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THE EFFECT OF COGNITIVE STATE ON THE MANAGEMENT OF DIABETES AND THE QUALITY OF LIFE IN OLDER ADULTS WITH DIABETES

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Abstract

Objective: To identify the effect of cognitive state on the management of diabetes and the quality of life in older adults with diabetes
Materials and Methods: The research was designed as a cross-sectional study, and its population was comprised of older adults with diabetes who were admitted to the Diabetes Training Center of a public hospital in Turkey from May 2018 to October 2018, and the research sample was composed of 120 older adults with diabetes who satisfied the criteria for being included in the research. The research data were collected by using the Patient Information Form, the Mini-Mental State Exam, the Summary of Diabetes Self-Care Activities Questionnaire, and the Ferrans and Powers Quality of Life Index/Diabetes Version-III. The collected data were analyzed by using the skewness and kurtosis coefficients, descriptive statistical methods, Independent samples t-test, Mann-Whitney U test, Pearson correlation coefficient, and the chi-squared test, and the statistical significance was identified if the *p*-value was ($p<0.05$).
Results: It was found that 40% of the participants had cognitive disorders, and cognitive disorder was more prevalent among the female participants (64.6%) and the participants who were elementary school graduates (53.0%). The participants with good cognitive states obtained a higher mean score from the Foot Care sub-scale of the Summary of Diabetes Self-Care Activities Questionnaire (3.97±2.89 points). The participants with cognitive disorder obtained higher median scores from the Social and Economic sub-scale (70.3 points) and Psychological/Spiritual sub-scale (8.39 points) of the Quality of Life Index. It was identified that the scores obtained by the participants from the Summary of Diabetes Self-Care Activities Questionnaire and Mini-Mental State Exam had a positive weak linear relationship, and as the patients had a better cognitive state, they performed more self-care activities for diabetes ($p<0.05$).
Conclusion: The cognitive disorder identified in nearly half of the participants has statistically significant relationships with the participants' gender, education level, and social and economic domain and psychological/spiritual domain of the quality of the participants' lives.
Keywords: Older adults with Diabetes, Cognitive State, Management of Diabetes, Quality of Life

DİYABETLİ YAŞLILARDA BİLİŞSEL DURUMUN DİYABET YÖNETİMİ VE YAŞAM KALİTESİNE ETKİSİ

Öz

Amaç: Diyabetli yaşlılarda bilişsel durumun diyabet yönetimi ve yaşam kalitesine etkisini belirlemektir. **Gereç ve Yöntem:** Kesitsel tipte gerçekleştirilen araştırmanın evrenini Mayıs-Ekim 2018 tarihleri arasında bir kamu hastanesinin Diyabet Eğitim Birimi'ne başvuran diyabetli yaşlılar, örneklemini ise araştırmanın dahil edilme kriterlerini karşılayan 120 diyabetli yaşlı oluşturdu. Veriler Tanıtım Formu, Mini Mental Test, Diyabet Öz-bakım Aktiviteleri Anketi, Ferrans ve Powers Yaşam Kalitesi Endeksi Diabet Version-III (QLI) kullanılarak toplandı. Veriler skewness ve kurtosis katsayıları, tanımlayıcı istatistiksel metodlar, Independent Sample t test, Mann-Whitney U testi, Pearson korelasyon katsayısı ve Ki-kare testi ile $p<0.05$ anlamlılık düzeyinde incelendi.

Bulgular: Katılımcıların %40'ında bilişsel bozukluk belirlendi, bilişsel bozukluk kadınlarda (%64.6) ve ilkokul mezunlarında (%53.0) yüksekti. Diyabet öz bakım aktiviteleri (DÖAÖ) ayak bakımı alt boyutu puanı ortalaması bilişsel durumu iyi olanlarda (3.97±2.89) daha yüksekti. Yaşam kalitesi ölçeği sosyal ve ekonomik durum (70.3) ile fizyolojik ve manevi durum (8.39) puan ortancaları bilişsel bozukluğu olanlarda daha yüksekti. DÖAÖ ile Mini Mental Test puanları arasında aynı yönlü, düşük düzeyde doğrusal yönde ilişki olduğu, bilişsel iyi olma durumu arttıkça diyabet öz bakım aktivitelerinin arttığı belirlendi (p<0.05).
Sonuç: Katılımcıların yarısına yakınında belirlenen bilişsel bozukluk cinsiyet, eğitim düzeyi, yaşam kalitesi alt boyutlarından sosyal ve ekonomik durum ile fizyolojik ve manevi durumunu etkilemekte, bilişsel iyi olma puan ortalaması arttıkça diyabet öz bakım aktiviteleri puan ortalaması artmaktadır.
Anahtar kelimeler: Diyabetli Yaşlı, Bilişsel Durum, Diyabet Yönetimi, Yaşam Kalitesi.

1. GİRİŞ

Along with age, the prevalence of diabetes generally increases all across the world, and with its social and economic burden, this creates an epidemic and endemic problem (1-3). The people aged 65 years or above have the highest prevalence of diabetes and the estimated number of diabetic patients aged 65-99 years is 135.6 million (19.3%), and if this trend continues, this figure is estimated to be 195.2 million in 2030 and 276.2 million in 2045 (1). Diabetes which is a global threat gives rise to numerous negative circumstances such as the complication risk, growing need for medical care, low quality of life, and the stress put on the individual and the family. The increase in the frequency of visits to the hospital and early deaths are inevitable if the diabetes is not well-managed. The management of diabetes covers the patient's involvement and several daily self-care activities to be performed by the patient (1). It is put forward that, as well as obstructing self-care, the accompanying social, physical, and cognitive health problems are associated with the increase in diabetes complications and the low quality of life (4).

