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RESEARCH

THE RELATIONSHIP BETWEEN FEAR OF FALLING AND BALANCE IN COMMUNITY-DWELLING OLDER PEOPLE

ABSTRACT

Introduction: The aim of this study was to determine the relationship between fear of falling and balance in community-dwelling older adults.

Materials and Method: Study sample included 100 volunteers. The assessment of fear of falling was performed by Falls Efficacy Scale-International; mobility by Timed-up and Go Test, balance by Berg Balance Scale, and disability by Modified Barthel Index.

Results: Falls Efficacy Scale-International and Timed-up and Go Test scores were significantly higher, and Berg Balance Scale scores were significantly lower in women and in subjects older than 70 years ($p<0.05$). Falls Efficacy Scale-International scores were correlated with Timed-up and Go Test scores positively, and with Berg Balance Scale scores negatively ($p<0.001$). There was a negative correlation between age and Berg Balance Scale score ($p<0.05$), and a positive correlation between age and Timed-up and Go Test and Falls Efficacy Scale-International ($p<0.001$) scores. Age, Modified Barthel Index, Timed-up and Go Test, and Berg Balance Scale scores were significantly higher in subjects with Falls Efficacy Scale-International score ≥ 24 than subjects with Falls Efficacy Scale-International score <24 ($p<0.05$). Multiple regression analysis revealed that the most significant correlations with Falls Efficacy Scale-International scores were Berg Balance Scale and Timed-up and Go Test scores ($p<0.001$). Age ($p=0.004$) and gender ($p=0.017$) were associated with Falls Efficacy Scale-International scores.

Conclusion: There is a possible relation between fear of falling and balance performance in older people and this interaction should be considered in geriatric rehabilitation especially in elderly women.

Key Words: Aged; Accidental Falls; Postural Balance; Fear.



ARAŞTIRMA

TOPLUM İÇİNDE YAŞAYAN YAŞLILARDA DÜŞME KORKUSU VE DENGE ARASINDAKİ İLİŞKİ

Öz

Giriş: Bu çalışmanın amacı, toplum içinde yaşayan yaşlılarda Uluslararası Düşme Etkinlik Skalasının Türkçe versiyonu ile değerlendirilen düşme korkusu ile denge arasındaki ilişkiyi araştırmaktır.

Gereç ve Yöntem: Çalışmaya 100 gönüllü dahil edildi. Katılımcılarda; Uluslararası Düşme Etkinlik Skalası ile düşme korkusu, Kalk ve Yürü Testi ile denge ve yürüme, Berg Denge Skalası ile denge, Modifiye Barthel İndeksi ile dizabilite düzeyi değerlendirildi.

Bulgular: Uluslararası Düşme Etkinlik Skalası skorları ve Kalk ve Yürü Testi, kadınlarda ve 70 yaş üzerindekielerde anlamlı olarak yüksek, BDS skorları anlamlı olarak düşüktü ($p<0.05$). Uluslararası Düşme Etkinlik Skalası skorları Kalk ve Yürü Testi ile pozitif, Berg Denge Skalası ile negatif yönde korele idi ($p<0.001$). Ayrıca yaş ile BDS arasında negatif korelasyon ($p<0.05$) ve yaş ile Kalk ve Yürü Testi ve Uluslararası Düşme Etkinlik Skalası arasında pozitif korelasyon saptandı ($p<0.001$). Yaş, Modified Barthel İndeksi, Kalk ve Yürü Testi ve Berg Denge Skalası skorları; Uluslararası Düşme Etkinlik Skalası skoru ≥ 24 olan katılımcılarda skoru <24 olan katılımcılara göre anlamlı olarak yüksekti ($p<0.05$). Yapılan regresyon analizinde, Uluslararası Düşme Etkinlik Skalası skorları ile en anlamlı ilişki Berg Denge Skalası skorları ve Kalk ve Yürü Testi arasındaydı ($p<0.001$). Uluslararası Düşme Etkinlik Skalası skorları ile yaş ($p=0.004$) ve cinsiyet ($p=0.017$) de ilişkiliydi.

