor levels of treatment compliance. In addition, the mean FCV-19S score of the patients was 29.1 ± 3.05. It was noticeable that those with high mean scores of FCV-19S had poor compliance with treatment and metabolic control during the pandemic ($p < 0.05$).
Practice implications: Fear of COVID-19 negatively affects treatment compliance and metabolic control of type II diabetes patients. The patients avoided attending their regular follow-ups at the hospital due to fear of contracting COVID-19. In order to reduce the fear of COVID-19 it is paramount to maintain optimum metabolic control and treatment compliance.

1. Introduction

Coronavirus Disease – 19 (COVID-19) is a serious disease that emerged in Wuhan, China in December 2019 [1]. This highly contagious disease spread worldwide in a short term and on 11th March 2020, the World Health Organization (WHO) declared that the COVID-19 outbreak is a pandemic public health menace. Since the beginning of the COVID-19 pandemic, its spread rate and mortality rates have been higher than the other coronavirus diseases in the literature. The disease can affect all individuals of all ages. However, some specific groups such as Diabetes Mellitus (DM), hypertension, obesity, chronic kidney disease, and cancer patients are more vulnerable to the COVID-19. High mortalities of COVID-19 were reported in these specific disease groups [2,3].

DM, which is the most common among chronic diseases, increases the risk for infections. However, maintaining normal blood glucose levels in patients with DM may help to decrease the severity of COVID-19 disease [4,5]. Thus, maintaining the normal blood glucose level has

Abbreviations: COVID-19: Coronavirus Disease -19, FCV-19S: Fear of COVID-19 Scale; DM: Diabetes Mellitus, FPG: Fasting Blood Glucose; PBG: Post-prandial Blood Glucose, HbA1c: Hemoglobin A1c; SD: Standard Deviation, SPSS: Statistical Package for Social Science; T2DTCS: Type 2 Diabetes Treatment Compliance Scale, WHO: World Health Organization.

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become more crucial in DM. Studies show that the interruption in the follow-up of the patients during the COVID-19 pandemic leads to impaired treatment compliance and decreased metabolic control in patients [5–10]. High blood glucose level is leading to hyperglycemia complications such as diabetic ketoacidosis and hyperglycemic hyperosmolar status in short term and micro-and macro-vascular complications in long term [11,12]. These complications may be life-threatening for the patients.

Treatment compliance is one of the main objectives in the control of type 2 DM. Treatment compliance has many definitions but it can simply define as a complex phenomenon that reflects the patient's contribution and adapt to the management of his or her treatment including medication, diet, and exercise [5,9,13]. Although DM is a well-known disease that is easy to diagnose and whose treatments are clear, the disease is hard to manage because of poor patient treatment compliance [2,12]. Studies have shown that up to 38.5% of patients with DMare non-compliant with the treatment [3,9,14]. These non-compliance rates are higher in developing countries according to the WHO [15]. Failure in treatment compliance in chronic diseases such as DM reduces the effectiveness of treatment, negatively affects the progress of the disease, and causes an increase in health care costs and deaths with the addition of other diseases as a complication of DM [1,2,16]. According to the WHO, variables that correlate with treatment adherence can be organized into four clusters; treatment and disease characteristics, intra-personal factors, inter-personal factors, and environmental factors [15]. However, during the pandemic, some restrictions and changes in the follow-up of the patients have occurred. These restrictions and changes lead patients to adopt this new environment. During this adaptation, some patients avoid applying to the hospital because of the fear of COVID-19 [17]. Because of the aforementioned factors, the treatment compliance and metabolic control of the patients may be affected during the pandemic.

It was reported in the literature that metabolic control of the patients with DM is adversely affected during the pandemic process [2,9,12]. In this context, there is a need for researches that examine the compliance and metabolic control of the patients with DM during the pandemic and investigates the effect of the fear of COVID-19 as a determinant.

2. Aim

This study was conducted to examine treatment compliance and metabolic control of patients with Type 2 DMduring the COVID-19 pandemic and to determine the effect of fear of COVID-19 on the patients' treatment compliance and metabolic control.

