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Original research

The effect of the COVID-19 pandemic on self-management in patients with type 2 diabetics

Hediye Utli [a,*], Birgül Vural Doğru [b]

[a] Department of Elderly Care, Vocational School of Health Services, Mardin Artuklu University, Artuklu Campus, 47200 Mardin, Turkey
[b] Department of Internal Medicine Nursing, Mersin University Faculty of Nursing, Ciftlikkoy Campus, Yenişehir, 33110 Mersin, Turkey

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ABSTRACT

Aims: The research was conducted with the aim of determining the effect of the COVID-19 pandemic on levels of self-management in individuals with type 2 diabetes.
Methods: This cross-sectional descriptive type of study was conducted between 21 December 2020 and 1 April 2021. It was performed with 378 individuals with type 2 diabetes attending the endocrinology clinic and outpatients' department of a government hospital who agreed to participate in the research. In the collection of data, a Patient Identification Form, Visual Analog Scales (an Anxiety VAS and a Stress VAS), and the Diabetes Self-Management Questionnaire (DSMQ) were used. The Wilcoxon test, Independent Sample t test, One-Way Anova and binary logistic regression were used in the analysis of data.
Results: The Diabetes Self-Management Questionnaire (DSMQ) total mean score of the individuals with type 2 diabetes participating in the study during the COVID-19 pandemic was 5.25 ± 1.04. Their anxiety total mean score was 0.32 ± 1.56, and their total mean stress score was 7.06 ± 1.62. Being male, over the age of 65, married and having a diagnosis of diabetes for 6–11 years, increased smoking, the COVID-19 pandemic, reduced physical activity (not walking) and support obtained from health professionals, and increased anxiety and stress levels were found to be risk factors affecting diabetic self-management.
Conclusions: The findings show that the COVID-19 pandemic has had a negative effect on the self-management levels of individuals with type 2 diabetes.

1. Introduction

COVID-19 first appeared in China, then became a public health threat to the whole world, and in March 2020 was declared a pandemic by the World Health Organization (WHO) [1]. People of all ages are susceptible to COVID-19, but diabetic patients are at greater risk because they have many accompanying chronic illnesses and their immune systems are under pressure [2–4]. The COVID-19 pandemic has led to more variable blood sugar levels in diabetic patients, and to an increase in HbA1c levels, hospitalization and intensive care needs [5].

There are 463 million people with diabetes in the world [6]. It is estimated that the prevalence of diabetes will rise to 10.2% (578 million) by 2045, and to 10.9% (700 million) by 2045 [7]. In 72 314 COVID-19 case reports published by the Chinese Disease Control and Prevention Center, it is shown that the mortality of persons with diabetes (7.3%) is approximately three times higher than that of persons without diabetes (2.3%) [8].

Type 2 diabetes is a disease which necessitates constant medical and individual care in order to prevent and slow acute and chronic complications [9,10]. Diabetes is a disease which is steadily increasingly seen, and which entails complications and the need for lifelong treatment and care. Thus, it is a significant health problem which constitutes a heavy burden on society [11–13]. The worry of diabetic individuals about going to a hospital during the pandemic makes it more difficult for health professionals to monitor them and to support their self-confidence [3,14]. Holistic self-management in diabetes includes regular glucose monitoring, medical nutrition treatment, adherence to regular drug use, and self-care behaviors ensuring adherence to physical activity [11,13]. Among other factors affecting self-management behaviors in diabetes are diabetes education, the duration of the illness, the presence of comorbid conditions, body mass index (BMI), foot care and smoking [16]. In order for a diabetic individual to be able to carry out self-management, it is of great importance to have sufficient knowledge concerning diabetes management and to always keep blood sugar within normal limits, to have cooperation from family members

* Corresponding author.
E-mail addresses: hediyeutli@artuklu.edu.tr (H. Utli), bvuraldogru@gmail.com (B. Vural Doğru).

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and the support of physicians and diabetes nurses, and to make self-management skills into a lifestyle and maintain them in order to prevent complications. In this way, the quality of life will be improved [2,13,16–18].

The fear of COVID-19 infection, the constant and immediate flow of news concerning the epidemic, the measures taken throughout the epidemic to prevent its spread, isolation, uncertainty and loneliness bring about radical changes in daily life [3,19]. It has been reported that these changes can result in a reduction in communication between individuals with diabetes and health professionals, limited access to health services, a reduction in family support and limited physical activity, as well as problems such as anxiety, insomnia and a disruption of blood sugar control [2,3,19,20].

