



# Reliability and validity of the Turkish version of the Falls Efficacy Scale International (FES-I) in community-dwelling older persons

Yasemin Ulus<sup>a,\*</sup>, Dilek Durmus<sup>a</sup>, Yesim Akyol<sup>a</sup>, Yuksel Terzi<sup>b</sup>, Ayhan Bilgici<sup>a</sup>, Omer Kuru<sup>a</sup>

<sup>a</sup> Department of Physical Medicine and Rehabilitation, Medical Faculty, Ondokuz Mayıs University, Samsun, Turkey

<sup>b</sup> Department of Statistics, Faculty of Science and Arts, Ondokuz Mayıs University, Samsun, Turkey

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## ABSTRACT

The FES-I is a questionnaire which was developed to assess fear of falling. The aim of this study was to evaluate validity and reliability of a Turkish language version of the FES-I in Turkish older people. The study sample included 70 volunteers with an age range of 65–81. To assess the test–retest reliability of the Turkish FES-I, questionnaire was applied again 10–15 days after the first interview (interclass correlation: ICC). FES-I was compared with The Modified Barthel Index (MBI), the timed up and go test (TUG), and The Berg Balance Scale (BBS) for construct validity. Cronbach's alpha ( $\alpha$ ) was used to evaluate the internal consistency. The internal structure of the FES-I was examined by factor analysis. ROC plots were used to define cut-point for the FES-I scales. Cronbach's  $\alpha$  of the Turkish FES-I was 0.94 and the individual item ICC ranged from 0.97 to 0.99. The Turkish FES-I total scores were correlated with TUG positively, and MBI, and BBS negatively. The cut-off score to differentiate between persons with fear of falling and persons without fear of falling was 24 points. It was found that the Turkish version of the FES-I was a reliable and valid measure of fear of falling in Turkish older people.

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## 1. Introduction

Falls are major public health problems of the aging population and fear of falling is perceived as a common problem in older people (Howland et al., 1993). When fear of falling is not excessive, it may not be a problem and does not interfere with daily life. However, fear of falling which results in avoidance of activities, can lead to social isolation and reduced quality of life, and may be risk factor for future (recurrent) falls (Yardley et al., 2005; Kempen et al., 2007).

Different approaches have been developed to assess fear of falling (Tinetti et al., 1990). 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) (Kempen et al., 2007). 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 first scale, named the 'Falls Efficacy Scale' (FES) was developed to assess the degree of perceived confidence in performing activities without falling in various situations by Tinetti et al. (1990). It has been shown that the original version and

its later modifications are reliable methods for measuring fear of falling and predict future falls and decline in functional capacity (Yardley et al., 2005).

According to several commentators original FES could be improved as a measure of fear of falling because the concepts of fear of falling and 'self-efficacy' or confidence in performing activities without falling may not be considered as the same constructs (Kempen et al., 2007). In addition, the items on the FES do not include the more demanding or complex activities which may be relevant for higher functioning older people and do not evaluate the impact of fear of falling on social life (Kempen et al., 2007) and finally, FES was developed in the USA and items were formulated according to US people so it is not widely applicable across different cultural contexts (Hill et al., 1996; Lachman et al., 1998; Sperber, 2004). For these reasons, modified version of the FES which is named the FES-I was developed by the Prevention of Falls Network Europe (PROFaNE) (Hill et al., 1996; Yardley et al., 2005). In FES-I four response options are used instead of 0–100% level of confidence. There was 0–100% level of confidence response in initial FES but it was noticed that it could be difficult to decide between a 30% or 40% level of confidence for older people so original authors have changed the response format (Yardley et al., 2005).

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 (Lachman

\* Corresponding author. Tel.: +90 362 312 19 19x3828; fax: +90 362 4576041.  
E-mail address: [yaseminulus@gmail.com](mailto:yaseminulus@gmail.com) (Y. Ulus).

et al., 1998; Yardley et al., 2005; Kempen et al., 2007, 2008; Ruggiero et al., 2009; Camargos et al., 2010; Billis et al., 2011). FES-I has not yet been adapted for use in Turkey, therefore the aim of this study was to develop a Turkish version of the FES-I and assess its reliability and validity in Turkish community-dwelling older adults.