Attention was recently drawn to the effects of diabetes on brain structure and memory as well as to the known complications of diabetes. As diabetes requires the patient to make complicated decisions and perform daily self-care activities, cognitive functions are of utmost importance (5). The cognitive dysfunction is more prevalent among individuals with diabetes (6, 7), and also, as age advances, its prevalence increases (8). The duration of being diagnosed with diabetes, age, high blood pressure, hyperglycemia, hypoglycemia, high Hemoglobin A1c (HbA1c), and the accompanying comorbidities affect the cognitive functions (5, 9, 10, 11). On the other hand, by developing metabolic control and enhancing the adaptation to the treatment, cognitive complications can be eliminated (5, 9, 10). Affecting the glycemic control negatively (12, 13) and associated with poor self-care(4, 14), the cognitive impairment creates problems in numerous activities such as the follow-up of blood glucose, eating, forgetting to have insulin or oral anti-diabetic drugs, shopping, time-orientation, planning, problem-solving, executive functions, communication, missing the appointments, decrease in the frequency of diabetes follow-up and increase in the errors in reporting the blood glucose follow-up, and the financial management (11, 15, 16). It is asserted that the fall in cognitive functions could start in the pre-diabetes period, was slowly progressive, and aggravated in the case of maladaptation to the treatment (17). Moreover, together with neuropsychiatric symptoms and the decline in functional capacity, diabetes and cognitive disorder affect the quality of life negatively, in particular, in old people (18-20). The quality of life is an important determinant of the effect of the disease and treatment on the individual. To enhance the quality of life, it is recommended that the cognitive disorder be diagnosed and treated early on (11, 20, 21). Thus, enhancing the quality of life contributes to the reduction of treatment and care costs besides being beneficial to the individuals (22). Evaluating the patient's cognitive state, discerning the symptoms of cognitive deficits in the patient, and performing initiatives in line with the patient's cognitive level are highly important for the nurse or other health professionals to facilitate the management of diabetes, enhance the quality of life, and

prevent and reduce cognitive dysfunction. It was ascertained that no study about this topic was carried out in Turkey.

The objective of this research is to analyze the effect of cognitive state on the management of diabetes and the quality of life in older adults with diabetes.

2. MATERIALS AND METHODS

2.1. Research Design and Participants

This is a cross-sectional study. The research population was comprised of the older adults with diabetes who were admitted to the Diabetes Training Center of a public hospital in Turkey, and the research sample was composed of the older adults with diabetes who satisfied the inclusion criteria set out for the research. The sample size was designated through the power analysis conducted with 95% power and 0.05 type 1 error by using G*Power 3.1.9.2 as per the correlation coefficient (r=0.33) obtained in a similar study (23), and hence, the research was performed with 120 older adults with diabetes. The criteria for being included in the research were to be diagnosed with diabetes for a minimum of one year, to be aged 65 years or above, to have no verbal communication disorder, to have no hearing disorder, not to be diagnosed with a psychiatric or neurological disorder, and to agree to participate in the study.

2.2. Data Collection

The research was conducted from May 2018 to October 2018. The research data were collected by using the Older Adults with Diabetes Information Form, the Revised Mini-Mental State Exam for Educated and Uneducated Old People, the Summary of Diabetes Self Care Activities Questionnaire, and the Ferrans and Powers Quality of Life Index/Diabetes Version-III.

Older Adults with Diabetes Information Form: The form that was created by the researchers as per the review of the relevant literature contained two parts, namely, socio-demographic characteristics (age, gender, education level, employment status, with whom the respondent lived, cigarette smoking, state of having any chronic disease besides diabetes, and body mass index) and diabetes-related features (duration of being diagnosed with diabetes, treatment method, state of having any diabetes-related complication, state of having any training about diabetes, and the measurement results for preprandial and post-prandial blood glucose and HbA1c) (6, 7, 12-14, 19).

Mini-Mental State Exam (MMSE): The exam that was first released in 1975 evaluated cognitive functions such as orientation, recording memory, attention and calculation, remembering, and language (24). Gürgen et al. performed the validity and reliability test of the MMSE for Turkish society (25), and Uçku et al. reorganized it for the educated and uneducated old people in Turkish society (26). For the educated old people, a score of 22 points or below refers to the presence of cognitive dysfunction whilst a score of 23 points or above shows that the respondent has a good mental state. For the uneducated old people, a score of 18 points or below suggests a likely cognitive dysfunction while a score of 19 points or above indicates that the respondent has a good mental state. The Cronbach's Alpha coefficient was calculated as 0.55 for the MMSE.

Summary of Diabetes Self Care Activities (SDSCA) Questionnaire: Designed to identify the diabetic individuals' self-care activities, this measure has questions about diet, exercise, blood-glucose testing, foot care, and cigarette smoking. The SDSCA Questionnaire asks the diabetic individuals how many days they were engaged in diabetes self-care activities for the last seven days (day/week). The answers to the first ten items about diet, exercise, blood-glucose testing, and foot care range from 0 to 7 days. Item 11 about smoking is dichotomously answered as either 0-No or 1-Yes. The validity and reliability test for the SDSCA Questionnaire was conducted in Turkey in

2009 by Çoşansu (27). Each sub-scale of the SDSCA Questionnaire can be scored separately and used independently. A high score obtained from the SDSCA Questionnaire demonstrates that the respondent performs health care activities frequently. The Cronbach's Alpha coefficient was found as 0.59 for the Diet sub-scale, 0.70 for the Exercise sub-scale, 0.94 for the Blood-Glucose Testing sub-scale, and 0.77 for the Foot Care sub-scale (27). In the current study, the Cronbach's Alpha coefficient was calculated as 0.31 for the Diet sub-scale, 0.85 for the Exercise sub-scale, 0.78 for the Blood-Glucose Testing sub-scale, and 0.68 for the Foot Care sub-scale.