It is thought that all of these changes and problems during the COVID-19 outbreak may affect diabetic self-management. In the literature, only one study was found on the perceived hindrances to type 2 diabetes self-management in the COVID-19 outbreak [2]. It is necessary for nurses working in this field to know how the COVID-19 epidemic affects patients' self-management. This study was planned with the aim of determining the sociodemographic and disease-related characteristics of individuals with type 2 diabetes, and the effect on their diabetes self-management of the changes which the COVID-19 pandemic has caused in their lives.

2. Methods

The research was a cross-sectional descriptive type of study.

2.1. Research hypotheses

H0. The COVID-19 pandemic has no effect on self-management in patients with type 2 dibetics.

H1. The COVID-19 pandemic has an effect on self-management in patients with type 2 dibetics.

2.2. Study sample and participants

The population of the research comprised a minimum of 295 individuals from among those (N = 1250) who attended an endocrinology clinic and outpatients' department in 2019 and 2020, with an error margin of 0.05 and a confidence interval of 95%. The research sample consisted of the 378 individuals with type 2 diabetes who attended the endocrinology clinic and outpatients' department of a government hospital between 21 December 2020 and 1 April 2021.

2.3. Inclusion criteria

Individuals were included in the study who had received a diagnosis of type 2 diabetes at least one year previously, who were aged 18 or more, who were literate and had no communication problems, whose physical and cognitive levels were such that they could answer the forms which were planned for use in the research, and who agreed to participate in the research.

2.4. Exclusion criteria

Those who had recently had a running nose, a fever, a cough or breathing difficulties, those with a diagnosis of type 1 diabetes, those who were under the age of 18, those with a communication problem, and those who did not agree to participate in the study were not included. Seven individuals who refused to take part in the study were not included.

2.5. Data collection tools

2.5.1. Patient identification form

This form was prepared by the researchers in accordance with the literature [2,13,14,16], and consisted of questions on information concerning sociodemographic characteristics and characteristics relating to illness and COVID-19.

2.5.2. Visual analog scale (VAS)

A visual analog scale was used in the research to evaluate anxiety and stress. The VAS was presented as a horizontal graph from 1 (nothing) to 10 (extreme) [21]. The individuals with type 2 diabetes were asked to mark their levels of stress and anxiety during the COVID-19 pandemic on the scale.

2.5.3. Diabetes Self-Management Questionnaire (DSMQ)

This scale was developed by Schmitt et al. in 2013 with the aim of investigating the relation between diabetic self-management in diabetic patients and glycemic control [22]. Validity and reliability were tested for Turkish by Eroglu and Sabuncu in 2018 [13].

The DSMQ is an individual evaluation scale of 16 items. Item 16 is not included in any subscales. The scale includes four subscales: glucose management (1, 4, 6, 10, 12), diet control (2, 5, 9, 13), physical activity (8, 11, 15), and use of health services (3, 7, 14). Participants were asked to answer taking into account their condition in the preceding eight weeks. The scale was of four-way Likert type, and each item on the scale was scored from 0 to 3 (0 does not apply to me, 1 applies to me a little, 2 apples considerably to me, 3 very much applies to me). Items 5, 7, 10, 11, 12, 13, 14, 15 and 16 on the scale were scored in reverse. The lowest possible score on the scale was 0, and the highest was 10. A score approaching 10 indicated greater diabetic self-management. The Cronbach alpha coefficient of the scale was 0.850, and was found to be 0.875 in our study.

2.6. Data collection

During the research, care was taken to take protective measures regarding the COVID-19 pandemic. Data collection was performed on the five working days of the week between 13.00 and 17.00 in the afternoon when there were fewer patients. Because of the COVID-19 pandemic, the researcher and the patients wore masks and social distancing of at least 1.5 m was maintained during data collection. The researcher handed out the data collection forms to the patients for them to complete, and took them back after completion. Form completion took approximately 10–15 min.

The most recently measured values of patients' pre and post-COVID-19 HbA1c, fasting blood sugar (FBS), diastolic blood pressure and systolic blood pressure were taken from their files. FBS levels were calculated from the mean of the patients' FBS levels of the previous seven days.

2.7. Data analysis

Data analysis was performed with the program IBM SPSS v25 (Chicago, USA). Examination for normal distribution of data was performed with skewness–kurtosis and the Kolmogorov–Smirnov test. For descriptive statistics, arithmetic mean ± standard deviation, numerical values and percentages were used. The Wilcoxon test was used for data which did not show normal distribution in the statistical analysis, while in the analysis of data which showed normal distribution, the independent sample t test, the one-way anova test and binary logistic regression were used. The level of statistical significance was taken as $p < 0.05$.