## 2. Subjects and methods

The study was conducted at the Department of Physical Medicine and Rehabilitation of Medical Faculty of “Ondokuz Mayıs University” and local ethics committee approved the study protocol. The study sample included 70 volunteers over 65 years old, who were informed about the aim of the study and gave written informed consent. Individuals were excluded if they had amputation of lower extremities, were primarily bed-bound or wheelchair dependent, had dementia or Alzheimer disease, or were not fluent Turkish speakers.

All participants were questioned about age, sex, weight, height, working status, educational level, medical co morbidities and current medications. Use of walking aids and falls history were also noted. All subjects were asked if they were afraid of falling. In addition, each individual rated their self-perception of overall well-being on 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. (1984). The FAC distinguishes 6 levels of walking ability on the basis of the amount of physical support required (0 = non ambulatory, 5 = independent functional ambulation).

The FES-I is a self-report questionnaire, providing information on 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).

To assess the validity of the FES-I, it was compared with The MBI, the TUG, and The BBS.

### 2.1. The MBI

The Turkish version of MBI was used to evaluate level of disability with respect to activities of daily living (Kucukdeveci et al., 2000). 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.

### 2.2. The TUG

The 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 m distance, turn, walk back to the chair, and sit down. The time required to complete the task is measured in seconds (Wall et al., 2000). It is suggested that elders with longer TUG times are more likely to fall than those with shorter times (Greene et al., 2010).

### 2.3. The BBS

The BBS was originally developed for the assessment of postural control, and is widely used in many fields of rehabilitation (Sahin et al., 2008). 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% (Shumway-Cook et al., 1997). The reliability and validity of the Turkish form of BBS was performed by Sahin et al. (2008).

All subjects were reevaluated 2 weeks later. In the second examination fear of falling, self-perception of well-being, FAC, MBI, and FES-I were asked and TUG and BBS were repeated once again for test–retest evaluation.

### 2.4. Translation procedure

The FES-I was translated into Turkish by three Turkish medical doctors who were proficient in English. Discrepancies in initial translations were addressed with the assistance of a fourth independent translator. The Turkish version of the FES-I was then translated back into English by 2 English-speaking language specialists who were blinded to the original scale and the objective of the study. The differences between translated versions were evaluated, and a satisfactory compliance with the original scale was achieved by consensus of the translators. Firstly ten older people filled the questionnaire and then they were asked whether they could understand all items of the Turkish FES-I. None of the patients in this initial group reported a problem with any item of the FES-I.

### 2.5. Statistical analyses

All the data were analyzed using the Statistical Package for the Social Sciences (SPSS) package, Version 16.0 (SPSS Inc., Chicago, IL, USA).

Descriptive statistics were used to characterize the sample.

Internal reliability of the FES-I was evaluated by calculating the Chronbach's  $\alpha$  coefficient for the whole scale.

Test–retest reliability was assessed by the intraclass correlation coefficient (ICC) between scores obtained in the main survey and follow-up.

The internal structure of the FES-I was examined by factor analysis, first using principal component analysis with Varimax rotation, then using oblique rotation to assess inter-correlation between factors, and finally specifying a single factor solution, to determine the unity of the scale.

Convergent validity was assessed by examining correlation between the FES-I and other parameters. Correlation was assessed by Pearson's correlation analysis.

Receiver operating characteristic (ROC) curves were used to calculate sensitivity and specificity in order to assess whether the total score of the Turkish FES-I would be able to accurately discriminate between persons with fear of falling and those without fear of falling.

## 3. Results

The mean age of participants was  $69.7 \pm 4.59$  years with an age range of 65–81, and 57 (81.4%) were women. The mean ages of women and men were 70.07 years (SD 4.68) and 68.62 years (SD 4.01), respectively. There was no significant difference in age between women and men ( $p > 0.05$ ). Table 1 provides the demographic and general assessment data of the patients.