Ferrans and Powers Quality of Life Index/Diabetes Version-III (QLI): The QLI was developed in 1984 by Ferrrans and Powers (28), and the validity and reliability test for the QLI was conducted by Özer and Efe in Turkey in 2006 (29). Designed as a six-point Likert-type scale, the QLI had two parts, four sub-scales, and 68 questions. The minimum and maximum scores to be obtained from each part were successively 0 and 30 points. As the overall score obtained from the QLI goes up, the quality of life also increases. The Cronbach's Alpha coefficient was found as 0.97 for the QLI, and it was calculated as 0.89 under this study.

2.3. Statistical Analysis

The research data were analyzed with the Statistical Package for Social Science (SPSS) 18.0, and in this respect, the statistical significance was identified if the P-value was below 0.05 ($p<0.05$). In the research, descriptive statistics were used (frequency, arithmetic mean, standard deviation, cross-tabulation). Whether the data were normally distributed was identified by checking whether the skewness and kurtosis coefficients were ranged between +2 and -2. The arithmetic means of the groups with normal distribution were compared, and in this respect, the independent samples t-test was used for comparing two independent groups. On the other hand, the medians of the groups with non-normal distribution were compared, and in this context, the Mann-Whitney U test was utilized for comparing two independent groups. The relationship between continuous variables was analyzed with the Pearson correlation coefficient and the relationship between categorical variables was examined with the chi-squared test.

3. RESULTS

The participants' median age was 70 years (min-max: 33-88), and 25% of the participants were aged ≤67 and 75% of them were aged ≤75. The median duration of being diagnosed with diabetes was 14 years (min.-max:1-40), and the duration of being diagnosed with diabetes was 7 years or below for 25% of the participants and 20 years or below for 75% of the participants. The mean of the participants' HbA1c percentages was 9.15±2.17 (min-max:6-15), the mean of their pre-prandial blood sugar values was 187.17±65.48 mg/dl (min-max: 9-350), and the mean of their post-prandial blood sugar values was 250.15±70.04 mg/dl (min-max: 135-565).

Of the research participants, 52.5% were female, 69.2% were married, 55% were elementary school graduates, 50% lived with their spouses, 94.2% did not work (n=113), 99.2% had social security, and 77.5% had an additional chronic disease. Hypertension (66.7%) and atherosclerosis (29.2%) were the diseases most prevalent among the participants. Besides, 59.2% of the participants had diabetes complications and the most common complications were consecutively retinopathy (30.8%), neuropathy (39.2%), and nephropathy (25%). Moreover, of all participants, 91.7% had nutrition therapy, 73.3% had oral anti-diabetic drugs, and 60% used insulin. Furthermore, of the participants, 93.3% stayed at the hospital for the last one year due to diabetes, 56.7% did not visit health facilities on a regular basis for diabetes treatment, and 78.3% had no training about the management of diabetes.

In the research, it was found that 40% of the participants had cognitive disorders, and upon the comparison of the participants' cognitive states as per their sociodemographic characteristics, it was discerned that there were statistically significant differences in the prevalence of cognitive disorder as per gender and education level (p<0.05). The female participants (64.6%) had a higher prevalence of cognitive disorder than the male participants (35.4%). Upon the examination of participants' cognitive states as per their education levels, it was identified that the participants who were elementary school graduates (53.0%) had the highest prevalence of cognitive disorder and the participants who were graduates of middle schools or higher educational institutions (17.4%) had the lowest cognitive disorder prevalence (Table 1).

Table 1. The comparison of older adults with diabetes cognitive states as per their socio-demographic characteristics (n=120)

	Cognitive disorder (n=48, 40.0%)	**Good cognitive state** (n=72, 60.0%)	**All participants** (n=120)	***p*-value**
Gender				
Female	31 (64.6%)	32 (44.4%)	63 (52.5%)	**0.030***
Male	17 (35.4%)	40 (55.6%)	57 (47.5%)	
Marital status				
Single	17 (45.9%)	20 (54.1%)	37 (30.8%)	0.375
Married	31 (37.3%)	52 (62.7%)	83 (69.2%)	
Education level				
Literate	9 (29.0%)	22 (30.6%)	31 (25.8%)	
Elementary school	35 (53.0%)	31 (43.1%)	66 (55.0%)	**0.004***
Middle school or a higher educational institution	4 (17.4%)	19 (26.3%)	23 (19.2%)	
With whom the respondent lives				
Alone	5 (33.3%)	10 (66.7%)	15 (12.5%)	0.304
With spouse	21 (35.0%)	39 (65.0%)	60 (50.0%)	
With family	22 (48.9%)	23 (51.1%)	45 (37.5%)	
Employment status**				
Not working	45 (39.8%)	68 (60.2%)	113 (94.2%)	0.874
Working	3 (6.3%)	4 (5.6%)	7 (5.8%)	
Income level				
Income below expenses	13 (38.2%)	21 (61.8%)	34 (28.3%)	0.380
Income equaling expenses	22 (36.1%)	39 (63.9%)	61 (50.8%)	
Income above expenses	13 (52.0%)	12 (48.0%)	25 (20.8%)	
Cigarette smoking				
Yes	6 (28.6%)	15 (71.4%)	21 (17.5%)	0.239
No	42 (42.4%)	57 (57.6%)	99 (82.5%)	
Having an additional chronic disease				0.929
Yes	37 (39.8%)	56 (60.2%)	93 (77.5%)	
No	11 (40.7%)	16 (59.3%)	27 (22.5%)	
Having any diabetes complication				
Yes	26 (36.6%)	45 (63.4%)	71 (59.2%)	0.363
No	22 (44.9%)	27 (55.1%)	49 (40.8%)	
Staying at the hospital for the last one year due to diabetes**				0.264