2.8. Ethics

This study was carried out in accordance with the principles of the Helsinki Declaration. Permission to conduct the study was obtained from the Scientific Research Studies Commission on COVID-19 from the internet site of the Ministry of Health of the Republic of Turkey. Also, written permission No. 2020/13-58 was obtained from the Human Research Ethics Committee of a university. Institutional permission No. 7201737-604.02 dated 29 December 2020 was also obtained in writing from the relevant Province Health Directorate of the government hospital where the research was conducted. Written approval was obtained from the individuals with type 2 diabetes who voluntarily participated in the study after they had been given information on the aims of the research.

3. Results

The mean age of the individuals with type 2 diabetes who participated in the research was 52.37 ± 11.37 years, and 47.8% were aged between 31 and 65 years. It was found that 56.8% were overweight, 62.7% were male, 90.5% were married, 50.5% lived in the provincial capital, 29.9% were educated to primary school level, 54% had lower income than expenditure, 48.4% were working and 35.7% were retired. Also, 44.7% had first-degree relatives with diabetes, 37.3% had had a diagnosis of diabetes for 12 years or more, 24.6% used insulin, and 88.4% had received education regarding diabetes (Table 1).

The COVID-19 pandemic had affected the diabetes management of 56.6% of the individuals with type 2 diabetes, and 79.9% of these stated that this effect had been negative. It was stated that this negative effect mostly (41.1%) arose from not being able to exercise by walking. According to their statements, 9.3% were smoking more during the COVID-19 pandemic, 57.4% went to health institutions less and 46.6% sought less support from health professionals, while 34.4% stated that there was no change in the support which they obtained from family members. Finally, 61.6% of the individuals stated that during the COVID-19 pandemic their anxiety increased, 61.9% that their stress increased, and 46% that their sleep quality was worse (Table 1).

The total mean score on the DSMQ during the COVID-19 pandemic of the individuals with type 2 diabetes who participated in the research was 5.25 ± 1.04. Examining the mean scores of the DSMQ and its subscales, the following scores were found: glucose management 5.18 ± 0.24, diet control 5.20 ± 1.15, physical activity 5.10 ± 0.22, and use of health services 5.24 ± 0.56. The individuals with type 2 diabetes had a total mean VAS anxiety score during the pandemic of 7.32 ± 1.56, and a total mean stress VAS score of 7.06 ± 1.62.

Significant differences were found when comparing the values before and during the COVID-19 pandemic of HbA1c, fasting blood sugar, diastolic blood pressure and systolic blood pressure ($p < 0.001$, $p < 0.001$, $p = 0.004$, $p < 0.001$) (Table 2).

Table 3 shows whether there was a difference in the participants' DSMQ total and subscale mean scores according to their sociodemographic and COVID-19-related characteristics. According to this, The DSQ total and diet control and physical activity subscale mean scores of those aged over 65 were significantly lower than those in the 31–65-year age group. Mean scores of total DSMQ and glucose management and physical activity were significantly lower in those with a body mass index (kg/m^2: BMI) of 25.0 or more than in those with a BMI of 18.9–24.9. Mean scores of total DSMQ and the subscale of use of health services were significantly lower in males than in females. Mean DSMQ total and glucose management subscale scores were significantly lower in those who were mar-

Table 1
Sociodemographic and COVID-19 pandemic-related characteristics of individuals with type 2 diabetes (n = 378).

Characteristics	Mean ± SD	
Age	52.37 ± 11.37	
	n	%
Age		
31–65	181	47.8
>65	169	44.7
Body mass index (kg/m^2)		
18.9–24.9 (normal)	163	43.1
25.0 or over (overweight)	215	56.8
Sex		
Male	237	62.7
Female	141	37.3
Marital status		
Married	342	90.5
Single	36	9.50
Place of residence		
City	191	50.5
Town	135	35.7
Village	52	13.8
Education level		
Literate	65	17.2
Primary school	113	29.9
High school	108	28.6
University	92	24.3
Monthly income		
Income less than expenses	204	54
Income equal to expenses	161	42.6
Income greater than expenses	13	3.4
Work		
Working	183	48.4
Not working	165	43.7
No longer working	30	7.9
Profession		
Retired	135	35.7
Office worker	104	27.5
Housewife	66	17.5
Manual worker	43	11.4
Self-employed	30	7.9
Family history of diabetes		
First degree relatives	169	44.7
Second degree relatives	116	30.7
None	93	24.6
Time since diabetes diagnosis		
1–5 years	126	33.3
6–11 years	111	29.4
12 years or more	141	37.3
Diabetes treatment		
Insulin therapy	93	24.6
Medical nutrition treatment	83	22
Oral hypoglycemic agents	73	19.3
Medical nutrition + insulin therapy	62	16.4
Insulin + oral hypoglycemic agents	36	9.5
No treatment	31	8.2
Education on diabetes		
Yes	334	88.4
No	44	11.6