The Turkish FES-I scores were significantly higher in subjects older than 70 years old, ( $p < 0.001$ ), in women ( $p < 0.05$ ), in subjects with fear of falling ( $p < 0.05$ ), in subjects using cane ( $p < 0.001$ ), in subjects whose self perception of health were fair ( $p < 0.05$ ), and in subjects who need assistance when outdoors ( $p < 0.001$ ). There was no statistically significant difference in Turkish FES-I scores between the subjects who had a history of falling and who had not ( $p > 0.05$ ) (Table 2).

**Table 1**  
Demographic and general assessment data of the patients.

Characteristic	Mean $\pm$ SD
Age (years, $n = 70$ )	69.7 $\pm$ 4.59
<70 ( $n = 37$ )	66.19 $\pm$ 1.48
$\geq 70$ ( $n = 33$ )	73.85 $\pm$ 3.27
BMI (kg/m <sup>2</sup> )	29.95 $\pm$ 4.48
	<i>n</i> (%)
Gender	
Female	57 (81.4)
Male	13 (18.6)
Occupation	
Housewife	54 (77.1)
Retired	9 (12.9)
Other	7 (10.0)
Education	
Literate	35 (50)
Primary education	28 (40)
Secondary education	3 (4.3)
College	4 (5.7)
Use of walking aids	
Without aids	52 (74.3)
Cane	18 (25.7)
Falls history	
Yes	23 (32.9)
No	47 (67.1)
Fear of falling	
Yes	50 (71.4)
No	20 (28.6)
Self-perception of health	
Good	26 (37.1)
Fair	44 (62.9)
FAC	
Independent	52 (74.2)
Dependent outdoors	18 (25.8)

Mean  $\pm$  SD: mean  $\pm$  standard deviation; BMI: body mass index.**Table 2**  
Comparison of the FES-I scores of the patients.

	FES-I scores	<i>p</i>
	Mean $\pm$ SD	
Age (years)		
<70	25.95 $\pm$ 7.81	0.008
$\geq 70$	34.88 $\pm$ 9.09	
Gender		
Female	31.58 $\pm$ 9.25	0.001
Male	23.92 $\pm$ 8.25	
Fear of falling		
Yes	31.80 $\pm$ 9.37	0.021
No	26.05 $\pm$ 8.74	
Falls history		
Yes	32.65 $\pm$ 9.81	0.125
No	28.94 $\pm$ 9.20	
Use of walking aids		
Without aids	26.48 $\pm$ 6.53	0.001
Cane	40.78 $\pm$ 8.83	
Self-perception of health		
Good	26.85 $\pm$ 7.67	0.024
Fair	32.11 $\pm$ 10.01	
FAC		
Independent	26.71 $\pm$ 6.62	0.001
Dependent outdoors	40.11 $\pm$ 9.69	

*p* value is significant when  $<0.05$ .

### 3.1. Reliability

Internal consistency (Chronbach's  $\alpha$ ) of FES-I total score was calculated as 0.94. For test–retest reliability, the individual item ICC ranged from 0.97 to 0.99 (Table 3). Test–retest correlation coefficients of MBI, BBS, and TUG were also found as 0.99 ( $p < 0.001$ ), 0.98 ( $p < 0.001$ ), and 0.97 ( $p < 0.001$ ), respectively.

**Table 3**  
Internal consistency and test–retest reliability of the Turkish FES-I.

FES-I questions	ICC	Cronbach alpha
1st question	0.99	0.99
2nd question	0.99	0.99
3rd question	0.98	0.99
4th question	0.97	0.98
5th question	0.98	0.98
6th question	0.99	0.99
7th question	0.98	0.99
8th question	0.99	0.99
9th question	0.98	0.98
10th question	0.99	0.99
11th question	0.98	0.97
12th question	0.99	0.99
13th question	0.98	0.98
14th question	0.98	0.99
15th question	0.97	0.98
16th question	0.97	0.98
Total		0.94

**Table 4**  
Correlations between the FES-I scores and clinical assessments.

	FES-I scores	
	<i>r</i>	<i>p</i>
BBS	−0.835	0.001
MBI	−0.622	0.001
TUG	0.743	0.001

*r*: Pearson correlation coefficient.*p* value is significant when  $<0.05$ .

### 3.2. Convergent validity

FES-I scores were negatively correlated with MBI total scores ( $r = -0.622$ ,  $p < 0.001$ ) and BBS scores ( $r = -0.835$ ,  $p < 0.001$ ). There was also a strong positive correlation between FES-I total scores and TUG ( $r = 0.743$ ,  $p < 0.0001$ ) (Table 4).

