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Determination of the relationship between frailty level and quality of life in elderly individuals with type 2 diabetes

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The aim of the study was to examine the relationship between frailty level and quality of life in elderly individuals with Type 2 diabetes. This descriptive and correlational study was conducted with 211 patients who applied to the diabetes outpatient clinic of a private and a public hospital in Istanbul between September and November 2022. The data were obtained by using the Personal Information Form, Edmonton Frail Scale and the Quality of Life in the Elderly Scale. The mean Edmonton Frail Scale score of the participants was 7.36 ± 4.35. Their mean quality of life scale score was 19.32 ± 7.12. A low degree of negative correlation was found between Elderly Quality of Life Scale total and subscale scores and the Edmonton Frail Scale score ($p < 0.05$). Besides, there was a statistically significant difference between the Edmonton Frail Scale mean score and education level, history of falling in the last 1 year, using oral antidiabetic drugs, and the presence of diabetes complications ($p < 0.05$). It is recommended that frailty and quality of life should be evaluated regularly in elderly patients with diabetes and necessary planning should be made in diabetes management and improving quality of life in the presence of frailty.

Keywords Elderly, Diabetes, Frailty, Quality of Life

The prevalence of diabetes mellitus increases worldwide due to the global increase in life expectancy. Worldwide, 537 million adults, i.e. 1 in every 10 people, are struggling with diabetes. This number is expected to reach 643 million by 2030 and 783 million by 2045. Diabetes caused 6.7 million deaths in 2021, representing one death every 5 s[1]. As of 2021, 9 million adults in Turkey had diabetes, accounting for approximately 15% of the total adult population. In addition, the number of individuals diagnosed with diabetes is expected to increase to 10.8 million in 2030 and 13.3 million in 2045[2]. Forty-four percent of patients with diabetes are now over the age of 65[3]. In addition to the risk of premature death, comorbidities such as hypertension, cardiac disease, cerebrovascular diseases and stroke are known to be more common in elderly individuals with diabetes. Elderly and diabetic individuals are also more likely to experience geriatric syndromes such as polypharmacy, depression, cognitive disorders, urinary incontinence, frailty syndrome, and falls[4,5]. All of these conditions can impact individuals' daily activities and social participation, subsequently diminishing their quality of life and life expectancy[6–8]. Frailty, an age-related condition characterized by a decline in physiological reserves, is a prevalent geriatric syndrome in older adults. It is defined by the reduction in the functions and reserves of physiological systems, impaired adaptability necessary for recovery, and is typically characterized by slowness, weakness, fatigue, and low physical activity[9]. Frail individuals often experience reduced mobility, muscle weakness, diminished muscle mass, poor nutrition, and cognitive impairments, all of which make them more susceptible to various stressors.

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This condition is closely associated with an increased risk of negative outcomes, such as functional decline, falls, delirium, hospitalization, and even death.

As such, frailty constitutes a significant global challenge in both clinical and public health contexts[10]. Studies suggest that the prevalence of frailty is 3 to 5 times higher in people with diabetes compared to those without[11,12]. The incidence of frailty has been reported to vary between 5 and 48% in patients with type 2 diabetes[4]. The pathophysiology of frailty is closely related to the changes that occur with aging but has not been fully explained. Loss of muscle mass and functions occurs as the person ages, movements become slower and complications due to inactivity begin to develop. Sarcopenia, known as loss of muscle strength due to these changes in elderly individuals, is one of the leading mechanisms in the development of frailty[13]. Sarcopenia, slowed down and reduced physical movements, burnout, weakness are important components of frailty. Because frailty affects multiple systems, it can lead to serious consequences such as increased hospitalizations, fractures and death[14]. From the perspective of the relationship between frailty and diabetes, hyperglycaemia, HbA1C levels, inactivity due to vascular complications from diabetes and physical and cognitive losses cause higher levels of frailty. Diabetes affects the quality of life physically, socially, psychologically and economically. The coexistence of frailty and diabetes adversely affects mortality, psychosocial well-being and quality of life of the elderly patient[15]. For this reason, it is so important to notice elderly individuals with frailty as early as possible, prevent frailty and increase their quality of life. Evaluating elderly individuals holistically and closely monitoring potential changes is crucial in defining frailty. Early diagnosis of frailty levels, especially of an individual with diabetes, will ensure timely implementation of appropriate interventions for the elderly and increase their quality of life[16].