Variables	n	%
Effect of COVID-19 pandemic on diabetes disease management		
Yes	214	56.6
No	164	43.4
If yes, how has it affected diabetes disease management?		
Negatively	171	79.9
Positively	43	20.0
Positive effects of the COVID-19 pandemic on diabetes disease management		
Exercising by walking more regularly	16	4.3
Going to the hospital for check-ups more often	15	4
Spending more time with the family	12	3.2
Negative effects of the COVID-19 pandemic on diabetes disease management		
Inability to exercise by walking	88	41.1
Worry about COVID-19 infection when gong to the doctor	52	24.2
Arguing with family	35	16.3
Wanting to eat more	28	13

Table 1 (*Continued*)

Characteristics	Mean ± SD	
Low morale from staying at home for a long time	11	5.1
Smoking		
I don't smoke	190	50.3
No change	135	35.7
I smoke less	35	9.3
I smoke more	18	4.8
Going to health institutions		
I go less	217	57.4
No change	145	38.4
I go more	16	4.2
Support from health professionals		
Less	176	46.6
No change	170	45
More	32	8.5
Support from family members		
No change	130	34.4
More	126	33.3
Less	122	32.3
Anxiety		
More	233	61.6
No change	121	32
Less	24	6.3
Stress		
More	234	61.9
No change	120	31.7
Less	24	6.3
Sleep quality		
Worse	174	46
No change	103	27.2
Better	101	26.7

ried than in those who were single, and in those whose receipt of support from health professionals decreased compared with those in whom it increased or did not change. The mean scores for the subscales of glucose management and use of health services was significantly lower in those who lived in a village or small town compared to those who lived in a larger town or city. In those who had been diagnosed with diabetes 1–5 years previously, the mean score for the subscale of use of health services was significantly lower than in those who had received a diagnosis 6–11 years previously or 12 or more years previously. The means on the subscale of physical activity were significantly lower in those who were smoking more than in those who were smoking the same or less. A significant difference was found in the total DSMQ and diet control and physical activity subscale mean scores of those who said that the COVID-19 pandemic had had a negative effect on their diabetes management compared with those who said it had not. The mean scores on the subscales of diet control and use of health services were significantly lower in those who worried about getting infected with COVID-19 if they went to a doctor, while the total DSMQ and physical activity subscale mean scores were significantly lower in those who could not exercise by walking. In individuals whose anxiety increased, DSMQ total and diet control and physical activity subscale mean scores were significantly lower than in those in whom it lessened or remained the same. In those whose stress increased or whose sleep quality was worse, total DSMQ and glucose management and physical activity subscale mean scores were found to be significantly lower.

Risk factors affecting the diabetic self-management of individuals with type 2 diabetes in the COVID-19 pandemic were found to be being over the age of 65, male and married, and having had a diagnosis of diabetes for 6–11 years, not being able to exercise by walking in the COVID-19 pandemic, a reduction in support received from health professionals, and increased anxiety and stress (Table 4).

4. Discussion

The basis of controlling diabetes in those with type 2 diabetes is the possibility of achieving self-management and making this a lifestyle [17]. The restrictions brought in to combat the COVID-19 pandemic have caused a repositioning of health service resources and an interruption of access to care during the pandemic. Strict isolation has had a greater effect on people with non-infectious diseases who need constant care and support [6]. In this way, there is concern in Turkey as to how the measures and restrictions regarding COVID-19 are affecting the self-care of individuals with type 2 diabetes. Research on determining the factors affecting diabetes self-management in the COVID-19 pandemic will open new perspectives to the literature.

Self-management programs arranged to bring under control the health of individuals with type 2 diabetes in situations such as a pandemic serve to strengthen patients. A score approaching 10 on the Diabetes Self-Management Questionnaire (DSMQ) is taken as showing an improvement in diabetes self-management, and so the self-management levels of the individuals with type 2 diabetes participating in our research were low. Studies were found in the literature which were conducted before the COVID-19 pandemic which had similar findings to our research [12,14,16]. In a qualitative study by Shi et al. [2], 11 participants stated that they had inadequate contact concerning their self-management of diabetes during the COVID-19 pandemic. It can be said that the quality of life and health outcomes of individuals with type 2 diabetes are made worse by the COVID-19 pandemic. It is thought that the reason for the low levels of self-management found in individuals with type 2 diabetes may be the uncertainty, fear, anxiety and stress experienced during the COVID-19 pandemic in relation both to disease management and to the pandemic itself.