### 3.3. Construct validity

Factor analysis of the 16 items in the FES-I revealed 2 factors above eigenvalue 1 were more prominent (Table 5). Total matrix variance was 62.5% for both factors (factor 1, 54.84%; factor 2, 7.66%). Tasks related to activities including taking bath, walking on a slippery or an uneven surface, were listed under factor 2; whereas tasks related to basic daily activities and socialization were listed under factor 1.

### 3.4. Identification of cut-point

ROC plots were used to define cut-point for the FES-I scales. The area under the curve for the 16-item FES-I was 0.70 for having fear of falling. The logistic regression model found the total score of the FES-I to be the most relevant variable to predict having fear of falling. The cut-off score to differentiate between persons with fear of falling and persons without fear of falling was 24 points, yielding sensitivity values of 70% (capacity to identify having fear of falling among older adults who really have fear of falling) and specificity values of 65% (capacity to identify persons without fear of falling among older adults who really do not have fear of falling).

## 4. Discussion

The FES-I was developed to assess both easy and more complex physical and social activities in a range of languages and different cultural contexts and it was concluded that FES-I can be used in

**Table 5**

Results of factor analysis of each Turkish FES-I item.

Items	Indicators	Factorial load		Communality
		Factor 1	Factor 2	
Item 1	Cleaning the house	0.71	0.25	0.56
Item 2	Getting dressed or undressed	0.66	0.08	0.43
Item 3	Preparing simple meals	0.76	0.06	0.59
Item 4	Taking a bath	0.51	0.62	0.64
Item 5	Going to the shop	0.86	0.26	0.81
Item 6	Getting in or out of a chair	0.55	0.18	0.55
Item 7	Going up or down stairs	0.69	0.40	0.65
Item 8	Walking around the neighborhood		0.75	0.64
Item 9	Reaching for something above your head or on the ground	0.65	0.33	0.28
Item 10	Going to answer the telephone before it stops ringing	0.73	0.30	0.63
Item 11	Walking on a slippery surface (e.g. wet)	0.01	0.93	0.86
Item 12	Visiting a friend or relative	0.61	0.21	0.53
Item 13	Walking in a place with crowds	0.81	0.17	0.68
Item 14	Walking on an uneven surface	0.42	0.74	0.73
Item 15	Walking up or down a slope	0.78	0.25	0.66
Item 16	Going out to a social event	0.89	0.20	0.84
Eigenvalues		8.77	1.23	10.0
Explained variance		54.8%	7.7%	62.5%
Cronbach's alpha		0.94	0.75	

rehabilitation research and clinical trials by authors (Yardley et al., 2005; Kempen et al., 2007; Delbaere et al., 2010). The goal of this study was to evaluate validity and reliability of a Turkish language version of this scale.

Chronbach's  $\alpha$  coefficient provides us with internal consistency of the scale tested where values over 0.80 are accepted as a higher index of consistency (Streiner and Norman, 1989). In this study, the analysis of internal validity of the Turkish FES-I revealed that the scale items presented adequate internal consistency ( $\alpha = 0.94$ ). This is comparable to results of other studies that used the FES-I, such as the original FES-I ( $\alpha = 0.96$ ), the FES-I adapted to Holland ( $\alpha = 0.96$ ), Germany ( $\alpha = 0.90$ ), UK ( $\alpha = 0.97$ ), Italy ( $\alpha = 0.98$ ), Brazil ( $\alpha = 0.93$ ), and Greek ( $\alpha = 0.92$ ) (Yardley et al., 2005; Kempen et al., 2007; Ruggiero et al., 2009; Camargos et al., 2010; Billis et al., 2011).

Test–retest reliability is used to assess the consistency of a measure from one time to another. This value was estimated using ICCs (Shout and Fleiss, 1977). In the current study ICC was determined as 0.94. It was similar to those of the other scales that evaluate falls-related self-efficacy, such as the original FES-I (ICC = 0.96), the FES-I adapted to Holland (ICC = 0.82), Germany (ICC = 0.79), Italy (ICC = 0.98), Brazil (ICC = 0.84) and Greek (ICC = 0.95) (Yardley et al., 2005; Kempen et al., 2007; Ruggiero et al., 2009; Camargos et al., 2010; Billis et al., 2011).