Yes	5 (62.5%)	3 (37.5%)	8 (6.7%)	
No	43 (38.4%)	69 (61.6%)	112 (93.3%)	
Visiting health facilities for the diabetes treatment				0.292
Yes	18 (34.6%)	34 (65.4%)	52 (43.3%)	
No	30 (44.1%)	38 (55.9%)	68 (56.7%)	
Having any training about the management of diabetes				0.786
Yes	37 (39.4%)	57 (60.6%)	94 (78.3%)	
No	11 (42.3%)	15 (57.7%)	26 (21.7%)	

* Statistically significant at 5% level.
** Fisher's Exact Test

There was no statistically significant difference in the participants' SDSCA Questionnaire scores as per the cognitive state, on the other hand, the participants with good cognitive states (3.97±2.89 points) obtained a higher mean of scores from the Foot Care sub-scale of the SDSCA Questionnaire than the participants with cognitive disorders (2.68±2.79) and this difference was statistically significant (p=0.016). Likewise, there was no statistically significant difference in the means of participants' QLI scores as per the cognitive state. On the other hand, as per the cognitive state, there were statistically significant differences in the median scores obtained by the participants from the QLI Social and Economic sub-scale (7.03 points) and the QLI Psychological/Spiritual sub-scale (8.39 points) (p<0.05). The participants with cognitive disorder obtained higher median scores from both QLI sub-scales. As per the cognitive state, there was no statistically significant difference in age, the median duration of being diagnosed with diabetes, and the mean of HbA1c percentages (p>0.05) (Table 2).

Table 2. The comparison of older adults with diabetes cognitive states as per their diabetes-related features (n=120)

	Cognitive disorder (n=48, 40.0%)	**Good cognitive state** (n=72, 60.0%)	**All participants** (n=120)	***p*-value**
Diet sub-scale[1]	2.62±1.63	2.55±1.24	2.58±1.40	0.807
Exercise sub-scale[2]	0 (0-7)	0 (0-7)	0 (0-7)	0.173
Blood-Glucose Testing sub-scale[1]	2.75±2.41	3.16±2.39	2.99±2.40	0.362
Foot Care sub-scale[1]	2.68±2.79	3.97±2.89	3.45±2.91	**0.016***
Overall SDSCA Questionnaire[1]	8.86±5.38	10.89±5.87	10.08±5.74	0.056
Health and Functioning sub-scale[1]	5.42±1.27	5.46±1.44	5.45±1.37	0.881
Social and Economic sub-scale[2]	7.03 (4.84-8.13)	6.72 (0.72-7.34)	7.03 (0.72-8.13)	**0.014***
Psychological/Spiritual sub-scale[2]	8.39 (4.61-8.39)	8.04 (4.61-8.39)	8.21 (4.61-8.39)	**0.012***
Family sub-scale[2]	9.25 (-2.75-9.25)	9.25 (-1.75-9.25)	9.25 (-2.75-9.25)	0.078
Overall QLI[2]	30.39 (14.49-32.10)	29.45 (6.64-31.82)	29.88 (6.64-32.10)	0.057

Age[2]	71 (65-86)	70 (33-88)	70 (33-88)	0.300
Duration of being diagnosed with diabetes[2]	13 (2-40)	14 (1-65)	14 (1-65)	0.722
HbA1c[1]	9.28±2.00	9.07±2.28	9.15±2.16	0.594

** Statistically significant at 5% level*
[1] arithmetic mean±standard deviation; [2] median (min-max); SDSCA: Summary of Diabetes Self Care Activities Questionnaire; QLI: Ferrans and Powers Quality of Life Index/Diabetes Version-III

Upon the review of the correlation between SDSCA Questionnaire scores, QLI scores, MMSE scores, and HbA1c percentages, it is discerned that the participants' SDSCA Questionnaire scores had a positive weak linear relationship with their MMSE scores (r=0.195. p=0.032), and as the patients had a good cognitive state, they performed more self-care activities for diabetes. On the other hand, the participants' SDSCA Questionnaire scores had no statistically significant relationship with the QLI scores and HbA1c percentages (p>0.05) (Table 3).

Table 3. The relationship between participants' SDSCA Questionnaire scores, QLI scores, MMSE scores, and HbA1c percentages (n=120)

		Overall SDSCA Questionnaire scores	Overall QLI scores	HbA1c percentages	Overall MMSE scores
Overall SDSCA Questionnaire scores	*r*	1	.116	.046	**.195***
	*p**		.206	.616	**.032**
Overall QLI scores	*r*	.116	1	.028	.031
	p	.206		.759	.735
HbA1c percentages	*r*	.046	.028	1	-.062
	p	.616	.759		.499

SDSCA: Summary of Diabetes Self Care Activities Questionnaire; QLI: Ferrans and Powers Quality of Life Index/Diabetes Version-III; MMSE: Mini-Mental State Exam; HbA1c: Glikolize Hemoglobin; p<0.05

4. DISCUSSION

In the current study, it was found that 40% of the participant older adults with diabetes had cognitive disorders, and as per gender and education level, there were statistically significant differences in the cognitive disorder prevalence. The female participants and participants with low-level education had a higher cognitive disorder prevalence. In the previous research, the prevalence of cognitive disorder was identified as 21.8% (30) and 18.7% (31). In the study by Crespo et al., it was found that the women had a higher prevalence of cognitive disorder (31). This finding of the current study is in a similar vein to the relevant literature, and the cognitive functions affect women more (30, 32). As per the review of the relevant literature, it is discerned that the education level affected the cognitive functions and there was a linear correlation between education level and cognitive functions (30, 33, 34). In the current study, it was identified that the cognitive state had no statistically significant relationship with participants' other socio-demographic characteristics and

their diabetes-related features such as having an additional chronic disease, age, and having any diabetes complications. It is supposed that the cognitive state had no correlation with age because the research participants were from the same age group. Also, similar results were obtained in a study carried out in 2019(30). As the age advanced, the prevalence of cognitive disorder increased, and particularly the accompanying diseases such as hypertension were a significant risk factor for cognitive functions (35, 36), and the diabetic individuals aged 70 years or above were more sensitive to cognitive disorder (37).