In the assessment of the subscales of the DSMQ in our study, the highest mean subscale score was use of health services, and the lowest was physical activity. Although the mean subscale score for use of health services was higher than the other subscales in our study, it is low in comparison with pre-pandemic mean scores in the literature [12,16]. This shows that the use of health services by individuals with type 2 diabetes and their physical activity levels decreased during the pandemic. In the qualitative study by Shi et al. [2], a participant with type 2 diabetes stated, "I have a bit of knowledge about physical exercise during the COVID-19 pandemic. I pay a lot of attention to this in my daily life." This shows that participants had limited knowledge concerning physical exercise during the COVID-19 pandemic. Regular physical activity is

Table 2
Metabolic variables of individuals with type 2 diabetes before and during the COVID-19 pandemic.

Variables	Pre-test	Post-test	
	Median(min–max)	Median (min–max)	Z(p)
HbA1c (%)	7.03(5.08–8.24)	8.4(5.12–8.28)	−3.522(0.000) [a]
Fasting blood sugar (mg/dl)	130(92–170)	135(95–199)	−11.644(0.000) [a]
Diastolic blood pressure (mmHg)	89.00(60.00–123.00)	91.00(65.00–125.00)	−2.906(0.004) [a]
Sistolic blood pressure (mmHg)	129.00(90.00–170.00)	131.50(92.00–174.00)	−5.349(0.000) [a]

[a] Z: Wilcoxon test.

Table 3
Comparison of various socio-demographic and COVID-19 pandemic-related characteristics and total Diabetes Self-Management Questionnaire (DSMQ) and subscale mean scores.