3. Materials and methods

3.1. Study design and sample

The study was of a single-center, observational design. The universe of the study consisted of 559 patients who apply to the internal medicine outpatient clinic of a university hospital in Turkey between January and April 2021. Convenience sampling was used for the study and the patients who agreed to participate in the study between January and April 2021 were included in the study. The sample consisted of 303 patients who agreed to participate in the study. The criteria for inclusion in the study; aged 18 years or older, being diagnosed with Type 2 DM at least six months before the pandemic, and had been applied to the clinic for metabolic control in three months before the pandemic; exclusion criteria were having symptoms such as fever, cough or breathing difficulties, being diagnosed with COVID-19 in last two weeks, and having a history of surgery or trauma in last two years. It was considered that the active form of COVID-19 may affect the patients' fear of COVID-19. For this reason, the patients who were diagnosed with COVID-19 in the last two weeks or who has symptoms of COVID-19 were excluded from the study.

3.2. Data collection

For data collection, as a result of the literature review, the Patient Identification Form (also including the metabolic parameters), the Type 2 Diabetes Treatment Compliance Scale (T2DTCS), and the fear of COVID-19 Scale (FCV-19S) were used.

3.2.1. Patient identification form

It was created by the researchers by reviewing the literature. It consists of 25 items including demographic data, anthropometric measurements, diet and exercise habits, treatment type, acute diabetic complications, and a checklist including FPG (Fasting Blood Glucose), PBG (Postprandial), HbA1c (Hemoglobin A1c), and other metabolic parameters [2,5,12,16].

3.2.2. Type 2 diabetes treatment compliance scale (T2DTCS)

The scale was developed by Demirtaş and Albayrak (2017). The scale consists of 30 items. The scale was of a 5-point Likert type scale and range from Strongly agree = 1 to Strongly disagree = 5. Of the items, 13 are positive and 17 are negative. Scoring is done from 1 to 5 for positive items. Items containing negative expressions are scored upside down (from 5 to 1). The highest score on the scale is 150 and the lowest is 30. Lower scores indicate that patient compliance to type 2 DM treatment is higher/better. In the assessment of scale total points, the scores between 30 and 54 show "good compliance", the scores between 55 and 125 show "moderate compliance", and the scores between 126 and 150 show "bad compliance"[9]. The Cronbach's alpha value of the scale in the current study was 0.79. All necessary permissions were obtained from the scale copyright owners.

3.2.3. Fear of COVID-19 Scale (FCV-19S)

This scale was developed by Ahorsu et al. (2020) to determine the fear of COVID-19 and included seven items. The participants indicate their level of agreement with the statements using a 5-Likert type scale that range from "strongly disagree" to "strongly agree". The score for each item ranged from 1 to 5 and the score for the scale ranged from 7 to 35. Higher scores show a higher level of fear of COVID-19. Turkish reliability and validity study of the scale was carried out by Satıcı et al. (2020). Cronbach's alpha value of the Turkish version of the scale was 0.88 [18,19]. All necessary permissions were obtained from the scale copyright owners.

3.2.4. Measurement of metabolic parameters before and during the pandemic

First, the scales were administered to the patients after they apply to the outpatient clinic. Then the metabolic parameters of the patients were added to the forms. For the metabolic parameters before the pandemic, only the parameters in the last three months before the pandemic was used. If the patients did not have metabolic control parameters in this period, the patients were excluded from the study. So, the metabolic parameters of the patients before the pandemic represents the measurements/assessment of the patients in three months before the first cases in Turkey on 11 March 2020. For the metabolic parameters during the pandemic, blood samples were taken from the patients during their visit outpatient clinic between January and April 2021. All parameters (before and during the pandemic) were evaluated by using the same device (Beckman Coulter DxC 800) and the same kits. For weight and height measurement, the TANITA MC 580 device was used both before and during the pandemic measurements. Both measurements were conducted by the same medical doctor who is also a researcher in the study. Throughout the pandemic, the change up to three kilograms was considered as no change in weight, more than three kilograms' gain was considered as "gained weight" and more than three kilograms lost was considered as "lost weight". Fasting Blood Glucose (FBG) was evaluated after 8-hours of fasting and Post-Prandial Blood Glucose (PBG) was evaluated two hours after breakfast. Both FBG and PBG were evaluated

by using glucose assay kits in the laboratory. Systolic and diastolic blood pressure were evaluated by using the Omron M10-IT digital automatic blood pressure monitor device.

3.3. Statistical analysis

The data were evaluated by using IBM SPSS v25.0 statistical package program. Descriptive statistics were used to determine the frequency and mean scores. The descriptive findings of the study are presented in number (n), percentage (%), mean and standard deviation. Kolmogorov-Smirnov and Shapiro Wilk tests were used to evaluate the normal distribution of the data.A Paired-sample t-test was used to compare the patients' metabolic parameters before and during the pandemic. A correlation was used to determine the relationship between the patients' characteristics and metabolic parameters. Linear regression was used to determine factors affecting treatment compliance. The significance level was set at $p < 0.05$.