Sonuç: Toplumda yaşayan yaşlılarda düşme korkusu ile denge arasında olası bir ilişki vardır ve bu etkileşim geriatrik rehabilitasyonda özellikle de yaşlı kadınlarda göz önünde bulundurulmalıdır.

Anahtar Sözcükler: Yaşlı; Düşme; Denge; Endişe.

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INTRODUCTION

Fear of falling is perceived as a common problem in older people and changes in balance control and falls have been associated with fear of falling with restricted activity, decreased independence, and quality of life (1). Balance is a complex function of numerous neuromuscular processes which include sensory, motor, and integrated components (2) and poor balance is one of the risk factors of fear of falling (3).

The assessment of fear of falling is complex and involves physical, behavioral, and functional components (4). In large-scale surveys or prevalence studies, fear of falling has been evaluated by single items (e.g., 'In general, are you afraid of falling over?') as a dichotomous outcome (be afraid or not) (5). With such measures, the determination of fear of falling intensity, the discrimination between different levels of fear, and the assessment of concern about different activities are not possible. The Falls Efficacy Scale International (FES-I) assesses concerns relating to basic and more demanding activities, both physical and social. It has been shown that the FES-I has excellent reliability and validity across different cultures and languages, and has become a widely accepted tool for assessing concern about falling and it has been adapted for use in Turkey, recently (6).

In previous studies comparing older adults with or without a fear of falling and/or low balance confidence, associations between fear and balance performance have been found. The aim of this study was to determine the relationship between fear of falling, assessed by a Turkish version of the FES-I, and balance in community-dwelling older adults.

MATERIALS AND METHOD

The study was conducted at the Department of Physical Medicine and Rehabilitation of Medical Faculty of "Ondokuz Mayıs University" and the local ethics committee approved the study protocol. The study sample included 100 volunteers over 65 years, who were informed about the aim of the study and written informed consents were obtained. Individuals were excluded if they had amputation of lower extremities, if they were primarily bed-bound or wheelchair dependent. Participants diagnosed with dementia or Alzheimer's disease by a neurologist and/or a psychiatrist, were also excluded.

Descriptive outcome parameters were age, sex, weight, height, working status, educational level, medical co-morbidities, and current medications. Use of walking aids and

history of falls were also noted. All subjects were asked if they were afraid of falling. In addition, each individual rated her/his self-perception of overall well-being on a Likert-type scale as excellent, very good, good, fair, or poor.

The ambulatory status of the subjects was classified using the Functional Ambulation category (FAC). The FAC is a common clinical gait assessment scale described by Holden et al. (7). The FAC distinguishes six levels of walking ability on the basis of the amount of physical support required (0=non ambulatory, 5=independent functional ambulation).

The Turkish version of Modified Barthel Index (MBI) was used to evaluate the level of disability with respect to activities of daily living (8). The MBI consists of 10 activities, scored with respect to physical assistance required. Scores from each item are summed to produce a total MBI score. MBI activities include transfers, ambulation, ascending and descending stair, feeding, dressing, personal self-care, taking a bath, use of the toilet, and urinary and/or fecal incontinence.

The Timed Up and Go Test (TUG) was used to evaluate mobility. The TUG is a balance and gait index which requires the patient to stand up from a chair, walk a 3 meter distance, turn, walk back to the chair, and sit down. The time required to complete the task is measured in seconds. It is suggested that elders with longer TUG times are more likely to fall than those with shorter times (9).

The Berg Balance Scale (BBS) was originally developed for the assessment of postural control, and is widely used in many fields of rehabilitation (10). BBS is performed by using a five-point ordinal scale to score subjects performing 14 functional activities. The maximum score on the BBS is 56; a score below 40 indicates a fall risk of nearly 100%. The reliability and validity of the Turkish form of BBS was performed by Sahin et al. (10).