When the literature was investigated, it has been found that while there were many studies evaluating the frailty levels and related factors of elderly individuals with diabetes, the studies evaluating the relationship between frailty and quality of life of elderly individuals with diabetes were quite limited. Therefore, this study aims to determine the relationship between frailty and quality of life in elderly type 2 diabetes patients.

Research questions

1. Is frailty level high in elderly individuals with type 2 diabetes?
2. Is there a relationship between frailty and quality of life in elderly individuals with type 2 diabetes?

Materials and methods

Study type

This study is a descriptive-analytical cross-sectional investigation aimed at defining the relationship between frailty levels and quality of life in elderly individuals with Type 2 diabetes.

Study area and population

The research was carried out with 211 patients who applied to the diabetes outpatient clinic of a private and a public hospital in Istanbul. The required minimum number of patients was calculated based on the population size, sample proportion, and the maximum error at a 95% confidence level using the unknown population sample formula, and it was determined to be 195 patients. To minimize data loss, the study was conducted with 211 patients. The sample of the study included individuals aged 65 and over who came to the hospital to receive medical services, were diagnosed with Type 2 diabetes, had no vision and hearing problems, could communicate verbally, and voluntarily accepted to participate in the study. The surveys were distributed by the researchers, and participants were asked to complete them. For participants who were illiterate, the researchers read the data collection tools aloud and ensured that the questions were answered.

Study design

The data of the research were collected between September 2022 and November 2022. Individuals were first informed about the study and verbal and written informed consents were obtained from the participants.

Data collection

Personal Information Form for Elderly Individuals, Edmonton Frail Scale and Quality of Life in the Elderly (CASP-19) were used to collect data.

Personal information form

The form includes sociodemographic and diabetes-related information of individuals.

Edmonton frail scale

Edmonton Frail Scale (EFS) was developed by Rolfson et al. (2006) in Canada[17]. Its Turkish validity and reliability were established by Aygör in 2013[18].The scale has 9 subscales, namely cognitive status, general health status, functional independence, social support, drug use, nutrition, mood, continence, and functional status and 11 items in total. The 'clock test' is used to assess cognitive status, and the 'Timed Get Up and Go test' is used to assess functional performance[17,18]. The highest score that can be obtained from the scale is 17, the lowest is 0. If the score is in the range of 0–4, the elderly person is not frail, but apparently frail in the range of 5–6, slightly frail in the range of 7–8, moderately frail in the range of 9–10, and severely frail in the range of 11 points or more. An increase in the total score obtained from the scale indicates an increase in the severity of frailty. The Cronbach alpha coefficient was found to be 0.75 in determining the internal consistency of the Edmonton Frail Scale by Aygör[18]. In this study, the Cronbach's alpha coefficient of the Edmonton Frail Scale was found to be 0.82.

Quality of life in the elderly (CASP-19) scale

The CASP-19 scale is a 4-point Likert type scale developed by Hyde et al. in 2003 to measure the quality of life of the elderly[19]. The scale consists of 19 items and four subscales: control, autonomy, pleasure and self-realization. The Turkish validity and reliability of the scale was studied by Türkoğlu and Adıbelli in 2014, and it includes 13 items and two sub-factors, namely, the perception of autonomy and satisfaction and the perception of obstacle. Each item of the scale is graded as 0 for never, 1 for occasionally, 2 for sometimes, and 3 for always responses. Items 1, 2, and 4 are reverse scored. Higher total scores indicate better quality of life. The Cronbach's alpha coefficient of the scale was found to be 0.91[20]. In our study, the Cronbach's alpha coefficient of the scale was found 0.89.

