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Evaluation of frailty in individuals aged 65 years and over, with and without diabetes: A cross-sectional study

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Abstract

Aim: This study aims to reveal the effect of frailty in patients aged 65 years and over with and without type 2 diabetes.

Materials and Methods: A total of 298 elderly individuals aged 65 and over, 149 type 2 diabetic individuals and 149 non-diabetic individuals as the control group, were included in the descriptive cross-sectional study. Both groups were surveyed using Edmonton Frail Scale and socio-demographic data questionnaire.

Results: The mean age of the participants was 70.68±5.45 years, and 63.4% (n=189) of participants were female. Of the diabetic patients, 61 (40.9%) patients were found to be frail, 41 (27.5%) to be prone to frailty, and 47 (31.5%) to be non-frail. In individuals without diabetes, 33 (22.1%) individuals were found to be frail, 22 (14.8%) to be prone to frailty, and 94 (63.1%) to be non-frail. When both groups were analyzed statistically in terms of frailty, it was observed that frailty increased significantly in diabetic patients ($p < 0.05$).

Conclusion: This study has proved that frailty increases in type 2 diabetic patients compared to non-diabetic patients, the perception and assessment of aging may play a role under frailty, and quality of life is one of the factors that should be considered in the development of frailty. The high rates of falling and hospitalization in elderly diabetic patients necessitate taking necessary precautions. Further studies are needed to reveal the pathophysiology of frailty in diabetic elderly patients.

Introduction

Frailty that develops with aging is an important public health problem all over the world. Frailty is defined as a decrease in physiological reserve in response to stressors and the continuation of daily activities owing to the insufficiency of the functions of organs and systems in the body with advancing age [1]. The most important indicators of frailty are considered as loss of muscle strength, changes in body composition and deterioration in energy level [2]. Even though different frequencies are calculated in various studies, it has been shown that approximately 25% of the elderly population is at risk of frailty [3]. Considering the high incidence of frailty, as well as the increased risk of falls, disability, hospitalization, and death in frail individuals, it can be better understood how much of a public health problem it is [4].

Some mechanisms have been proposed for the etiology of frailty in elderly individuals. Physiological dysregulation and reduction of reserves that lead to frailty may result from complex mechanisms including the musculoskeletal system, immune system, endocrine system, cardiovascular system, and neurological system. One of the leading mechanisms is sarcopenia, which refers to loss of muscle strength. It has been reported that the prevalence of sarcopenia, which is around 15% starting from the 60's, can reach up to 50% in the 80's [5]. Improper nutrition such as inadequate protein intake, decreased physical activity, and decreased growth and sex hormones associated with aging seem to be important causes of sarcopenia in the geriatric population [6].

Recent studies have suggested that diabetes may be an important factor in the development of sarcopenia. It has been demonstrated that chronic inflammation, oxidative stress, and insulin resistance in diabetic patients may trigger sarcopenia and increase frailty in the elderly [7, 8, 9]. One of the possible pathways is that insulin, which has the effect of increasing protein synthesis in the muscles, loses its effect in diabetic patients and increases sarcopenia [10, 11]. Indeed, in a study in which body composition

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was monitored for 6 years, it was shown that loss of muscle mass in elderly patients with diabetes was twice faster than in non-diabetic elderly patients [12]. Moreover, muscle strength and physical performance were found to be significantly lower in poorly controlled diabetic patients than in well-controlled diabetic and non-diabetic patients [13]. These studies revealed that sarcopenia and frailty caused by sarcopenia should be carefully analyzed in the progress of type 2 diabetes.

The development of frailty in patients with diabetes has been studied in a limited number of studies. In the study of Cacciatore et al., frailty was observed in 48.4% of diabetic patients [14]. In the study of Howrey et al. on individuals over 65 years of age, the frequency of frailty was found to be higher in diabetics than in non-diabetic individuals [15]. However, studies examining the relationship between frailty and diabetes in the elderly are insufficient, and there is a need for studies examining this relationship.

This study aims to reveal the effect of frailty in patients aged 65 years and over with and without diabetes.

Materials and Methods

In this cross-sectional study, elderly individuals aged 65 years and over with and without type 2 diabetes who presented to İzmir Katip Çelebi University Ataturk Training and Research Hospital polyclinics and Izmir Katip Çelebi University Narlidere Education Family Health Center No. 4 in 2018 were included. Participants who met the criteria for inclusion in the study were informed about the study, and verbal and written consent of the volunteers was obtained and signed with a voluntary consent form. Inclusion criteria for the study were determined as being over 65 years old, being able to communicate verbally, being able to answer the questions in the questionnaires cognitively, answering the questions completely, and not being bedridden. Those with dexterity problems and those with hearing and visual impairments were not included in the study.