The FES-I is a self-report questionnaire, providing information on the level of concern about falls during activities of daily living. The questionnaire contains 16 items scored on a four-point scale (1 = not at all concerned to 4 = very concerned) providing a total score ranging from 16 (absence of concern) to 64 (extreme concern). Two subgroups of participants were classified as having a Turkish FES-I score less than 24 (group 1), and as having a FES-I score 24 or greater (group 2) (6).

Statistical Analyses

Statistical analyses were performed with SPSS 16.0 for Windows. Descriptive data were presented as mean \pm standard deviation (SD) or minimum–maximum (median). The



Shapiro–Wilk test was used to analyze normal distribution assumption of the quantitative outcomes. For comparison Mann–Whitney U test was used, because the data were not normally disturbed. The correlations were investigated by using Spearman correlation analysis. Multivariate linear regression analysis was performed to analyze the relationships between the FES-I scores and the demographic and clinical variables. Univariate analysis of variance was used to assess the effects of the age and gender on FES-I scores, BBS scores, and TUG. In order to have statistical power of 0.99, and $p < 0.05$, it was calculated that 50 subjects were required to detect the differences in balance scores between the participants. P values less than 0.05 were considered statistically significant.

RESULTS

The mean age of participants was 69.36 years (SD 4.44) with an age range of 65-81, and 74 (%74) were women. The mean ages of women and men were 69.73 years (SD 4.53) and 68.31 years (SD 4.08), respectively. Demographic and clinical characteristics of the study sample are shown in Table 1.

FES-I scores and TUG were significantly higher, and BBS scores were significantly lower in women and in subjects older than 70 years ($p < 0.05$) (Table 2). In addition, significant effects of age on BBS scores ($p < 0.001$) and TUG ($p = 0.002$), and gender on BBS scores ($p < 0.001$) and TUG ($p = 0.001$) were found by univariate analyses of variance.

FES-I scores were correlated with TUG positively ($r = 0.799$, $p < 0.001$), and with BBS negatively ($r = -0.829$, $p < 0.001$). There was also a negative correlation between age and BBS scores ($p < 0.05$), and a positive correlation between age and TUG and FES-I ($p < 0.001$) (Table 3). Forty four percent of the subjects ($n = 44$) had FES-I score < 24 and 56% of the subjects ($n = 56$) had FES-I score ≥ 24 . Age, MBI, TUG, and BBS scores were significantly higher in group 2 than group 1 ($p < 0.05$) (Table 4).

The relationship between the FES-I scores and the demographic and clinical parameters according to the multivariate linear regression analysis are shown in table 5. The most significant correlations with FES-I scores were found to be the BBS scores and TUG ($p < 0.001$). Age and gender were also associated with FES-I scores ($p = 0.004$ and $p = 0.017$, respectively).

Table 1— Demographic and Clinical Characteristics of the Subjects

Characteristics	n= 100	
	Mean±SD	Median (min-max)
Age (years)	69.36±4.44	68 (65-81)
BMI (kg/m ²)	29.38±4.52	29 (17-40)
BBS score	49.43±6.83	52 (30-63)
MBI score	98.7±3.14	100 (85-100)
FES-I score	28.82±9.26	26 (16-52)
TUG (s)	14.41±5.67	13 (7-45)
	n	%
Occupation		
Housewife	67	(67)
Retired	25	(25)
Other	8	(8)
Education		
Literate	42	(42)
Primary education	45	(45)
Secondary education	3	(3)
College	10	(10)
Use of walking aids		
without aids	77	(77)
cane	23	(23)
Falls history		
yes	70	(70)
no	30	(30)
Fear of falling		
yes	36	(36)
no	64	(64)
Self-perception of health		
good	38	(38)
fair	62	(62)
FAC		
independent	80	(80)
dependent outdoors	20	(20)

Mean ± SD: mean ± standard deviation, Median (min-max): Median (minimum-maximum), BMI: body mass index, BBS: Berg balance scale, MBI: Modified Barthel index, FES-I: Fall efficacy scale international, TUG: Timed up and go test, FAC: functional ambulation categories.