In the current study, it was identified that, as per cognitive state, there was no statistically significant difference in the means of participants' SDSCA Questionnaire scores, however, the participants with good cognitive state obtained a higher mean of scores from the Foot Care sub-scale of the SDSCA Questionnaire than the participants with cognitive disorder and this difference was statistically significant. According to the results of the current study, the cognitive state had no statistically significant relationship with age, duration of being diagnosed with diabetes, and HbA1c percentages. In the study by Primozic et al., it was found that the participants with good cognitive states obtained a higher mean of scores from the SDSCA Questionnaire than the participants with cognitive disorders (38). Similarly, in another study, it was identified that there was no statistically significant difference in cognitive functions as per certain variables such as age and education level, and there was a statistically significant relationship between cognitive state and the fulfillment of self-care activities (39). In a study that analyzed the effect of cognitive functions on the management of diabetes in older adults with diabetes, the low MMSE score was found to be associated with the decrease in the fulfillment of daily life activities, the increase in the number of stays at hospitals, and the increase in the need for help for personal care (40). In the current study, it was discerned that the participants' SDSCA Questionnaire scores had a positive weak linear relationship with the cognitive state. In diabetes that requires high-level individual responsibility, self-care is of critical importance to glycemic control and the attainment and maintenance of optimal health outcomes (41). The cognitive functions are an important determinant of self-care and are directly associated with it (42-44). Poor self-care activities can lead to inadequate metabolic control and brain dysfunctions (40). Cognitive functions play a key role in the management of diabetes (40, 45). Self-care is an integral ingredient for disease management, the maintenance of well-being, and the development of cognitive functions and quality of life (11).

Self-care activities such as the follow-up of blood glucose, the calculation of insulin dose, and the arrangement of meal schedule and content become harder due to the cognitive disorder (20). As the aging population and the number of diabetic individuals growing along with this aging population will lead to an increase in the likely cognitive disorders, the cognitive assessment conducted at the early period is of importance to the person's adaptation to treatment and diabetes self-care (46). Also, the recent studies demonstrate the importance of screening to be performed on diabetic individuals' cognitive functions (33, 47-49). Moreover, the American Diabetes Association recommends that diabetic individuals be screened for cognitive functions first just after being diagnosed with diabetes and then annually (20).

Just as in the case of all other chronic diseases, diabetes negatively affects the general health state, well-being, and quality of life (17, 18, 32, 50). In the case of diabetes, the quality of life declines further particularly in the presence of complications due to factors such as the need for drugs and treatment and the problems brought by physical restraints (32). Besides, the factors such as gender, income level, education level, and diabetes treatment affect the quality of life (51). The undiagnosed cognitive disorder is associated with depressive symptoms and a fall in the quality of life in individuals with type 2 diabetes. Depression is more prevalent among diabetic individuals than those without diabetes (52, 53), and depression raises the risk of cognitive dysfunction (30, 54, 55). Together with self-care, the change in cognitive functions leads to a decrease in the quality of life by affecting several areas such as communication, sleep pattern, eating habits, and the ability to

perform daily life activities independently (16). In a study conducted in 2017, it was found that the participants with cognitive disorder obtained lower quality of life scores (37). The results of the current study showed that, as per the cognitive state, there was no statistically significant difference in the means of participants' QLI scores whereas there were statistically significant differences in the means of scores obtained by the participants from the QLI Social and Economic sub-scale and the QLI Psychological/Spiritual sub-scale and the participants with cognitive disorders had higher mean scores from these two sub-scales. Also, in the study by Ready et al., it was identified that, as per the cognitive state, there was no statistically significant difference in the quality of lives of experimental and control groups (56). Besides, in another study, it was found that the old individuals who were in the group that had a decrease in cognitive functions (Alzheimer) had the quality of life scores close to the scores obtained by the healthy individuals in the same age group and even better than these scores in some areas (general quality of life, independence, and social relations) 57). On the other hand, it was identified that the individuals who had depression had lower quality of life scores (58). As the reason for this situation, it was stated that the individuals might have stopped expressing/reporting/sharing their circumstances in the presence of cognitive disorder (58). Likewise, in the current study, it is considered that the fall in cognitive functions might have affected topics such as the individuals' perceptions about the quality of life and the expression of their circumstances. Moreover, taking into consideration other additional factors affecting the cognitive state, such as depression, can help to perform a healthier assessment. It is considered that, as the individuals who were diagnosed with depression were not included in the study, the above result was obtained.

The diagnosis and treatment of cognitive disorders can be neglected in the management of diabetes (59). The decrease in cognitive functions affects diabetes training and treatment negatively (60), and the early diagnosis of cognitive state in older adults with diabetes and its effective management is of importance (6, 61). It is asserted that continuous monitoring, changes in lifestyle, and cognitive training can contribute to the development of cognitive functions. It was found that regular physical activity contributed to the development of cognitive functions (62), and the cognitive state in older adults with diabetes was associated with nutrition, physical activity, and dependence on treatment (31, 63). At the same time, it was stated that cognitive training and stimulation, exercise, and drugs have certain positive effects on cognitive functions, however, more evidence was needed to support this finding (64). The previous studies showed that the practices such as musical intervention (65), cognitive therapies (66), walking and dancing practices (67), and telemedicine practice (68) had positive effects on cognitive functions.

5. CONCLUSION

This study explored the effect of cognitive state on the management of diabetes and the quality of life in older adults with diabetes. It was found that nearly half of the participants had cognitive disorders. It was identified that the cognitive state had associations with gender, education level, diabetes self-care activities, and the quality of life. In light of these findings, it is recommended that the diabetic individuals' cognitive functions be assessed with neurocognitive tests and interviews first upon being diagnosed with diabetes and then during the routine follow-ups and more meticulous assessment be performed particularly in cases such as having a long duration of diabetes diagnosis, having an additional chronic disease accompanying diabetes, and inexplicable poor metabolic control. Nursing interventions aimed at overcoming and alleviating the cognitive problems should be put into practice and a larger-scale evidence-based study needs to be performed about this topic.

