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Comparison of the fall risk and balance in frail and non-frail older adults

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ABSTRACT

Aim: To compare fall risk and balance in frail and non-frail older adults.

Methods: Older people over the age of 65 who agreed to participate in the study voluntarily were included. Older people with a score of 9 and above according to the Edmonton Frail Scale (EFS) were classified as frail group (n=52) and older people below this score were placed into the non-frail group (n = 52). Older people's fall risks were evaluated with the Fall Risk Questionnaire (FRQ) and their balance performance was evaluated with the Tinetti Balance and Gait Test (TBGT) and Four Square Step Test (FSST).

Results: The Frail group's FRQ mean score was significantly higher than the other group (p<0.001). The frail group's TBGT balance, gait, and total scores were significantly lower than the non-frail group (p<0.001). The FSST time was significantly lower in the non-frail group (p=0.009).

Conclusions: The results of our study suggest that the balance performance of the elderly during the frailty period decreases compared to the normal elderly and this increases the risk of falling. Therefore, we think that this negative aspect of frailty should be taken into account in clinical practice.

Key words: Frail older, balance, fall risk, cognition, older adults.

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1. Introduction

Frailty is a syndrome that, with multifaceted systemic changes due to aging, leaves older people vulnerable to external stressors and brings with it many health problems [1,2]. While frailty is seen in 10-25% of older people, these rates increase to over 40% in the pre-frail period [3,4]. In general, frailty causes an increase in the risk of adverse health outcomes, mortality, and hospitalization rates. It causes physical performance limitations by causing restrictions in daily living activities [2]. Due to these restrictions, there is an increase in fall rates and fractures [2,5].

It was emphasized that frail older people had worse physical activity levels and lower extremity activity performance than non-frail individuals, and they had a higher risk of falling [6]. Moreover, It was stated that frailty was associated with a decrease in walking speed, a decrease in balance quality, a decrease in grip strength, and an increase in the rate of falls, and these situations were common in older people [7]. In addition, it was emphasized that reduced mobility and impaired balance were some of the basic components of frailty [8].

Balance is one of the important determinants for older people to be able to perform physical activities independently. It is known that falls associated with balance disorders in older people cause loss of independence and mortality [9]. By drawing attention to balance problems in frail older people, the usefulness of balance training programs to reduce the risk of falling was also stated [10]. It is reported that balance involves the complex interaction of more than one postural control system and that fragility and balance impairments are observed. In addition, it was stated that cognitive distractions might further jeopardize balance control in frail older people, which might lead to an increased risk of falling [11].

Although there are studies in the literature regarding fall risk and balance in frail older people, it was determined that comparative studies on the subject in frail and non-frail older people are quite insufficient. This study aimed to compare fall risk and balance in frail and non-frail older people. It is thought that the findings obtained from the study would make significant contributions to the literature on the effects of frailty on fall risk and balance in older people.

2. Materials and metods

2.1. Participants and Study Design

The research was planned as a cross-sectional study. The statistician in the study was blinded. The study was conducted at Gaziantep Islam Science and Technology University's Physiotherapy and Rehabilitation Laboratory between December 2022 and August 2023. Ethics committee approval was obtained from Gaziantep Islam Science and Technology University's, Non-Interventional Clinical Research Ethics Committee on 03.11.2022 (Protocol No: 2022/161, decision no:161.20.05) and it was executed according to the Declaration of Helsinki Declaration. Older adults aged 65 and over without cooperation problems were included in the study. Participants with neurological problems, visual impairment and hearing losses, the Mini-Mental State Examination (MMSE) scores of 17 points or less, and musculoskeletal system problems that would affect walking were not included in the study [12]. Older adults were included in the study on a voluntary basis.

A total of 117 older adults volunteered for this study. According to the Edmonton Frail Scale (EFS), individuals with 9 points and above were grouped as frail older people, and participants with 8 points and below were grouped as non-frail older people [13]. 5 people with musculoskeletal system problems and 8 people with the MMSE score below 17 points were excluded in the study. The flow chart is presented in Figure 1. According to this grouping, the frail group consisted of 52 participants and the non-frail group consisted of 52 participants.