Characteristics	Glucose management subscale Mean ± SD	Dietary control subscale Mean ± SD	Physical activity subscale Mean ± SD	Healthcare use subscale Mean ± SD	DSMQ total Mean ± SD
Age					
31–65	4.74 ± 0.94	5.71 ± 0.96	5.82 ± 0.96	5.72 ± 1.02	5.17 ± 2.13
>65	4.69 ± 0.92	5.32 ± 0.95	5.11 ± 0.84	5.59 ± 0.90	5.00 ± 1.95
Test value	t = −0.518[a], p = 0.605	t = −3.458[a], **p = 0.001**	t = −2.912[a], **p = 0.004**	t = 0.268[a], p = 0.789	t = −3.729[a], **p = 0.000**
Body mass index (kg/m^2)					
18.9–24.9 (normal)	5.75 ± 0.99	5.57 ± 1.07	5.98 ± 0.96	5.74 ± 1.03	5.55 ± 2.15
25.0 and over (overweight)	5.57 ± 0.91	5.45 ± 1.02	5.93 ± 0.84	5.66 ± 0.92	5.52 ± 2.06
Test value	t = −9.547[a], **p = 0.045**	t = −0.250[a], p = 0.124	t = −10.390[a], **p = 0.047**	t = −0.055[a], p = 0.956	t = −11.405[a], **p = 0.001**
Sex					
Male	5.71 ± 0.93	5.43 ± 1.05	5.93 ± 0.84	5.60 ± 0.95	5.36 ± 1.97
Female	5.71 ± 0.97	5.59 ± 1.06	5.97 ± 0.96	5.88 ± 0.97	5.82 ± 2.15
Test value	t = −0.065[a], p = 0.948	t = −1.339[a], p = 0.182	t = −0.394[a], p = 0.694	t = −2.700[a], **p = 0.007**	t = −2.079[a], **p = 0.038**
Marital status					
Married	5.15 ± 0.92	5.47 ± 0.92	5.25 ± 0.91	5.70 ± 0.98	5.44 ± 1.86
Single	5.66 ± 1.08	5.71 ± 1.06	5.90 ± 0.95	5.84 ± 0.84	5.50 ± 2.09
Test value	t = −2.795[a], **p = 0.005**	t = −1.246[a], p = 0.214	t = −0.276[a], p = 0.783	t = −0.790[a], p = 0.430	t = −2.737[a], **p = 0.007**
Place of residence					
City	5.82 ± 0.96	5.55 ± 1.07	5.98 ± 0.97	5.93 ± 1.00	5.71 ± 2.28
Town	5.64 ± 0.94	5.46 ± 1.05	5.97 ± 0.94	5.79 ± 0.91	5.61 ± 2.06
Village	5.48 ± 0.88	5.46 ± 1.04	5.90 ± 0.88	5.51 ± 0.91	5.27 ± 2.04
Test value	F = 2.279[b], **p = 0.054**	F = 0.261[b], p = 0.770	F = 0.324[b], p = 0.723	F = 4.689[b], **p = 0.010**	F = 1.672[b], p = 0.189
Time since diabetes diagnosis					
1–5 years	5.76 ± 0.92	5.47 ± 1.11	5.02 ± 0.85	5.41 ± 0.91	5.18 ± 1.90
6–11 years	5.74 ± 0.89	5.39 ± 1.07	5.03 ± 0.90	5.79 ± 0.97	5.67 ± 2.23
12 years or more	5.65 ± 1.00	5.59 ± 0.98	5.83 ± 0.97	5.87 ± 0.96	5.72 ± 2.06
Test value	F = 0.453[b], p = 0.636	F = 1.146[b], p = 0.319	F = 1.865[b], p = 0.157	F = 7.375[b], **p = 0.001**	F = 2.272[b], p = 0.105
Smoking					
I don't smoke	5.71 ± 0.94	5.58 ± 1.04	5.20 ± 0.92	5.71 ± 0.97	5.66 ± 2.13
No change	5.63 ± 0.93	5.40 ± 1.01	5.06 ± 0.89	5.78 ± 0.95	5.42 ± 2.01
I some more	5.90 ± 0.95	5.56 ± 1.07	4.56 ± 1.20	4.46 ± 1.07	4.81 ± 2.53
I smoke less	5.93 ± 0.99	5.06 ± 1.38	5.87 ± 0.89	5.62 ± 0.88	5.66 ± 1.86
Test value	F = 0.995[b], p = 0.395	F = 1.737[b], p = 0.159	F = 2.710[b], **p = 0.045**	F = 0.921[b], p = 0.431	F = 1.016[b], p = 0.386
Effect of COVID-19 pandemic on diabetes disease management					
Yes	5.71 ± 0.97	5.56 ± 1.08	5.00 ± 0.94	5.71 ± 1.01	5.66 ± 2.16
No	5.70 ± 0.90	5.40 ± 1.01	5.88 ± 0.90	5.70 ± 0.94	5.38 ± 2.04
Test value	t = −1.070[a], p = 0.284	t = −2.150[a], **p = 0.032**	t = −1.918[a], **p = 0.055**	t = −0.337[a], p = 0.736	t = −2.049[a], **p = 0.040**
Negative effect of COVID-19 pandemic on diabetes disease management					
Inability to exercise by walking	4.05 ± 0.94	4.95 ± 0.75	4.28 ± 1.25	4.60 ± 0.94	4.14 ± 2.60
Fear of COVID-19 infection when visiting the doctor	4.14 ± 0.37	4.39 ± 9.77	4.76 ± 1.01	4.55 ± 0.99	4.16 ± 2.03
Arguing with family	4.40 ± 0.88	4.61 ± 0.96	4.78 ± 0.94	4.65 ± 0.95	5.75 ± 2.44
Wanting to eat more	4.56 ± 0.91	4.75 ± 0.91	5.05 ± 0.88	5.85 ± 0.89	5.13 ± 2.18
Low morale because of staying at home for long periods	4.65 ± 0.92	4.71 ± 1.11	5.20 ± 0.95	5.38 ± 1.21	5.30 ± 2.10
Test value	F = 2.215[b], p = 0.073	F = 2.583[b], **p = 0.042**	F = 2.854[b], **p = 0.011**	F = 2.485[b], **p = 0.021**	F = 2.775[b], **p = 0.031**
Support from health professionals					
Less	4.35 ± 0.93	4.32 ± 1.20	4.78 ± 0.95	5.53 ± 0.88	4.57 ± 2.23
No change	4.71 ± 0.94	4.51 ± 1.02	4.88 ± 0.95	5.70 ± 1.03	5.48 ± 2.00
More	4.90 ± 1.02	4.51 ± 1.09	5.06 ± 0.87	5.75 ± 1.10	5.77 ± 2.11
Test value	F = 6.602[b], **p = 0.002**	F = 0.420[b], p = 0.658	F = 2.083[b], p = 0.126	F = 0.630[b], p = 0.533	F = 3.237[b], **p = 0.011**
Anxiety					
More	4.72 ± 1.04	4.61 ± 1.05	4.20 ± 0.95	4.82 ± 1.28	4.19 ± 2.05
No change	4.72 ± 0.95	4.83 ± 1.11	4.80 ± 0.65	4.71 ± 0.97	4.87 ± 2.21
Less	4.71 ± 0.92	5.38 ± 0.96	5.08 ± 0.86	5.67 ± 0.94	5.08 ± 2.03
Test value	F = 0.036[b], p = 0.965	F = 3.114[b], **p = 0.046**	F = 7.632[b], **p = 0.001**	F = 1.459[b], p = 0.234	F = 7.343[b], **p = 0.001**
Stress					
More	4.57 ± 0.89	4.83 ± 1.09	4.71 ± 0.82	5.87 ± 1.02	4.28 ± 1.98
No change	4.71 ± 0.99	4.59 ± 1.05	5.08 ± 0.93	5.79 ± 0.97	4.79 ± 2.16
Less	4.93 ± 1.01	4.40 ± 0.99	5.07 ± 0.87	5.65 ± 0.95	5.62 ± 2.26
Test value	F = 6.255[b], **p = 0.002**	F = 2.451[b], p = 0.088	F = 5.835[b], **p = 0.003**	F = 1.1163[b],p = 0.314	F = 5.783[b], **p = 0.003**
Sleep quality					
Worse	4.65 ± 0.87	4.32 ± 0.99	4.73 ± 0.85	5.71 ± 0.88	4.25 ± 0.86
No change	4.76 ± 0.95	4.42 ± 1.06	5.04 ± 0.99	5.73 ± 0.97	4.44 ± 1.91
Better	4.77 ± 1.00	5.63 ± 1.13	5.03 ± 0.89	5.75 ± 1.02	5.76 ± 2.14
Test value	F = 2.836[b], **p = 0.047**	F = 2.808[b], p = 0.062	F = 3.829[b], **p = 0.023**	F = 0.607[b], p = 0.545	F = 3.894[b], **p = 0.022**