3.4. Ethics

All principles of the Helsinki Declaration were followed throughout the study. Ethical approval was obtained from the Non-Invasive Ethics Committee of the relevant University on and written permission was obtained from the institution where the research was conducted on. The purpose and scope of the study were explained to the patients who met the inclusion criteria, and their verbal and written consent was obtained to participate in the study.

4. Results

The mean age of the patients was 45.79 ± 7.53 years, and the mean duration of disease was 8.16 ± 3.60 years. The majority of the patients were female (54.8%), married (69.0%), secondary school graduate (33.7%), unemployed (41.6%), has an extended family structure (64.4%), has hypertension (30.7%), experienced DM-related complications (63.4%), had neuropathy (32.8%), using oral antidiabetics (43.6%), did not smoke (65.0%), had a family history of DM (71.3%) and had an education on DM (52.1%). Of the patients, 75.9% (n = 230) were using oral antidiabetic treatments while %24.1 (n = 73) were using insulin.

During the pandemic, the majority of the patients gained weight (47.9%), rarely measured blood glucose level (35.6%), rarely exercised (38.0%), rarely followed the recommended diet (44.2%), had complications (50.5%), experienced hypoglycemia (62.1%), did not prefer to go to hospital controls during the pandemic (63.4%) and afraid of going to the hospital with the thought of contagion (64.7%) (Table 1).

It was found that there was a significant difference between the mean scores of patients' weight, Body Mass Index (BMI), Low-Density Lipoprotein (LDL), cholesterol, triglyceride, FBG, PBG, HbA1c before and during the pandemic. It was found that there were no significant differences in the mean scores of HDL, systolic and diastolic blood pressure averages ($p < 0.05$) (Table 2).

It was determined that the mean scores of T2DTCS during the pandemic process were 113.59 ± 8.31. The mean FCV-19S score of the patients was 29.14 ± 3.05 (Table 3).

Education level, duration of illness, having a chronic disease, having a complication of DM, mean scores of FBG, PBG, HbA1c, FCV-19, regular measurement blood glucose level during the pandemic, diet and exercise habits during the pandemic were found to be variables that significantly predicted compliance with treatment. According to this; the compliance of primary school graduates and those with low illness years, chronic diseases, hypoglycemia complications, has a high level of FBG, PBG, HbA1c, with a higher score on the FCV-19S, who do not perform regular measurement of blood glucose level during the pandemic process, those who do not comply with exercise and diet had a worse level of treatment compliance (Table 4).

Table 1
Disease-related characteristics of the patients with diabetes mellitus During the Pandemic.

	n	%
Weight changes during the pandemic (±3 Kilograms)		
Gained weight	145	47.9
Lost weight	58	19.1
No changes	100	33
Blood glucose level measurement during the pandemic		
Never	53	17.5
Rarely	108	35.6
Sometimes	92	30.4
Regularly	50	16.5
Performing exercise during the pandemic		
Never	97	32
Rarely	115	38
Sometimes	60	19.8
Regularly	31	10.2
Following recommended diet during the pandemic		
Never	76	25.1
Rarely	134	44.2
Sometimes	50	16.5
Regularly	43	14.2
Experiencing acute complications of diabetes during the pandemic		
Yes	153	50.5
No	150	49.5
Type of the acute complication of diabetes experienced (n:153)		
Severe hypoglycemia	95	62.1
Diabetic ketoacidosis	51	33.3
hyperglycemic hyperosmolar state	7	4.6
Did you prefer to go to the hospital during the pandemic?		
Yes	111	36.6
No	192	63.4
Changes in follow-up and treatment of the disease during the pandemic		
Afraid of going to the hospital with the thought of contagion	196	64.7
I stopped my medications because I believe that it will adversely affect my immunity	77	25.4
I regularly use my insulin/oral antidiabetic and went to the follow-ups regularly	30	9.9

Table 2
Metabolic Parameters of the Patients Before and During Pandemic.