DISCUSSION

Falls are a major public health problem of the aging population and fear of falling is defined as a lasting concern about falling that can lead an individual to avoid activities (11). Fear of falling occurs with or without a previous history of fall and it has been associated with increased risk of falling (3). Age-related changes in postural stability and balance con-



Table 2— Comparative Results of FES-I, BBS, and TUG Based on Age and Sex

	FES-I		BBS		TUG	
	Mean±SD Median (min-max)	p	Mean±SD Median (min-max)	p	Mean±SD Median (min-max)	p
Age (years)		0.001		0.004		0.002
<70 (n=58)	25.69±7.43 23 (16-50)		50.93±6.41 54 (30-56)		12.84±3.87 12 (8-29)	
≥70 (n=42)	33.14±9.85 32 (16-52)		47.36±6.92 48 (35-56)		16.57±6.97 15 (7-45)	
Gender		0.001		0.001		0.002
female (n=74)	30.77±9.01 29 (19-52)		48.39±6.80 48 (30-56)		15.3±6.05 14 (7-45)	
male (n=26)	23.27±7.71 21 (16-45)		52.38±6.10 55 (36-56)		11.88±3.37 10 (8-21)	

Mean ± SD: mean ± standard deviation, Median (min-max): Median (minimum-maximum), FES-I: Fall efficacy scale international, BBS: Berg balance scale, TUG: Timed up and go test
p value is significant when <0.05

Control have been previously documented, and impaired balance and mobility have been identified as the main risk factors associated with falls (12). The objective of this study was to determine a possible association between fear of falling and balance in older people within the community.

Aging involves gradual, progressive, and spontaneous deterioration of most physiological functions. Fear of falling has been reported to occur in older adults and increasing age was correlated with fear of falling in most studies that compared age groups with degree of fear of falling (13). Similar to the literature, in the current study a positive correlation was found between age and FES-I scores, and the subjects older than 70 years had higher FES-I scores. It was found that the cut-point to differentiate between subjects with and without fear of falling was 24 points in the Turkish FES-I (6). In the current trial, subjects with fear of falling were also older com-

Table 3— Correlations Between Age and BBS, TUG, and FES-I

	Age	
	r	p
BBS	-0.313	0.002
TUG	0.345	0.001
FES-I	0.416	0.001

BBS: Berg balance scale, TUG: Timed up and go test, FES-I: Fall efficacy scale international
r: spearman correlation coefficient

pared with those without fear of falling. Fear of falling is also associated with sex and previously it was shown that the prevalence of fear of falling was consistently higher among women than men (3,13,14). Likewise, females had higher FES-I scores in this trial. Additionally, gender and age were found to be influential variables on fear of falling. It can be suggested that being female and getting older are highly associated with fear of falling.

Since diminished ability to maintain balance may lead to an increased risk of falling in older people, evaluating balance

Table 4— Comparison of Participant's Clinical Characteristics According to Value of FES-I Cut Off

Characteristics	Group 1 (FES-I < 24, n= 44)	Group 2 (FES-I ≥24, n= 56)	p
	Mean±SD Median (min-max)	Mean±SD Median (min-max)	
Age (years)	67.86±3.28 67 (65-78)	70.54±4.89 70 (65-81)	0.006
BBS score	54.07±3.83 55 (38-63)	45.79±6.46 47 (30-56)	0.001
TUG (s)	12.07±5.67 11 (7-45)	16.25±4.90 15 (9-30)	0.001

Mean ± SD: mean ± standard deviation, Median (min-max): Median (minimum-maximum), FES-I: Fall efficacy scale international, BBS: Berg balance scale, TUG: Timed up and go test
p value is significant when <0.05



Table 5— Multiple Regression Analysis with FES-I As Dependent Variable and Demographic and Clinical Parameters as Independent Variables