[a] Independent Sample t test.
[b] One-way ANOVA F test.

Table 4
Binary logistic regression analysis on COVID-19 pandemic of factors influencing diabetes self-management.

	Univariate			
Variables	B	P	OR	95% CI
Age >65	0.195	**<0.001**	1.216	1.093–1.351
BMI 25.0 or over	−0.007	0.970	1.008	0.686–1.480
Male gender	−0.108	**0.043**	0.898	0.808–0.997
Being married	−0.253	**0.008**	0.777	0.645–0.935
Living in a village or small town	−0.020	0.794	1.020	0.880–1.181
Diabetes diagnosis 6–11 years ago	−0.119	**0.035**	0.888	0.794–0.992
Circle of friends giving diabetes education	−0.055	0.481	0.947	0.813–1.102
Smoking (increase)	−0.131	**0.007**	1.032	0.862–1.234
COVID-19 pandemic	−0.164	**0.021**	1.138	0.847–1.039
Increased immobility in the COVID-19 pandemic (inability to exercise by walking)	−0.186	**<0.001**	1.002	0.770–1.093
Less support from health professionals during the COVID-19 pandemic	−0.246	**0.012**	0.782	0.646–0.947
Increased anxiety during the COVID-19 pandemic	−0.202	**<0.001**	0.817	0.733–0.910
Increased stress during the COVID-19 pandemic	−0.153	**0.005**	0.858	0.772–0.954
Less sleep during the COVID-19 pandemic	−0.030	0.604	0.970	0.866–1.087

*Significant at level of $p < 0.05$. OR: odds ratio.

an important factor in improving metabolic outcomes and may increase insulin sensitivity and lead to glycemic control. Therefore, physical exercise is of great benefit in preventing the development of complications relating to type 2 diabetes [23]. In order to protect themselves during the outbreak, diabetic patients are spending more time indoors. Measures taken during the COVID-19 pandemic, isolation and social distancing restrictions have made it difficult for people with diabetes to exercise regularly and remain physically active [3,6]. In this time, many diabetics have chosen to delay or cancel their health service appointments. This may lead to a reduction in the support which diabetic individuals need to manage their disease and to an increase in the risk of developing complications [6].

In a study by Sayeed et al. [14], sociodemographic characteristics of the participants such as age, gender, marital status, and time since diabetes diagnosis were similar to those in our study. Also similar to our study, a significant difference was found between the total score on the DSMQ scale and age, gender, marital status and time since diabetes diagnosis. In a study by Al-Qahtani [16], a significant difference was found between the total DSMQ scale score and marital status and time since diagnosis of diabetes. A significant difference was reported in a study by Totesora et al. [12] between the total DSMQ scale score and age. The mean age of the individuals participating in our research was 52.37 ± 11.37 years and that of the participants in the study by Totesora et al. [12] was 54.0 ± 11.5 years. The similar result to that of our study may have arisen from the closeness in the mean ages.