	Before Pandemic Mean±SD	During Pandemic Mean ± SD	Mean difference (95% CI)	t	p
Weight (kg)	92.33 ± 1.5	98.25 ± 1.1	6.50 (2.73–10.01)	1.97	0.02
BMI (kg/m^2)	34.91 ± 1.3	37.03 ± 1.0	2.21 (1.25 – 3.17)	1.90	0.04
HDL (mg/dL)	45.18 ± 1.7	46.34 ± 1.7	1.39 (0.53–3.71)	1.88	0.10
LDL (mg/dL)	161.54 ± 2.9	190.90 ± 1.5	29.74 (22.11–36.80)	2.35	0.03
Cholesterol (mg/dL)	246.00 ± 2.5	265.74 ± 1.6	19.65 (14.02–24.10)	1.76	0.02
Triglyceride (mg/dL)	249.12 ± 2.0	286.67 ± 2.9	37.88 (31.24–43.00)	2.03	0.01
FBG (mg/dL)	128.70 ± 1.6	140.42 ± 2.4	12.60 (6.34–17.87)	1.59	0.00
PBG (mg/dL)	140.61 ± 1.3	161.19 ± 1.4	21.00 (16.91–26.13)	2.45	0.00
HbA1c (%)	7.53 ± 0.25	8.10 ± 1.2	0.57 (0.21–0.9)	1.00	0.01
Systolic Blood Pressure (mmHg)	131.7 ± 11.08	137.9 ± 10.3	6.75 (2.59–10.91)	2.85	0.69
Diastolic Blood Pressure (mmHg)	70.24 ± 7.35	72.18 ± 6.4	2.86 (1.23–4.50)	1.42	0.72

Table 3
The mean scores of T2DTCS and FCV-19S of the patients.

		During The Pandemic		
		n	%	Mean±SD
T2DTCS	**Good** (30–54)	73	24.1	51.36 ± 4.02
	Moderate (55–125)	107	35.3	119.05 ± 10.34
	Bad (126–150)	123	40.6	146.18 ± 6.77
	Total	303	100	113.59 ± 8.31
		Mean±SD		
FCV-19S Total		29.14 ± 3.05		

Table 4
Regression Analysis for Factors Predicting Treatment Compliance in Pandemic Process.

Variables	β	S.E.	t	B	p
Constant		0.966	11.302	4.314	0.001
Age	0.010	0.015	5.016	0.129	0.705
Gender (Female)	0.272	0.589	4.214	0.426	0.083
Education level (primary school)	0.033	0.060	5.908	0.183	**0.010**
Family structure	0.012	0.294	4.730	0.205	0.077
Disease duration	-0.017	0.026	4.850	0.310	**0.008**
Having a chronic disease (hypertension)	0.030	0.081	5.964	0.270	**0.015**
Complication (severe hypoglycemia)	0.055	0.934	4.321	0.614	**0.026**
Treatment type (Insulin/Oral Antidiabetics)	0.234	0.805	5.168	0.415	0.656
BMI	0.203	0.957	4.579	0.400	0.289
FBG	0.609	0.036	5.093	1.761	**0.003**
PBG	0.681	0.214	4.805	1.895	**0.005**
HbA1c	0.705	0.049	3.099	1.410	**0.040**
Triglyceride	0.023	0.152	4.605	0.213	0.194
LDL	0.198	0.349	4.773	0.309	0.227
Cholesterol	0.550	0.061	5.008	1.040	0.106
FCV-19S	0.992	0.083	5.710	1.817	**0.012**
Blood glucose level measurement during the pandemic (never)	0.853	0.120	4.230	1.692	**0.004**
Following recommended diet during the pandemic (never)	0.801	0.295	3.005	1.605	**0.033**
Performing exercise during the pandemic (never)	0.786	0.072	3.700	1.461	**0.015**

R square:0.35 F= 3.021 $p < 0.05$.

5. Discussion

It was found that the blood glucose level of the patients participating in the study gradually deteriorated. However, patients with DM need to maintain good glycemic control to reduce the risk and severity of infection. Hyperglycemia, regardless of its source, is associated with increased mortality and a poor course of infections. Good glycemic control will reduce or prevent the severity of the disease requiring intensive care in the case of COVID-19, as it will also reduce the likelihood of pneumonia due to bacterial superinfections [18,20]. In addition, it was found that most of the patients gained weight, did not exercise, and did not comply with recommended diet during the pandemic. In studies on this subject; it has been reported that less than half of the patients exercise regularly. It is emphasized that regular physical exercise and compliance with recommended diet are very important in the treatment of DM and the prevention of complications, and in ensuring glycemic control [21,22]. Since patients rarely exercise during the pandemic process and rarely follow their diet, it is observed that most of the patients gained weight during the pandemic. It was found that most of the patients developed acute complications - mostly experienced hypoglycemia. Hypoglycemia is one of the most feared acute complications of DM, and it is one of the most harmful complications for the body. However, regular follow-up and treatment for glycemic control could reduce the risk of complications [23,24]. We thought that the development of complications in patients may be a result of that patients did not go to hospital controls regularly for fear of infection during the pandemic and did not measure their blood sugar level regularly.