LIMITATIONS

This study has certain limitations. Other variables affecting the cognitive state, such as depression, could have been examined in addition to the variables of the quality of life and the diabetes self-care activities. Moreover, this study does not reflect the general state of all older adults with diabetes across Turkey, rather, it is limited to the answers of the older adults with diabetes who satisfied the criteria for being included in the current research.

ETHICAL STATEMENT

The study complied fully with the principles set out in the Declaration of Helsinki and was endorsed by the ethics committee of the institution where the research took place (Decision no. 2018/40). Moreover, the written permission was received from the same institution (No. 49769843-619), and the older adults with diabetes consented to participate in the study in written format.

INFORMED CONSENT

Before launching the research, the older adults with diabetes were informed about the objective of the study, and next, each older adults with diabetes was asked to consent to participate in the research in written format by filling in and signing the informed consent form.

REFERENCES

1. International Diabetes Federation. Internationl Diabetes Atlas. 2019 (Ninth edition) Available from: https://www.diabetesatlas.org/en/
2. Milanesi A, Weinreb JE. (2018). Diabetes in the Elderly, Available from: https://www.ncbi.nlm.nih.gov/books/NBK279147/
3. Chentli, F., Azzoug, S., Mahgoun, S. (2015). Diabetes mellitus in elderly. *Indian J Endocrinol Metab, 19*(6), 744-52.
4. Hopkins, R., Shaver, K., & Weinstock, R. S. (2016). Management of adults with diabetes and cognitive problems. *Spectr, 29*(4), 224-37.
5. Samaras, K., Lutgers, H. L., Kochan, N.A., Crawford J. D., & Camphll, L. V., & Wen, W., et al. (2014). The impact of glucose disorders on cognition and brain volumes in the elderly: the sydney memory and ageing study. *Age, (Dordr), 36*(2), 977-93.
6. Zhang, X., Jiang, X., Han, S., Liu, Q., & Zhou, J. (2019). Type 2 Diabetes mellitus is associated with the risk of cognitive impairment: A Meta-Analysis. *J Mol Neurosci, 68*(2), 251-60.
7. Cheng, Y., Wu, W., Feng, W., Wang, J., Chen, Y., & Shen, Y., et al. (2012). The effects of multi-domain versus single-domain cognitive training in non-demented older people: A randomized controlled trial. *BMC Med, 27,* 10, 1-13.
8. Uchmanowicz, I., Jankowska-Polańska, B., Mazur, G., & Sivarajan, Froelicher., E. (2017). Cognitive Deficits and self-care behaviors in elderly adults with heart hailure. *Clin Interv Aging, 3*(12), 1565-72.
9. Ryan, C. M., Duinkerken, E. V., & Rosano, C. (2016). Neurocognitive consequences of diabetes. *Am Psychol, 71*(7), 563–76.
10. Duinkerken, E., & Snoek, F. J. (2019). Cognition in Elderly with type 1 diabetes: Is there an Interaction between glycemia and aging? *J Diabetes Complications, 33*(1), 4-5.
11. Tomlin, A., & Sinclair, A. (2016). The influence of cognition on self-management of type 2 diabetes in older people. *Psychol Res and Behav Manag, 21*(9); 7-20.
12. Felix, M., Enedina, P., Ortiz, V., Magdelana, P., Felix, O., & Edith, R. (2016). Relation of the glycemic control, cognitive function and executive function in the elderly with type 2 diabetes: Systematic review. *Enfermería Global, 24,* 481-9.
13. Munshi, M. N., Hayes, M., Iwata, I., Lee, Y., & Weinger, K. (2012). Which aspects of executive dysfunction influence ability to manage diabetes in older adults? *Diabet Med, 29*(9), 1171-7.
14. Feil, D. G., Zhu, C. W., & Sultzer, D. L. The Relationship between cognitive impairment and diabetes self-management in a population-based community sample of older adults with type 2 diabetes. *J Behav Med, 35*(2), 190-9.
15. Jekel, R., Damian, M., Waltmo, C., Hausner, L., Bullock, R., & Connelly, P, J., et al. (2015). Mild Cognitive impairment and deficits in instrumental activities of daily living: A systematic review. *Alzheimers Res Ther, 18,*7(1), 17.
16. Magesh, P., & Sathish, L. (2014). Cognitive Quality of life in diabetes mellitus-implication for cognitive assessment and rehabilitation. *Int J Med Biomed Sci, 2*(4), 49-54.
17. Taşkın, Yılmaz, F., Karakoç, Kumsar, A., & Olgun, N. (2013). Cognitive dysfunction in individuals with diabetes. *Journal of Nursing Forum in Diabetes, Obesity and Hypertension, 5*(3), 12-20.