The participants were administered a 33-question questionnaire on socio-demographic data developed by the researchers and the Edmonton Frail Scale, which is used to measure frailty in the elderly. In the socio-demographic data questionnaire, questions were asked to evaluate age, gender, educational status, marital status, hospitalization status, falling status of the participants, their own age and perception of old age. Moreover, participants were asked to rate their quality of life on a scale of 1 to 10 points (1 defined as the worst, 10 as the best).

Edmonton Frail Scale is a scale developed by Rolfson et al. in 2006 [16]. Its Turkish validity and reliability study was performed by Fadıloğlu et al. in 2013 [17]. Edmonton Frail Scale consists of 9 sub-dimensions, a total of 11 items; cognitive status (clock drawing test, 2 points), general health status (how many hospitalizations in the last year, 2 points, and describing health status, 2 points), functional independence (How many of the 8-day activities - shopping, meal preparation, transportation, telephone, house cleaning, laundry, money management and taking medication - he/she can do independently, max 2 points), social support (the presence of an individual that he/she can ask for help when he/she needs help and can be trusted, max 2 points), drug use (intake of more than 5 drugs per day, 1 point, and forgetting to take prescribed drugs, 1 point), nutrition (weight loss that may cause looseness in clothes, 1 point), mood (feeling often sad or depressed, 1 point), continence (incontinence status, 1 point), functional performance (Timed Up and Go test, 2 points). The lowest total score obtained from the scale is 0 and the highest score is 17 (16). 0-4 points received from the scale is considered as non-frail, 5-6 points as prone to frailty, and 7 points and above as frail [18].

The heights and weights of the participants were measured, and their Body Mass Indices were calculated with the formula (BMI) = Weight (kg)/Height^2 (m). Those with a BMI of less than 18.50 were considered underweight, those with a BMI of 18.50 to 24.99 were considered normal weight, those with a BMI of 25.0–29.99 were considered overweight, and those with a BMI of 30.0 and above were considered obese [19].

As the sample size was found to be 24.4% in individuals with DM and 11.3% in individuals without DM, in the frailty studies conducted with the Edmonton Frail Scale on individuals aged 65 years and over, the minimum number was calculated as 298 people, 149 people for each group with a confidence interval of 95%, a power of 80%, a margin of error of 5% [20].

Statistical Analysis

Statistical evaluation was performed on SPSS (Statistical Package for the Social Sciences) 22.0 packaged software. In the evaluation of the obtained data, continuous variables were expressed as mean ± standard deviation or median (minimum-maximum) values, and categorical variables were expressed as frequency and related percentage values in the study. Whether numerical data such as age and body mass index (BMI) showed normal distribution was evaluated with the Kolmogorov-Smirnov test. Mann-Whitney U test was used for intergroup comparisons. Evaluation of categorical variables was performed with the chi-square test. Relationships between continuous variables were examined using Spearman correlation analysis. $p < 0.05$ was considered statistically significant.

Results

A total of 298 individuals, 149 with type 2 diabetes and 149 without diabetes, were included in the study. The mean age of the participants was 70.68±5.45 years, the median value was 69.00 (min: 65, max: 89), and 189 (63.4%) participants were women.

Socio-demographic characteristics of diabetic and non-diabetic individuals are provided in Table 1. Both groups display similar characteristics in terms of age, gender, and other demographic parameters. It was observed that there was no significant difference between diabetic and non-diabetic individuals in terms of perceiving their own age ($p > 0.05$). Similarly, both groups were found to be statistically similar in terms of assessing old age ($p > 0.05$) (Table 2).

The effect of diabetes on falling and hospitalization among elderly individuals is shown in Table 3. It was observed

Table 1. Sociodemographic Parameters of Study Group

		Diabetic (n=149) n(%)	Non-diabetic (n=149) n(%)	P
Age		70.38±5.1	70.97±5.7	0,4
Gender	Female / Male	100 (49)	89 (60)	0,186
Graduation	Illiterate	28(18.8)	19(12.8)	0,496
	Primary school	70(47)	74(49.7)	
	Secondary school	13(8.7)	12(8.1)	
	High school	13(8.7)	20(13.4)	
	University	25(16.8)	24(16.1)	
Martial Satatus	Married	105(70.5)	98(65.8)	0,384
	Unmarried	44(29.5)	51(34.2)	
Socioeconomic Status	Low income	96(64.4)	93(62.4)	0,230
	Middle income	41(27.5)	50(33.6)	
	High income	12(8.1)	6(4)	
Employment Status	Yes	7(4.7)	11(7.4)	0,331
	No	142(95.3)	138(92.6)	
Smoking	Yes	14(9.4)	18(12.1)	0,454
	No	135(90.6)	131(87.9)	
Alcohol	Yes	4(2.7)	8(5.4)	0,239
	No	145(97.3)	141(94.6)	