It was determined that the average score of the COVID-19 fear scale of the patients was at a high level when it compared to general population. In a study conducted by Reznik et al. (2021) investigating the COVID-19 fear of general population, the average score of the COVID-19 fear scale was reported 17.4 ± 4.7 in Russia and 16.6 ± 4.5 in Belarus [25]. In a study conducted in Turkey by Haktanir, Seki and Dilmaç (2022), the average of COVID-19 fear scale of general population was reported 18.48 ± 5.42 [26]. We believed that the reason for this high score in patients with diabetes was that they consider themselves under higher risk than the general population. This may lead to the increased fear of COVID-19 in these patients.

In our study, it was found that most patients were ata bad level of treatment compliance. As a result of the literature review, the treatment compliance of patients with DM to treatment varies. In a study, it was stated that medication compliance was at a moderate to the high level [27]. Contrary to our study, it was stated in some studies that patients' treatment compliance was at a high level [21,22,28,29]. This may be due to whether patients have received DM education, the difference in health services, and the use of different measurement tools to evaluate treatment compliance. During the pandemic, it is understood that patients' treatment compliance is deteriorated due to the need for serious daily life changes because of the pandemic which affects the patients' lifestyle too. This failure to adapt to chronic diseases such as DM prevents the effectiveness of treatment, negatively affects the course of the disease, and causes an increase in health expenditures and deaths with the addition of other diseases to the existing disease [30,31].

Compliance with the disease and treatment in chronic diseases is a dynamic process that is affected by individual and environmental stimuli [9,32]. Factors affecting compliance with treatment during and after the pandemic were educational level, duration of illness, comorbidity, and complications [2,5]. Accordingly, university graduates have higher levels of treatment compliance. Assari et al. (2017) were reported that as the education level of patients with DM increased, their level of treatment compliance increased too [4]. We thought that type 2 patients with DM at a lower educational level, often have a low level of knowledge and awareness about DM, they also have troubles in complex treatment interventions such as insulin use, blood glucose monitoring, and they do less healthy lifestyle practices, so this may be the reason for the bad compliance in this group. This also may be related to the high level of awareness in patients with a high level of education [11,20,33].

We found that the duration of DM affects treatment compliance. As the disease duration increases, patients' treatment compliance increases. It has been reported in the literature that the longer the duration of DM (10 years or more), the better the treatment compliance [10]. Similarly, Guo et al. (2020) stated that as the duration of DM increases, treatment compliance increases [5]. Bode et al. (2020) reported that the years that patients live with chronic disease is a determinant of treatment compliance [8]. In our study, it can be thought that patients with a long duration of DM learn more about the disease and treatment, pay more attention to treatment in the long run, develops better coping strategies, and increase treatment compliance.

Comorbidity and complications affect patients' treatment compliance sometimes negatively or positively. In the study conducted by Drucker (2020), 52.7% of those without complications had good compliance with treatment, while 63.8% of those with complications had good compliance with treatment [31]. Hussain et al. (2020) reported that patients with comorbidity in patients with DM had better compliance with treatment [34]. In another study, it was reported that treatment compliance was higher in the patients with DM with more than one comorbidity [28]. It can be said that the obligatory lifestyle changes of patients with chronic diseases, frequent follow-ups in this group, and personal characteristics may affect treatment compliance [28,35]. Contrary to other studies, we found that treatment compliance was bad in those with comorbidity. We thought that during the

pandemic patients' lifestyle adaptation to other chronic diseases may be affected and their frequent follow-ups may also be interrupted due to the pandemic.