18. Sharma, G., Parihar, A., Talaiya, T., Dubey, K., Porwal, B., & Parihar, M. S. (2020). Cognitive impairments in type 2 diabetes, risk factors and preventive strategies. *J Basic Clin Physiol Pharmacol, 22*, 31(12), 1-14.
19. Hjelm, C. M., Brosröm, A., Riegel, B., Arestedt, K., & Strömberg, A. (2015). The association between cognitive function and self-care in patients with chronic heart failure. *Heart Lung, 44*(2), 113-9.
20. Liu, H. Y., Tsai, W. C., Chiu, M. J., Tang, L. Y., Lee, H. J., & Shyu, Y. I., et al. (2019). Mild cognitive impairment in combination with comorbid diabetes mellitus and hypertension is negatively associated with health-related quality of life among older persons in Taiwan. *Qual Life Res, 28*(5), 1281-91.
21. Kırkman, S., Briscoe, V. J., Clark, N., Florez, H., Haas, L. B., & Halter, J. B., et al. (2012). Diabetes in older adults. *Diabetes Care, 35*(12), 2650-64.
22. American Diabetes Association Older Adults: Standards of medical care in diabetes-2021. (2021). Management in a multiethnic sample. *J Diabetes Metab Disord, 15*(16), 1-7.
23. Cuevas, H., & Stuifbergen A. (2017). Perceived cognitive deficits are associated with diabetes self-management in a multiethnic sample. *Journal of Diabetes Metabolic Disorders*, 16,7, 1-7.
24. Folstein, M. F., Folstein, S. E., & McHugh, P. R. (1975). "Mini-mental state". A practical method for grading the cognitive state of patients for the clinician. *J Psychiatr Res, 12*(3), 189-98.
25. Güngen, C., Ertan, T., Eker, E., Yaşar, R., & Engin, F. (2002). Reliability and validity of the standardized mini mental state examination in the diagnosis of mild dementia in Turkish population. *Turkish Journal of Psychiatry, 13*(4), 273-81.
26. Keskinoglu, P., Ucku, R., Yener, G., & Yaka, E., et al. (2009). Reliability and validity of revised turkish version of mini mental state examination (rMMSE-T) in Community-dwelling educated and uneducated elderly. *Int J Geriatr Psychiatry, 11*, 1242-50.
27. Cosansu, G., & Erdoğan, S. (2014). Influence of phychosocial factors on self-care behaviors and glycemic control in Turkish patients type 2 diabetes mellitus, *J Transcult Nurs 25*(1), 51-9.
28. Ferrans, C. E., & Powers, M. J. (1985). Quality of life index: Development and psychometric properties. *ANS Adv Nurs Sci, 8*(1), 15-24.
29. Özer, Z. C., & Efe, E. Validity and Reliability of the Turkish Version of The Ferrans and Powers quality of life index diabetes version. *Saudi Med J, 27*(1), 123-5.
30. Li, W., Sun, L., Li, G., & Xiao, S. (2019). Prevalence, influence factors and cognitive characteristics of mild cognitive impairment in type 2 diabetes mellitus. *Front Aging Neurosci, 30*, 11, 1-7.
31. Crespo, T. S., Anrade, J. M. O., Lelis, D. F., Ferreira, A. C., Souza, J. G. S., Eleuterio, A. M., & Martins L. B., et al. (2020). Adherence to medication, physical activity and diet among older people living with diabetes mellitus: correlation between cognitive function and health literacy. *IBRO Reports, 8*, 9, 132-37.
32. Yilmaz, F. T., Sabancıogullari, S., Aldemir, K., & Kumsar, A. K. (2015). Does social support affect development of cognitive dysfunction in individuals with diabetes mellitus? *Saudi Med J, 36*(12), 1425-31.
33. Munshi, M. N., Hayes, M., Iwata, I., Lee, Y., & Weinger, K. (2012). Which aspects of executive dysfunction influence ability to manage diabetes in older adults? *Diabetic Medicine, 29*(9), 1171–77.
34. Geijselaers, S. L. C., Sep, S. J. S., Stehouwer, C. D. A., & Biessels, G. J. (2015). Glucose regulation, cognition, and brain mri in type 2 diabetes: A systematic review. *Lancet Diabetes Endocrinol, 3*(1), 75-89.
35. *Ryan, C. M., Duinkerken, E., Rosano, C. (2016).* Neurocognitive consequences of diabetes. *American Psychologist, 71*(7), 563-76.
36. Ryuno, H., Kamide, K., Gondo, Y., Mai, K., Ryosuke, O., & Nakama, C., et al. (2017). Longitudinal association of hypertension and diabetes mellitus with cognitive functioning in a general 70-year-old population: The SONIC study. *Hypertens Res, 40*(7), 665-70.
37. Janssen, J., Koekkoek, P. S., Biessels, G.-J., Kappelle, J. L., & Rutten, Cog-ID study group. (2019). Depressive symptoms and quality of life after screening for cognitive impairment in patients with type 2 diabetes: Observations from the cog-ID cohort study. *BMJ Open, 17, 9*(1), 1-8.
38. Primozic, S., Tavcar, R., Avbelj, M., Dernovsek, M. Z., & Oblak, M. R. (2012). Specific cognitive abilities are associated with diabetes self-management behavior among patients with type 2 diabetes. *Diabetes Res Clin Pract, 95*(1), 48-54.
39. Hjelm, C. M., Brosröm, A., Riegel, B., Arestedt, K., & Strömberg, A. (2015). The association between cognitive function and self-care in patients with chronic heart failure. *Heart Lung, 44*(2), 113-9.
40. Sinclair, A.J., Girling, A. J., & Bayer, A. J. (2000). Cognitive dysfunction in older subjects with diabetes mellitus: impact on diabetes self-management and use of care services. *Diabetes Res Clin Pract, 50*(3), 203-12.
41. American Diabetes Association. (2020). 2. Classification and diagnosis of diabetes: Standards of medical care in diabetes-2020. *Diabetes Care, 43*(1), 14-31.
42. Świątoniowska-Lonc, N., Polański, J., Tański, W., & Jankowska-Polańska, B. (2021). Impact of cognitive impairment on adherence to treatment and self-care in patients with type 2 diabetes mellitus. *Diabetes Metab Syndr Obes, 15*(14), 193-203.
43. Uchmanowicz, I., Jankowska-Polańska, B. Mazur, G., & Sivarajan, Froelicher, E. S. (2017). Cognitive deficits and self-care behaviors in elderly adults with heart failure. *Clin Interv Aging, 13*(2), 1565-72.