Convergent validity was assessed by looking at the magnitude and direction of the correlation of Turkish FES-I scores to other performance or scores on other measures. Low TUG indicates that effective mobility and it is anticipated that a positive correlation between the FES-I scores and TUG. In this study low FES-I scores were associated with lower TUG, as expected. Similarly, Billis et al. found a positive correlation between the Greek FES-I and TUG ( $r = 0.638, p < 0.01$ ) (Billis et al., 2011). In the current study, there was also a negative correlation between the FES-I scores and MBI, and BBS. This result indicated that lower FES-I scores were associated with more independent functional ambulation and better balance.

Factor analysis is a collection of methods used to examine how underlying constructs influence the responses on a number of measured variables (DeCoster, 1998). There were different results of factor analysis in the original scale and FES-I Brazil. In FES-I Brazil, factor 2 included items 7, 11, 14, 15 (Camargos et al., 2010). In original scale items 8, 9, 11, 13, 14, and 15 were included under factor 2 (Yardley et al., 2005). In the present study items 4, 11, and 14 which were related to fear of slipping during activities, were

included under factor 2. This difference can be explained by the variation between the cultures.

Fear of falling is associated with age and sex (Chu et al., 2011). Previously, it was shown that females and older people had higher scores as compared to younger people and males by researchers (Arfken et al., 1994; Howland et al., 1998; Delbaere et al., 2010). In a study by Kempen et al. (2007), the results from Germany, the Netherlands, and the UK were consistent with these findings except the difference in sex in Germany and in the UK. In the current study subjects older than 70 years old and females had higher FES-I scores.

It was reported that being a multiple faller significantly increases the risk of activity restriction due to fear of falling (Fletcher and Hirdes, 2004). Kempen et al. (2007) and Delbaere et al. (2010) found that FES-I scores were higher in participants with a fall history. It was also found that total score of the FES-I Brazil was the most relevant variable to predict history of falls (Camargos et al., 2010). In contrast, the FES-I scores were not associated with history of falling in the current study.

The FES-I assesses 'concern' about falling in physical and social activities so it can be expected that a positive correlation between the FES-I scores and fear of falling. Kempen et al. (2007) reported that FES-I scores were clearly related to the fear of falling single item measure, with quite similar results in The Netherlands and the UK. Similarly in the present study, the subjects who reported fear of falling had higher FES-I scores.

Functional dependence in activities of daily living, walking aid use, and perception of poor health were investigated as a risk factor for fear of falling in different studies (Murphy et al., 2002; Suzuki et al., 2002; Austin et al., 2007; Zijlstra et al., 2007). Similar to these in the present study, subjects whose self perception of health was fair, who need assistance when outdoors, and using cane had higher FES-I scores.

It was suggested that there is no gold standard for the establishment of the validity of the cut-points so the calculated cut-points should be regarded as preliminary (Delbaere et al., 2010). Camargos et al. (2010) found that the cut-off score to differentiate between the fallers and non-fallers was 23 points for FES-I Brazil. Delbaere et al. (2010) defined cut-points to differentiate between low and high concern (16–22 and 23–64) and between low, moderate, and high concern (16–19, 20–27, and 28–64). As compared to other studies, in this study the correlation was not detected between the FES-I scores and falls history so cut-point was calculated by fear of falling. Cut-point to differentiate



between with and without fear of falling was 24 points. According to this result, people whose FES-I scores are 24 points and more, should be informed about precautions to reduce risk factors for falls; and restriction of physical and social activities due to fear of falling should be avoided.

It was shown that there was 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 (Sai et al., 2010). For this reason, ambulatory and independent or partially dependent in activities of daily living subjects were enrolled in this study.

In conclusion, the findings of this study confirm that Turkish FES-I has good reliability and validity as a measure of fear of falling in community-dwelling older people in Turkey and can be an important instrument for the assessment of fear of falling both in research and clinical practice.

### Conflict of interest

None.

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