Only 9–15% of individuals with type 2 diabetes achieved optimal glycemic control [15], and poor glycemic control in diabetic individuals can lead to greater sensitivity to the effects of COVID-19. A viral infection in diabetic individuals can make treatment more difficult because of sudden fluctuations in blood sugar levels and the presence of diabetes complications [5]. Diabetes management has become a comprehensive approach which includes lifestyle changes, pharmacological treatment and sometimes surgical interventions [15]. Thus, it is necessary in difficult conditions like the pandemic to encourage lifestyle changes in individuals with type 2 diabetes by defining targets. The HbA1c levels of the type 2 diabetics participating in our research were 7.03% before the pandemic, but rose to a level of 8.4% during the pandemic. The fasting blood sugar levels of the individuals participating in our study were 130 mg/dl before the pandemic, but rose during the pandemic to 135 mg/dl. Also, significant increases were seen in diastolic and systolic blood pressure values during the pandemic compared with the pre-pandemic values. It can be said that factors such as inadequate self-management skills, irregular nutrition, a decrease in physical activity and an increase in stress and anxiety levels make the management of blood sugar and blood pressure more difficult. In a randomized controlled study, Kang et al. [3] researched the effectiveness in diabetic individuals of management at a distance over a period of three months by mobile phone using the WeChat app on comprehensive diabetic management. It was found that the fasting blood sugar values of individuals in the control group were higher than those of individuals in the intervention group. Also, although no significant difference was found in diastolic and sistolic blood pressure values in the control group in the COVID-19 pandemic compared with the beginning, a significant decrease was seen in the intervention group [3]. Thus, it can be said that the traditional face-to-face medical treatment needs of the individuals with type 2 diabetes participating in our study could not be met.

In the study by Al-Qahtani [16], it was determined that being married and having had a diabetes diagnosis for more than five years were risk factors affecting diabetes self-management. It was determined in a study by Almigbal et al. [24] that age and gender were risk factors affecting diabetes self-management. The results of our study are similar to the pre-COVID-19 period. Also, a reduction in physical activity and the support received from health professionals and an increase in smoking anxiety and stress levels in the COVID-19 pandemic were added to the existing picture. Support from health professionals is important for diabetic patients to develop their self-management. In a study by Khalooei and Benrazavy [17] conducted with diabetic individuals, the state of receiving support from health professionals was determined to be a significant risk factor with regard to diabetes self-management. In the pre-COVID-19 period, routine follow-up and home visits were important strategies to support elf-management. These strategies increase individuals' trust and expectations with regard to maintaining positive behaviors [23]. However, health outcomes have deteriorated in the COVID-19 period because of factors such as increasing anxiety, stress and social isolation, difficulty in adhering to drug treatment, reduced physical activity, increased periods of immobility and changing eating habits which affect lifestyle behaviors, and disrupted sleep quality [25]. The results of the research supported H1: The COVID-19 pandemic has an effect on self-management in people with type 2 diabetes.

4.1. Limitations

A limitation of this study is that because it was conducted in one government hospital in the south-east of Turkey, it cannot be generalized. Another limitation is that because the pandemic emerged suddenly, pre-pandemic diabetic self-management could not be assessed.

5. Conclusions

It was found as a result of the research that the diabetes self-management levels of individuals with type 2 diabetes during the COVID-19 pandemic were low. Being male, over the age of 65, married, and having had a diagnosis of diabetes for 6–11 years, increased smoking, the COVID-19 pandemic, a reduction in physical activity and support from health professionals, and an increase in anxiety and stress levels were determined to be risk factors affecting diabetes self-management.

The results of this study show that it is necessary to comprehensively address the factors affecting diabetes self-management in the COVID-19 pandemic and to take the necessary measures. In this regard, it is necessary to plan and implement measures for individuals with type 2 diabetes in particular to take responsibility for their own care and to increase self-management in the COVID-19 pandemic. In order for self-management levels to increase in individuals with type 2 diabetes, it is important that they should be ready to change their self-care plans, that they should easily obtain support from family members and health professionals, and that their skills in increasing physical exercise, managing stress and self-motivation should be developed. It can be said that during the pandemic, it has not been possible to meet the needs of individuals with type 2 diabetes for traditional face-to-face medical treatment. For this reason, self-management skills can be increased by widening access to services such as telemedicine and e-health in order for individuals with type 2 diabetes to manage their own conditions, to determine problems which arise, and in the long term to encourage behavioral changes.

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Declaration of interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

CRediT authorship contribution statement

Hediye Utli: Investigation, Data curation, Methodology, Formal analysis, Writing - original draft preparation. **Birgül Vural Doğru:** Conceptualization, Validation, Supervision, Writing - reviewing and editing.

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