Table 2. Age Perception and Assessment of Elderliness

	Diabetic n(%)	Non-diabetic n(%)	P
Age Perception			
Oldest-old	4(2.4)	7(4.7)	0.718
Old	45(30.2)	44(29.5)	
Middle-old	70(47)	73(49)	
Young	30(20.1)	25(16)	
Assessment of Elderliness			
I don't feel elderly	22(14.8)	17(11.4)	0.869
As a bad situation	28(18.8)	32(21.5)	
As inconvenience	14(9.4)	17(11.4)	
As a normal situation	74(49.7)	73(49)	
As a good situation	11(7.4)	10(6.7)	

Table 3. Falling and Hospitalization of The Subjects ın the Last Year

	Diabetic n(%)	Non-diabetic n(%)	P
Falling			
Fallers	48(32.2)	29(19.5)	< 0.05
Non-fallers	101(67.8)	120(80.5)	
Hospitalization			
Yes	66(44.3)	41(27.5)	< 0.01
No	83(55.7)	108(72.5)	

Table 4. The frailty status in patients with and without diabetes

	Frail n (%)	Apperently vulnerable n(%)	Not frail n(%)	p
Diabetes				
Yes	61(40.9)	41(27.5)	47(31.5)	< 0.001
No	33(22.1)	22(14.8)	94(63.1)	

that 48 (32.2%) diabetic patients and 29 (19.5%) non-diabetic patients fell at least once a year. The falling rate in diabetic patients was statistically significantly higher than in non-diabetic patients ($p < 0.05$). The number of hospitalizations was 66 (44.3%) in diabetic patients and 41 (27.5%) in the control group. This difference was found to be statistically significantly higher in patients with diabetes ($p < 0.01$). Table 4 shows the frailty status in patients with and without diabetes. Of the diabetic patients, 61 (40.9%) patients were found to be frail, 41 (27.5%) to be prone to frailty, and 47 (31.5%) non-frail. In individuals without diabetes, 33 (22.1%) individuals were found to be frail, 22 (14.8%) to be prone to frailty, and 94 (63.1%) to be non- frail. When both groups were analyzed statistically in terms of frailty, it was observed that frailty increased significantly in diabetic patients.

The relationship between frailty and gender was evaluated in both diabetic and non-diabetic groups. Fragility was found higher in women than men ın the diabetic group ($p < 0.05$). Of the women, 49 (49%) patients were found to be frail, 25 (25%) to be prone to frailty, and 26 (26%) non-frail. . Of the men, 12 (24.5%) patients were found to be frail, 16 (32.7%) to be prone to frailty, and 21 (42.9%) non-frail. There was no difference in terms of genders in the non-diabetic group ($p > 0.05$).

Table 5. The frailty of the participants according to their age perception and assessment elderliness

		Frail n (%)	Apperently vulnerable n (%)	Not frail n (%)	P
Age Perception	Oldest-old	9(9.6)	1(1.6)	1(0.7)	< 0.001
	Old	42(44.7)	25(39.7)	22(15.6)	
	Middle-old	35(37.2)	29(46)	79(56)	
	Young	8(8.5)	8(12.7)	39(27.7)	
Assessment of Elderliness	I don't feel elderly	6(6.4)	8(12.7)	25(17.7)	< 0.001
	As a bad situation	30(31.9)	11(17.5)	19(13.5)	
	As inconvenience	17(18.1)	5(7.9)	9(6.4)	
	As a normal situation	36(38.3)	36(57.1)	75(53.2)	
	As a good situation	5(5.3)	3(4.8)	13(9.2)	

Table 6. Logistic regression of factors affecting diabetes

	RR (%95 GA)*	p
Age	0.959 (0.916-1.004)	0.072
Gender	0.938 (0.558-1.577)	0.809
Falling	0.670 (0.378-1.189)	0.171
Hospitalization	0.746(0.429-1.298)	0.300
Apperently vulnerable	3.498(1.816-6.737)	0.000
Frail	3.216(1.701-6.081)	0.000

*RR: estimated relative risk as represented by odds ratio and 95% confidence interval

The frailty of the participants according to their age perception and elderliness assessment is shown in Table 5. Accordingly, individuals, who perceived themselves as old and considered old age as a bad condition, were found to be statistically significantly frailer ($p < 0.001$).