In the study, it was determined that the higher mean scores of FBG, PBG, HbA1c, and FCV-19S, the lack of regular blood glucose measurement, poor compliance with diet, and the lack of exercise negatively affected the compliance with the treatment. Self-measurement (blood glucose), diet, physical activity are three key components of DM management. Regular exercise is necessary for the recovery of the disease and the prevention of complications. As a result of regular exercise and a balanced diet, individuals with type 2 DM need less insulin treatment. The most recommended physical activity for patients with DM is walking. However, during the pandemic, it is important to avoid walk-in crowd places for patients with DM. Other activities that can do during the pandemic are biking and running at a slow pace [10,11,28]. Attention to diet, nutrition, and adequate protein intake is important. If there is any mineral and vitamin deficiency, it should be eliminated to protect patients from other diseases [33,34]. In the literature, it was reported that patients disrupt their treatment due to fear of COVID-19 and their metabolic control deteriorates [9,10]. Outbreaks can also be described as a crisis or a disaster due to the rapidly increasing nature of the number of people in need of medical treatment, as societies require measures that may change and disrupt their daily life practices [16,24]. In this respect, the COVID-19 epidemic, which has been declared a pandemic by WHO, can be considered as a crisis that harms individuals' sense of confidence that their lives are under their control, and increases threat perception and fear by creating an environment of uncertainty. Especially for patients with DM, the fear of entering environments with a high risk of encountering infected people, such as hospitals, draws attention [30,32,36]. In the current study, increases in comorbidity and fear of COVID-19 were also increasing FPG and HbA1c. During the pandemic, there have been restrictions on the elderly population in Turkey, due to these restrictions, diet, exercise, and medication adherence of the patients has been deteriorated [12]. It has been stated that the presence of hypertension in patients with type 2 DM leads to difficulties in treatment compliance [21,34]. Our findings reflect the literature in this respect. Between FBG and HbA1c with regular blood glucose tests after pandemic; A moderate negative correlation was found between exercise and diet and total cholesterol and BMI after the pandemic. During the pandemic, a moderate negative correlation was found between regular blood glucose measurement and FBG-HbA1c and between exercise-diet, and total cholesterol-BMI. It can be said that patients who measure regularly blood glucose levels have information about their health status, so they are more careful in terms of keeping the disease under control. In addition, the fact that some patients have to stay at home most of their time due to the pandemic restrictions, this may be affecting the eat and exercise habits of them, leading to an increase in cholesterol and BMI. Munekawa et al. (2021) reported that the increased level of the stress lead to the decrease exercise levels in the patients with diabetes during the pandemic. Experienced stress and lifestyle changes have been associated with increased body weight and HbA1c levels [37]. In the systematic review and meta-analysis study of Ojo et al. (2022), they stated that glycosylated hemoglobin, fasting glucose and body mass index levels increased in patients with type 2 diabetes during the quarantine period compared to pre-COVID-19 [38]. DM management includes many factors that make compliance difficult for the patients. The fact that DM is a chronic disease, requires lifestyle changes and its treatment is complex are among the important factors that affect treatment compliance [24,27,32]. During the pandemic, the fear of COVID-19 also emerges as an important factor that makes adaptation difficult. In the literature, it has been stated that DM is an important factor that increases the severity of COVID-19 disease. Especially the information sharing in social media, radio or television increases the fear of COVID-19 in these patients, and therefore, they stay at home more (this also lead doing less exercise, interrupt of follow-ups) and this cause poor metabolic control and bad treatment compliance [30,32,39].

5.1. Conclusion

In this study, it was found that the fear of COVID-19 was high in patients with DM during the pandemic, their compliance with treatment and metabolic control was disrupted, and metabolic control results were poor. In the COVID-19 pandemic, it will be the most ideal follow-up to monitor patients with DM at home, transmit blood glucose measurement results to healthcare professionals, and adjust the medication and insulin doses. To maintain DM management and its effective control, training on protection from COVID-19 should be provided to patients with DM and their families. With the COVID-19 pandemic, it is also necessary to plan and carry out measures for the risk of psychological disorders in patients. In this context, to prevent or at least reduce the fear of COVID-19 and its negative effects during the pandemic, it is recommended to provide training, motivational interviews, and planning psychosocial support services to patients with DM and their families that emphasize the importance of COVID-19 contamination, prevention principles, and DM-related controls.

5.2. Limitations

The study had some limitations. The study was not a population-based study and the patients who were referred to the hospital were included in the study. The study was carried out in a single center.

Conflict of interest

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Data availability

Authors do not prefer to publish data but it will be available upon request of editor or reviewers.

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Authors' contributions

Author T.B. contribute to design of the study, manuscript writing, and data analysis. Author B.Y. contribute to the design of the study and data collection. Author A.T. and S.Ş. contribute to the design of the study and supervision of the manuscript.

Ethics approval

Ethical approval was obtained from the Non-Invasive Ethics Committee of İnönü University on 17 December 2020 (Protocol Number: 2020–19/3) and written permission was obtained from the institution where the research conducted on.

Consent to participate

Verbal consent were obtained from all participants before data collection.

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Informed consent

Informed consent was obtained from all individual participants included in the study.

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