2.2. Data Collection Tools

The data of older adults over the age of 65 who agreed to participate in this study voluntarily were collected by the researchers through face-to-face interviews. Demographic information, education level information, assistive device use and chronic disease presence information were recorded. Frailty status, fall risk, balance status, and cognitive impairment of older people were evaluated.

MMSE was used to evaluate the cognitive states of individuals. There are 6 main headings: orientation, registration memory, attention and calculation, remembering and language, motor function, and perception. The total score that can be obtained is 30. In scoring, 24-30 points are compatible with normal, 18-23 points with mild dementia, 10-17 points with dementia, and 10 points and below with severe dementia.

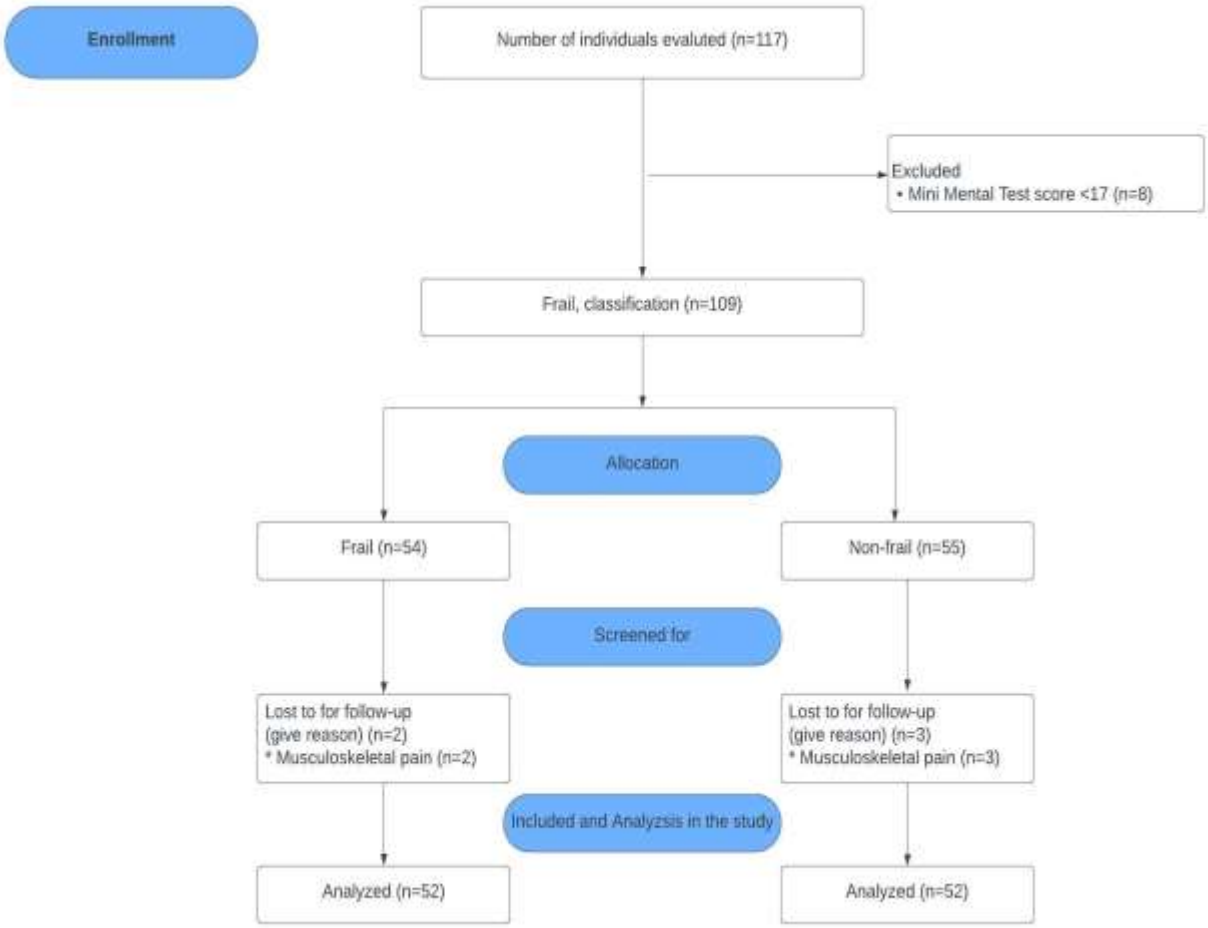

Figure 1. Flow chart.