Data analysis

SPSS 21.0 statistical software package was used in data analysis. Frequency tables and descriptive statistics were used to interpret the findings. The fit of the data for normal distribution was evaluated with the Kolmogorov–Smirnov test, demonstrating that the data was not normally distributed. Mann Whitney U test was therefore used in statistical comparisons to compare two independent groups for non-parametric tests, and Kruskal Wallis analysis to compare multiple independent groups. Spearman correlation was used to determine the relationships between the scales. In the evaluation of the results, $p < 0.05$ was considered statistically significant at the 95% confidence interval.

Ethical considerations

Ethical committee approval was obtained from the Human Research Ethics Committee of Istanbul Gelişim University with the decision dated 12.11.2021/34, in line with the principles of the Declaration of Helsinki, to carry out the study. Before starting data collection, the elderly diabetic individuals were informed about the purpose of the research and ensured that their identities would not be disclosed in any way, after which their informed consent was obtained verbally and in writing.

Results

Participants' mean age was 72.45 ± 7.43 years (range 65–92). 102 (48.3%) were female, 59 (28%) had primary school degree, 177 (83.9%) were married, and had 185 (87.7%) health insurance. 127 of them (60.2%) had average income and 73 of them (34.6%) lived with their spouses. A total of 78.2% were non-smokers and 87.7% did not use alcohol. 60.7% of participation did not use a walking aid and 49.3% did not fall in the last year (Table 1).

Time since diabetes diagnosis of 37.4% of the participants is between 6–10 years, 61.1% (n = 129) use oral antidiabetic and 33.2% (n = 70) use insulin medication. 80.1% (n = 169) did not have any other chronic disease and 53.6% (n = 113) developed diabetes-related complications (Table 2).

When the average Edmonton Frail Scale Scores of elderly individuals with Type 2 Diabetes were compared by their personal and diabetes-related characteristics, no statistically significant differences were identified between gender, marital status, having health insurance, income level, people they lived with, using a walking aid, using insulin, presence of a chronic condition other than diabetes, time since diabetes diagnosis and the total mean score of the scale ($p > 0.05$).

	Personal characteristic	n	%	Mean Rank	χ2/ Z	P
Gender	Female Male	102 109	48.3 51.7	104.96 106.97	Z = -0.24	0.81
Marital status	Married Single	177 34	83.9 16.1	107.32 99.12	Z = -0.72	0.47
Health insurance	Yes No	185 26	87.7 12.3	108.01 91.69	Z = -1.28	0.19
Education	Illiterate Literate Primary school Secondary school High school University	42 52 59 41 14 3	19.9 24.6 28.0 19.4 6.6 1.5	119.40 117.49 105.21 92.04 84.21 27.17	χ2 = 12.94	**0.02***
Income	Low Average High	46 127 38	21.8 60.2 18.0	112.87 106.62 95.62	χ2 = 12.94	0.42
Lives with	Alone Spouse Spouse and children Children Other	53 73 58 25 2	25.1 34.6 27.5 11.9 0.9	104.83 106.82 99.86 113.26 194.50	χ2 = 5.23	0.26
Walking aid use	Yes No Sometimes	46 128 37	21.8 60.7 17.5	108.49 101.44 118.69	χ2 = 2.41	0.29
Fell in the last 1 year?	Never fell 1 time 2 times 3 and more	104 49 31 27	49.3 23.2 14.7 12.8	87.01 116.39 122.98 140.80	χ2 = 22.89	**0.00***

Table 1. Relationship between personal characteristics of participants and frailty level (N = 211).