	FES-I		
	β	t	p
Age	0.143	2.945	0.004
Gender	-0.120	-2.425	0.017
BMI	-0.060	-1.241	0.017
Use of walking aids	0.012	0.203	0.840
Falls history	0.001	0.009	0.993
Fear of falling	0.092	1.664	0.100
Self-perception of health	0.008	0.175	0.862
FAC	-0.177	-2.896	0.005
BBS	-0.386	4.331	<0.001
TUG	0.262	3.703	<0.001
MBI	-0.012	-0.331	0.741

BMI: body mass index, FAC: functional ambulation categories, BBS: Berg balance scale, TUG: Timed up and go test, MBI: Modified Barthel index, FES-I: Fall efficacy scale international
p value is significant when <0.05

problems in the elderly becomes important (15). The BBS was developed as a clinical measure of functional balance specifically in older people and the psychometric properties of reliability and validity for this scale have been well demonstrated (16). TUG is a test of balance that is commonly used to examine functional mobility in community-dwelling older adults. It was suggested that the TUG is a sensitive and specific measure for identifying community-dwelling adults who are at risk for falls (12). Age-related deterioration in balance or postural control exerts a significant negative impact on the ability to perform everyday activities safely (17-19). In the current study, subjects older than 70 years had poor BBS scores and TUG data, and age was correlated negatively with BBS and positively with TUG, as expected. In the literature, there are conflicting results on the sex difference in postural balance. Some authors suggested that women had worse balance than men, while others reported contradictory results showing no sex differences in balance performance in the elderly (20). Similar to some published work, current study showed that BBS scores and TUG data were worse in women than men. Furthermore, age and gender were found to be predictor variables of balance tests. It seems that BBS and TUG may be useful instruments to detect the impact of ageing and gender on balance.

The mutual correlation between fear of falling and balance was shown previously. Although balance control changes in older adults are attributed to underlying psychological factors such as fear of falling, it has been suggested that older people who are afraid of falling may have this fear as a result of difficulties in maintaining their balance (1,21-23). Uemura et al. reported that specific deficits in balance control occur in subjects with fear of falling during gait and they develop some gait adaptations secondary to fear of falling to reduce risk of falling (24). In the current trial, a strong association was found between FES-I scores, and BBS and TUG suggesting fear of falling and poor balance may have negative impact on each other.

The present study has some limitations requiring further discussion. The participants in this study, despite their comorbidities, were healthy, independently living, and physically active. Additionally, the study was conducted in a small sample of community. Therefore, the results cannot be generalized to the general older population. On the other hand, this sample homogeneity increases the strength of the study. Sai et al. showed that there is a high risk of falls in an elderly ambulatory and free living group so assessment of fear of falling is important in community-dwelling older people (25). This is the reason why subjects who were ambulatory and independent or partially dependent in activities of daily living were enrolled in this study. Secondly, strong links between fear of falling, balance confidence, anxiety, and balance performance in the elderly were reported previously (1). In the current study, psychological status of the participants was not evaluated so future studies assessing psychological status together with fear of falling and balance should be planned. Finally, there were more female participants than males in this study. In spite of this gender difference, gender was found to be an influential variable on fear of falling and balance tests by univariate analyses of variance. To clarify the impact of gender on fear of falling, future studies should include more male and female patients.

This trial is the first study in our country investigating the relationship between fear of falling and balance in community-dwelling older adults. The results of this study showed that elderly subjects who expressed a fear of falling were found to exhibit significantly poorer performance in balance tests. Additionally, elderly women had more fear of falling and poorer balance performance compared with elderly men. Since low levels of falls efficacy and poor balance can further increase fall risk, these parameters should be routinely assessed in geriatric rehabilitation and particular attention



should be given to elderly women. In conclusion, there is a possible relation between fear of falling and balance performance in older people and this interaction should be considered in planning tailor specific intervention and prevention strategies for falling among community-dwelling elderly.

Conflict of Interest

The author has no financial disclosures to declare and no conflicts of interest to report.

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