Individuals who scored 17 or below on this test were not included in the study [12].

EFS was used to evaluate frailty. The scale consists of 11 items and 9 parameters for frailty. These are, social support, medication use, general health status, nutrition, functional independence, mood, cognitive status, continence, and functional performance Two domains of performance are used in the scale to evaluate cognitive status (clock test) and functional performance (Timed-up-and-go-test). A scoring system was used in the scale and was evaluated as 0-17 points: 0-4 points=Fragile; 5-8 points=Apparently Vulnerable; 7-8 points=Slightly Frail; 9-10 points=Medium Frail; the scores of 11 and higher were classified as Severely Frail [13].

FRQ was used to evaluate the risk of falling in older adults. This questionnaire, which evaluates the risk of falling in older people, consists of 13 items. Individuals who score 4 or more have a high risk of falling [14].

TBGT was used to evaluate older adults balance and gait parameters. This test evaluates balance and gait under two main headings. The balance section consists of 9 questions and the gait section consists of 7 questions. When calculating the test score, the total score of the first 9 questions gives the balance score, the total score of the next 7 questions gives the gait score, and the sum of the balance and gait scores gives the total score. If the total score of the test is 18 or lower, the risk of falling is high, if it is between 19 and 24 points, it indicates that the risk of

falling is moderate, and if it is 24 or higher, it indicates that the risk of falling is low. [15].

FSST was used to evaluate the dynamic balance statuses of older adults. For the test, 4 squares are created by placing two canes on a flat surface. All squares are numbered. It is said that both feet should be in contact with the ground. Thus, the individual steps forward, backward, right, and left. The test is repeated in cases where the individual cannot complete the sequence successfully, loses balance, and comes into contact with the cane. Test completion time is recorded [16].

2.3. Statistics

SPSS 25 package program was used for statistical analysis. Variables determined by numerical measurement were given as the arithmetic mean and standard deviation (X±SD). Compliance of the data with normal distribution was evaluated using the Shapiro-Wilk test. Independent samples t-test was used for mean comparison of data between groups. The statistical significance level was set at $p<0.05$. For power analysis, a 5% significance level, 80% power (1-b), and a medium effect size in the population (d = 0.645) were assumed [17]. G*Power analysis was used to estimate the minimum sample size required. The sample size was calculated as 52 participants in each group [18].

Table 1. Sociodemographic characteristics.

Parameters	**Frail Older (n=52)**	**Non-frail older (n=52)**	***p***
Age (years)	75.4±10.1	68.7±2.3	*0.000***
Height (cm)	163.5±8.4	165.3±8.4	*0.165*
Weight (kg)	70.8±12.2	77.1±11.2	*0.000***
BMI (kg/m^2)	26.3±3.9	28.8±4.6	*0.006**
	n (%)	**n (%)**	
Gender			
Female (n)	34	30	
Male (n)	18	22	
Educational Level			
Illiterate (n)	20 (%38)	10 (%19)	
Primary School (n)	23 (%44)	9 (%17)	
Middle School (n)	6 (%11)	27 (%51)	
High School (n)	2 (%3)	4 (%7)	
University (n)	1 (%1)	2 (%3)	
Walking Aid			
Present (n)	36 (%69)	18 (%34)	
Absent (n)	16 (%30)	34 (%65)	
Chronic Disease Present (n)	49 (%94)	33 (%63)	
Absent (n)	3 (%5)	19 (%36)	

***p<0.001, independent sample t test, *p<0.05 independent sample t test, BMI: body mass index*.

3. Results

The demographic characteristics of the groups are given in Table 1. In the comparison of the ages of the frail and non-frail groups, it was found that the ages of the frail older group were higher than the non-frail group (p<0.001). In the comparison of weight and BMI values of the two groups, it was found that the frail group had lower values (p<0.001, p=0.006, respectively). There was no important difference in the height comparison of the two groups (p = 0.165).

Fall and balance comparisons between the two groups are presented in Table 2. The MMSE mean score of the Frail group (20.6±3.7) was found to be lower than the mean of the Non-Frail group (23.7±3.8) (p<0.000). The Frail group's FRQ mean score was significantly higher than the Non-Frail group's FRQ mean score (p<0.001, see Table 2). The TBGT balance, walking, and total scores of the Frail group were important lower than the Non-Frail group (p<0.001, see Table 2). The FSST time was significantly lower in the Non-Frail group (p=0.009, see Table 2).