Diabetes-related characteristics		n	%	Mean Rank	χ2/ Z	P
Time Since Diabetes Diagnosis	≤5 Years 6–10 Years 11–15 Years over 15 years	19 79 60 53	9.0 37.4 28.4 25.1	96.11 109.19 110.98 99.16	χ2 = 1.79	0.61
Using Oral Antidiabetics	Yes No	129 82	61.1 38.9	112.86 95.20	Z = -2.06	**0.03***
Using Insulin	Yes No	70 141	33.2 66.8	112.71 102.67	Z = -1.13	0.25
Having Another Chronic Disease	Yes No	42 169	19.9 80.1	89.63 110.07	Z = -1.95	0.06
Having Developed Complications	Yes No	113 98	53.6 46.4	89.46 120.34	Z = -3.68	**0.00***

Table 2. Relationship between diabetes-related characteristics of participants and frailty level (N = 211).

Number of Items	11
Highest and lowest receivable scores	0–17
Highest and Lowest Scores Received in the Study 0–15	Highest and Lowest Scores Received in the Study 0–16
Mean and Standard Deviation	7.36 ± 4.35
Cronbach Alpha Value	0.83

Table 3. Edmonton frail scale scores and internal consistency (N = 211).

Scales	Edmonton Frail Scale Score
Quality of life scale total score (N = 211)	r = -287* **p = 0.00**
Autonomy and satisfaction perception subscale	r = -291* **p = 0.00**
Obstacle perception subscale	r = -240* **p = 0.00**

Table 4. The relationship of quality of life and its subscales with Edmonton Frail Scale Score (N = 211).
*Spearman's Correlation test was used.

A statistically significant difference was found between the total mean score of the scale and participants' education level, history of falling in the last 1 year, using oral antidiabetic drugs and the presence of diabetes complications ($p < 0.05$). Edmonton Frail Scale mean scores of type 2 diabetic elderly individuals who were illiterate and fell three times or more in the last year were found to be higher than the others. Those using oral antidiabetic drugs and developing diabetes complications were also found to have higher Edmonton Frail Scale mean scores (Table 1, Table 2). The distribution of participants' Edmonton Frail Scale scores is given in Table 3. The total mean score of the scale was 7.36 ± 4.35 (Table 3).

The scores obtained from the subscales of the Elderly Quality of Life Scale are as follows: the total score was 19.32 ± 7.12, the Autonomy and Satisfaction Perception subscale scored 14.82 ± 6.84, and the Obstacle Perception subscale scored 4.49 ± 2.21. When the relationship between the Edmonton Frail Scale Score and the quality of life scale of elderly individuals with Type 2 Diabetes was examined, it was found that there was a low negative correlation between the total score of the quality of life scale and its subscales and the Edmonton Frail Scale Score. As the total Edmonton Frail Scale Scores of the elderly individuals increased, the quality of life score decreased (Table 4).

Discussion

When elderly people with diabetes develop fragility, this can lead to falls, disability, hospitalizations, reduced quality of life and mortality. The elderly individuals with diabetes who were illiterate had higher levels of frailty in this study ($p < 0.05$). In studies conducted in our country and in other countries, the elderly with low levels of education were found to experience more frailty[21–26]. The findings are directly in line with previous findings.

In present study, those who fell three times or more in the last year also experienced more frailty ($p < 0.05$). Several studies examining the factors related to frailty have reported more frailty in people with a history of falling in the last year and emphasized that there was a relationship between frailty and falls[21,22,26,27]. For example, among 298 elderly people with and without type 2 diabetes with a mean age of 70.68 ± 5.45 years, those with diabetes experienced more falls and were frailer[13]. Falling is a major problem in elderly patients and is associated with frailty, as in this study. It is an expected result that the elderly people with a more prominent history of falling experienced more frailty. These findings are consistent with those of the previous studies.

In the study demonstrated that elderly people with diabetes using oral antidiabetics were frailer ($p < 0.05$). According to previous studies, frailty was more common in elderly people on continuous medication than those who were not[28].

Elderly patients may be more exposed to the adverse effects of oral drugs due to decreased[29–31]. We believe that higher rates of frailty in elderly patients in this study is due to exposure to adverse effects of drugs. The results support literature information.