When frailty and quality of life were examined, it was seen that frailty was negatively correlated with quality of life ($p < 0.001$, r: -0.458). There was a weak positive correlation between body mass index and frailty ($p < 0.05$, r: 0.12)

According to the logistic regression analysis, susceptibility to frailty is 3,498 times, and frailty is 3.216 times more risk of diabetes compared to non-fragile (Table 6).

Discussion

The most important causes of morbidity and mortality in the progress of diabetes are microvascular and macrovascular complications due to hyperglycemia. However, classical diabetes complications such as cardiovascular diseases can explain only 60% of the increased mortality in patients with diabetes; the cause of the remainder of the increased mortality is unclear and is considered nonvascular [21]. An important candidate for vascular unexplained mortality in the geriatric diabetic population may be frailty. This study examined the relationship between diabetes and frailty in the geriatric population.

In our study, 41% of patients with diabetes were found to be frail, and 27.5% to be prone to frailty. In patients without diabetes, these rates were found to be 22.1% and 14.8%, respectively. In our study, it was observed that frailty was approximately twice as high in diabetic patients as in the healthy control group. Looking at previous studies, the German ESTHER cohort study and the Whitehall II Prospective Study revealed that frailty increased 3 to 5 times in elderly diabetic patients [22, 23]. In other studies, it was determined that frailty was statistically significantly higher in patients with diabetes, and Cacciatore et al. reported the frailty rate in patients with diabetes at a rate of 48%, similar to our study [24-26]. Our study supported previous studies showing increased frailty in diabetic elderly patients.

Many mechanisms have been asserted, leading to increased frailty in the elderly diabetic population. Elevated blood glucose levels may cause insulin resistance, chronic inflammation, oxidative stress, and mitochondrial dysfunction, leading to skeletal muscle mass and dysfunction [27]. In various studies, including meta-analyses, it has been shown that IGF-1 and testosterone levels are lower in diabetic patients than in healthy individuals [28, 29]. Both IGF1 and testosterone are hormones that have important effects on muscle protein synthesis and thus muscle strength and may contribute to frailty in diabetic patients. Furthermore, vitamin D, which is found to be relatively low in patients with diabetes, may increase the development of frailty [30].

In our study, there was no difference between patients with and without diabetes regarding the perception and evaluation of old age. However, individuals who perceive themselves as old and consider old age as a bad condition were found to be statistically significantly frailer. This result obtained in our study shows that the person's perception and evaluation of aging is another factor that plays a role in the development of frailty.

Another important factor to consider when assessing frailty in the elderly is quality of life. In previous studies, Masel et al. reported that frailty increased as the quality of life decreased in Mexican elderly people [31]. In our study, a negative correlation was found between quality of life and frailty, which supports the previous study. This shows that psychosocial factors should be considered in addition to the physiopathogenetic mechanisms related to diabetes in the development of frailty.

This study showed that both falling and hospitalization rates of diabetic elderly patients were higher than those of the healthy group. According to the results of the study, one-third of the patients with diabetes fall at least once a year, and nearly half of them are hospitalized. This finding, which also supports the results of previous stud-

ies, reveals that the necessary precautions should be taken seriously in terms of factors that will increase falling in elderly diabetic individuals [32, 33].

Some limitations should be taken into account when evaluating our study. First of all, the diabetes laboratory data of the patients were not evaluated in this study, and no comment could be made on the effect of blood sugar regulation on diabetes. Secondly, this study is a cross-sectional study, and there is a need for prospective studies on this subject in our country. Moreover, the fact that the study was carried out within the borders of only one province is another limitation.

Conclusion

This study has proved that frailty increases in diabetic patients compared to non-diabetic patients, the perception and assessment of aging may play a role under frailty, and quality of life is one of the factors that should be considered in the development of frailty. The importance of diabetes control in reducing the risk of frailty has been seen in elderly individuals. The high rates of falling and hospitalization in elderly diabetic patients necessitate taking necessary precautions. Further studies are needed to reveal the pathophysiology of frailty in diabetic elderly patients.

Ethics Committee Approval

The ethics committee approval required for the research was obtained from the Izmir Katip Çelebi University Non-Interventional Studies Ethics Committee (Decision Date: 12/20/2017, Decision No: 306).

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