44. Cameron, J., Worrall-Carter, L., Page, K., Riegel, B., Lo, S. K., & Stewart, S. (2010). Does cognitive impairment predict poor self-care in patients with heart failure? *Eur J Heart Fail, 12(*5), 508-15.
45. Asimakopoulou, K., & Hampson, S. E. (2002). Cognitive functioning and self-management in older people with diabetes. *Diabetes Spect, 15*(2), 116-21.
46. Teixeira, M. M., Passos, V. M. A., Barreto, S. M., Schmidt, M. I., & Duncan, B. B. et al. (2020). Association between diabetes and cognitive function at baseline in the brazilian longitudinal study of adult health (ELSA- Brasil). *Sci Rep, 31, 10*(1), 1596.
47. Thabit, H., Kennelly, S. M., Bhagarva, A., Ogunlewe, M., McCormack, P. M. E., & McDermott J. H., et al. (2009). Utilization of Frontal Assessment Battery and Executive Interview 25 in Assessing for Dysexecutive syndrome and its association with diabetes self-care in elderly patients with type 2 diabetes mellitus. *Diabetes Res Clin Pract, 86*(3), 208-12.
48. Nguyen, H. T., Grzyuracz, G., Arcury, T., Chapman, C., Pharm, J. K. K, & Ip, E. H., et al. (2010). Linking glycemic control and executive function in rural older adults with diabetes. *J Am Geriatr Soc, 58*(6), 1123-7.
49. Palamenghi, L., Carlucci, M. M., & Graffigna, G. (2020). Measuring the quality of life in diabetic patients: a scoping review. *J Diabetes Res, 20*, 1-19.
50. Munshi, M. N. (2017). Cognitive dysfunction in older adults with diabetes: What a clinician needs to know. *Diabetes Care, 40*(4), 461–7.
51. Bilgin, M. S., Özenç, S., Sarı, O., Yeşilkaya, Ş., & Aydoğan, Ü., et al. (2015). A study on quality of life in patients with diabetes. *J Clin Anal Med, 6*(1), 159-63.
52. Smith, K. J., Beland, M., Clyde, M., Gariepy, G., Page, V., & Badawi, G., et al. Association of diabetes with anxiety: A systematic review and meta-analysis. *J Psychosom Res, 74*(2), 89-99.
53. Koekkoek, P. S., Biessels, G, J., Kooistra, M., Janssenj, L., Kappelle, J., & Rutten G. Undiagnosed Cognitive impairment, health status and depressive symptoms in patients with type 2 diabetes. *J Diabetes Complications, 29*(8), 1217-22.
54. Zheng, F., Zhong, B., Song, X., & Xie, W. (2018). Persistent depressive symptoms and cognitive decline in older adults. *Br J Psychiatry, 213*(5), 638-44.
55. Berghöfer, A., Martin, L., Hence, S., Weinmann, S., & Roll, S. (2020). Quality of life in patients with severe mental illness: A cross-sectional survey in an integrated outpatient health care model. *Qual Life Res, 29*(8), 2073-87.
56. Ready, R. E., Ott, B. R., & Grace, J. (2004). Patient versus informant perspectives of quality of life in mild cognitive impairment and alzheimer's disease. *Int J Geriatr Psychiatry, 19*(3), 256-65.
57. World Health Organization. (1997). Programme on mental health, *WHOQOL measuring quality of life, 97*(4), 1-15.
58. Scocco, P., Fantoni, G., & Caon, F. (2006). Role of depressive and cognitive status in self-reported evaluation of quality of life in older people: Comparing proxy and physician perspectives. *Age and Ageing, 35*(2), 166–71.
59. Narges, M., Adis, K. M., & Alireza, A. (2018). The Effectiveness of cognitive therapy on quality of life in patients with type ii diabetes. *Int Arch Health Sci Res*, 5(4), 115-9.
60. Palamenghi, L., Carlucci, M. M., & Graffigna, G. (2020). Measuring the quality of life in diabetic patients: a scoping review. *J Diabetes Res, 20*, 1-19.
61. Eshkoor, S. A., Hamid, T. A., Mun, C. Y., & Ng, C. K. (2015). Mild Cognitive impairment and its management in older people. *Clin Interv Aging, 10*(10), 687-93.
62. Podolski, N., Brixius, K., Predel, H. G., & Brinkmann, C. (2017). Effects of regular physical activity on the cognitive performance of type 2 diabetic patients: A Systematic Review. *Metab Syndr Relat Disord, 15*(10), 481-93.
63. Quigley, MacKay-Lyons., M., & Eskes, G. (2020). Effects of exercise on cognitive performance in older adults: a narrative review of the evidence, possible biological mechanisms, and recommendations for exercise prescription. *J Aging Res, 14*, 1-15.
64. Patnode, C. D., Perdue, L. A., Rossom, R. C., Rushkin, M. C., Redmond, N., & Thomas, R. G. et al. (2020). Screening for cognitive impairment in older adults updated evidence report and systematic review for the us preventive services task force. *JAMA, 25*, 323(8), 764-85.
65. Cheung, D. S. K., Lai, C. K. Y., Wong, F. K. Y., & Leung, M. C. P. (2018). The effects of the music-with-movement intervention on the cognitive functions of people with moderate dementia: A randomized controlled trial. *Aging Ment Health, 22*(3), 306-15.
66. Mousivian, N., Mujembari, A. D., & Aghayousefi, A. (2018). The effectiveness of cognitive therapy on quality of life in patients with type II diabetes. *Int Arch Health Sci, 5*(4), 115-9.
67. Merom, D., Grunseit, A., Eramudugolla, R., Jefferis, B., Mcneill, J., & Anstey, K. J. (2016). Cognitive benefits of social dancing and walking in old age: the dancing mind randomized controlled trial. *Front Aging Neurosci, 2*(8), 1-11.
68. Luchsinger, J. A., Palmas, W., Teresi, J. A., Silver, S., Konj, J., & Elmicke, J. P. et al. (2011). Improved diabetes control in the elderly delays global cognitive decline. *J Nutr Health Aging, 15*(6), 445-9.