The elderly people with diabetes complications had more frailty in our study ($p < 0.05$). Likewise, a relationship has been described between frailty and nephropathy in Chinese elderly people with type 2 diabetes[32]. In another study conducted with 7164 elderly people in Mexico, diabetes and hypertension or any occurring complications were associated with frailty[33]. A study conducted in our country concluded that the majority of elderly individuals with Type 2 diabetes who had coronary artery disease or neuropathy as a diabetic complication were frail[34]. Studies show that diabetes complications increase frailty. Old age and diabetes are two important factors that reduce muscle mass and strength[35,36]. We believe diabetes complications added to these may have caused more frailty.

The mean frailty score of elderly individuals with diabetes in our study was 7.36 ± 4.35. O'Donovan et al. (2021) found that frailty was common in 662 elderly people aged 60 and over with diabetes[37]. Duzgun et al. (2018) found the Edmonton Frail Scale mean score of 6.84 ± 3.83, i.e. apparently frail in the elderly over 65 years of age[24]. In another study using a similar scale, the majority of 366 patients with a mean age of 81.5 years experienced apparent frailty[28]. A score of 7–8 on the Edmonton Frail Scale is considered mildly frail. There are many risk factors that cause frailty in older people with diabetes. We believe that the majority of elderly people with diabetes had milder frailty because they did not use a walking aid and did not have a history of falling in the last year.

In the study, the quality of life decreased as frailty increased ($p < 0.05$). O'Donovan et al. (2021), in their cross-sectional analysis of the health, aging and retirement study in Europe, reported that participants with both diabetes and frailty rated their health status as poor, displayed more depression symptoms, and had a low quality of life[37]. In a study conducted in 662 elderly people aged 60 and over in Brazil, increased frailty was associated with reduced quality of life[38]. In addition, the quality of life was reported to be low in elderly patients with type 2 diabetes and frailty syndrome[4]. A relationship has been shown in our country between frailty and decreased quality of life in patients with type 2 diabetes over the age of 65[34]. According to Karsli et al. (2022), quality of life is an important factor to be considered in the occurrence of frailty[13].

The importance of the relationship between frailty and low quality of life was also expressed in other meta-analyses and systematic reviews[39,40]. Our study supports the conclusion demonstrated in other studies that quality of life decreases as frailty increases.

Limitations:

The data used in the study is limited to the participants' self-reports. The data is restricted to patients visiting the specified clinics and cannot be generalized to the entire population.

Conclusion

Elderly patients with diabetes were evaluated as mild frail. Elderly individuals who were illiterate, fell three times or more in the last 1 year, used oral antidiabetics and developed diabetes complications has experienced more fragility. As the frailty of elderly individuals with diabetes increases, their quality of life decreases.

It is predicted that regular assessment of frailty and quality of life in elderly diabetic individuals and early interventions for patients with identified frailty may improve the quality of life of these individuals. Diabetes management in these individuals should take into consideration their frailty status. A multidisciplinary approach should be adopted to prevent or manage diabetes-related complications, and nutrition, medication, exercise and other treatment modalities should be considered as a whole. Furthermore, improving muscle strength, balance, and coordination through appropriate physiotherapy and exercise programs may play a significant role in reducing or preventing the risk of falls. Awareness-raising initiatives should be implemented to enhance the quality of life for individuals with lower levels of education. It is considered that such measures could improve the health status of elderly individuals and enhance their overall quality of life. Future research could investigate the mediating effect of a variable on the relationship between these two variables in a larger and more diverse patient population, and consider using statistical modeling to strengthen the analysis.

Data availability

The data that support the findings of this study are available from the cor-responding author upon reasonable request.

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Author contributions

Study conception, design and data collection: MR, GY, FK; Data analysis and interpretation: FK, GY; Drafting of the article: MR, GY, AG, SÇ, ED,HFA; Critical revision of the article: SÇ, ED, HFA,BSŞ.

Declarations

Competing interests

The authors declare no competing interests.

Additional information

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