Table 2. Between-group comparisons of fall and balance assessments of the frail group and the non-frail group.

	Frail Older (n=52)	**Non-Frail Older (n=52)**	**t**	***p***
FRQ score	7±2.8	4.4±3.3	4.227	*0.000***
TBGT total score	12.1±7.8	18.9±8	4.145	*0.000***
TBGT balance score	6.9±4.4	10.8±4.6	4.250	*0.000***
TBGT gait score	5.1±3.7	8±3.9	3.659	*0.000***
FSST (seconds)	80.8±45.2	49.2±36.6	2.726	*0.009**

***p<0.001, independent sample t test,*p<0.05 independent sample t test, FRQ: Fall Risk Questionnaire, TBGT: Tinetti Balance and Gait Test, FSST: Four Square Step Testi.*

4. Discussion

This study presents comparative data on fall risk and balance assessments in frail and non-frail older adults. In the present study, which included participants with different average ages according to their frailty level, it was revealed that the risk of falling was higher in the frail group than in the non-frail group. It was concluded that the frail group presented lower performance than the non-frail group in terms of balance. It is thought that the differences in falls and balance between the groups are the result of the effect of the frailty factor.

It was stated that frailty in older people increases with age, and the risk of weight loss and chronic disease is higher in frail individuals. However, it was also reported that frailty is more common in individuals with lower educational levels [19]. In the current study, the average age and BMI index of the frail group were detected to be lower than the non-frail group. While the presence of chronic disease is 94% in the frail group, it is 63% in the non-frail group. While the rate of illiterate people is 38% in the frail group, it is 19% in the non-frail group. This situation coincides with previous studies in the literature. It was reported that frail older people were more likely to fall and had multiple falls than non-frail older people [20]. In another study, it was reported that there was a relationship between frailty and the risk of falling and that the risk of

falling was 6.05 times higher in frail older people than in non-frail older people [21]. In another study, it was stated that three different frailty conditions defined had different levels of fall risks, and it was reported that the risk of falling was higher in the frail group than in the non-frail and pre-frail groups [22]. It was reported that factors such as low physical activity, weak peripheral muscle strength, and gender might be effective in the increased risk of falling in frail older people [6, 22-25]. It was also stated that fragility increases with age and the risk of falling increases as a result of decreased proprioception [22]. In the current study, the FRQ and TBGT mean scores of the frail group were found to be high, and the risk of falling was higher than the non-frail group. We think that this is because the frailty of older adults increases the risk of falling.

The postural control mechanism is a perceptual process that ensures the maintenance of balance with this feedback regulated by the feedback of the visual, somatosensory, and vestibular systems [26]. With age, the postural control mechanism deteriorates, and the risk of falling increases [27]. The perception process of the postural control mechanism, which plays a substantial role in balance, decreases even more in frail older people [28]. In a study comparing the balance performances of frail, non-frail, and pre-frail older adults, it was concluded that frail older people had balance deficiencies related to postural responses and stability in walking [28]. In our study, the TBGT balance and walking mean scores were found to be lower in frail older people than in non-frail older people, and we thought that this was due to the postural control mechanism being affected in frail older adults. It was stated that the FSST is a test used to evaluate dynamic balance and to distinguish frail and non-frail older people. Contrast to non-frail older adults, pre-frail and frail older adults were found to show poorer performance [29]. In the present study, the FSST time was found to be higher in the frail group than in the non-frail group. This can be professed by the fact that frail older adults spend more time during mobility.

The main limitations of this study are the inability to use balance platforms and more sensitive measurement methods to assess fall risk and balance performance. Additionally, inclusion criteria and accompanying chronic diseases were determined according to individuals' statements. In both groups, balance performance and fall risk might have been more affected in individuals with chronic diseases due to the physiological responses of the diseases, and this situation was ignored.

4.1. Conclusion

Balance performance in old age is important in terms of fall risk. Especially during the frailty period, the balance performance of frail older adults' decreases compared to normal older people, which increases the risk of falling. We believe that evaluating older adults in terms of balance and fall risk in the pre-frail period and using appropriate treatment methods may have a positive impact on the mobility of patients during their frailty periods.

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