

Validation of The Modified Falls Efficacy Scale –International (FES-I) in Egyptian Geriatric Population

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ABSTRACT

Background: Falls are a common and complex geriatric syndrome. The fear of falling has negative consequences for older adults. Fall Efficacy Scale-International (FES-I) is one of the questionnaires that assesses fear of falling and its Arabic version has established validity. **Aim of the work:** To evaluate the validity of the modification on original Arabic FES-I to be suitable for the Egyptian culture.

Materials and Methods: 100 geriatric patients participated in this research. All participants were subjected to full medical history taking, application of the modified Arabic Falls Efficacy Scale–International (FES-I), Mini mental state examination, Time Up and go test. **Results:** The present study group included 100 participants 46 men and 54 women with female predominance, with a mean age of 66 years, the minimum age was 60 years and maximum was 85 years. Most of participants age lies between 60ys & 69ys. Medical history revealed that 67 % of participants had no history of falling and 33% with positive history of falling once or more; also 31 % with history of imbalance and 69 % without history of imbalance. From the participants in our study there were 40% below cut off value of TUG (14 sec) (low risk of falling), and 60% above or equal cut off value of TUG (14 sec) (high risk of falling). Also according to Mini Mental Status Examination (MMSE), 59% with mild cognitive impairment (21 to 26 points) and 41% with normal cognitive function. As regards the categories of modified Arabic FES-I; 16% in low concern category, 22% in moderate concern category, 62% in high concern category. In the current study, the validity and reliability of the modified Arabic FES-I have been proved, there was a statistically significant difference between the two ROC curves in favor of the modified FES-I regarding sensitivity (90.9% compared to 72.7%) and in favor of original FES-I regarding specificity (68.7% compared to 58.2%). Modified Arabic FES-I showed significant positive correlation with age and Time Up and go test, history of falling and history of imbalance and a negative correlation with the MMSE. **Conclusion:** The validated modified Arabic FES-I can be used in assessment of risk of falling among Egyptian geriatric population. The modified Arabic FES-I is more sensitive than the original Arabic FES-I.

Keywords: Arabic FES-I, modified Arabic FES-I, TUG, MMSE.

INTRODUCTION

Falls among older adults are recurrent and multifactorial episodes. Examining an individual at risk of falling by considering only the physical risk factors is in a sense to neglect other important aspects that cause falls, such as the fear of falling^[1]. Fall risk factors can be classified as intrinsic and extrinsic risk factors^[2]. Intrinsic factors are related to clients' functional and health status, Extrinsic factors are related to environment^[3]. Fear of falling has been defined as a lasting concern about falling that leads to an individual avoiding activities that he/she remains capable of performing^[4].

The fear of falling has negative consequences for older adults' physical and functional well-being, degree of independence, ability to perform activities of daily living (ADLs) and restriction on physical activity^[5]. Furthermore, those who have a history of

falls with one or more balance abnormalities are even more likely to express fear^[6].

The most frequently used scale for fear of falling, which measures different levels of concern about falling, is the Falls Efficacy Scale-International (FES-I), FES-I is reliable and valid in determining concern about falling in older adults across cultures as well as in persons with and without cognitive impairment^[1].

The Arabic FES-I has established concurrent validity and may be helpful for measuring an individual's concern of falling in people with vestibular and balance disorders^[7].

MATERIALS AND METHODS

This study included 100 geriatric patients randomly selected from the geriatric out-patient clinic and vestibular unit, ENT department, Ain Shams university hospitals.

All participants gave written informed consent, and their names were coded from the start of the study through data collection and analysis. All study participants had to meet all of the following inclusion criteria : adult over the age of 60 at of the day of testing, able to ambulate independently and safely with or without assistive device and able to understand and complete the modified Arabic Fall Efficacy Scale International (FES-I) questionnaire.

Full medical history taking, application of the modified Arabic Falls Efficacy Scale–International (FES-I), Mini Mental State Examination, and Timed Up and Go test were done to all the participants.

History taking: full history was taken including medical history, the main complaint of the patient and its duration. History of the present illness was taken including analysis of the main complaint as well as onset, course, frequency, duration of the complaint. The history of falls was driven through asking patient to report number of any previous falls, medications, gait problems, dizziness, vertigo, or loss of consciousness, environmental problems such as lighting, flooring or others.

Application of the modified Arabic Falls Efficacy Scale–International (FES-I). Some items were adapted making sure the original FES-I was preserved in order to improve their appropriateness to specific characteristics of Egyptian culture. The modified fall efficacy scale international is 22 items questionnaire that include the 16 original items from the FES-I and 6 more demanding items. The questionnaire is rated on a 4-point scale for each activity, where: 1 = not at all concerned, 2 = somewhat concerned, 3 = fairly concerned and 4 = very concerned. The total score ranged from 22 (no concern about falling) to 88 (severe concern about falling).

Timed Up and Go test: In this test, the patient was asked to stand up from a chair (seat height = 45cm, and arm height = 65cm), then to walk (quickly as he/she feels safe and comfortable) for 3 meters (10 feet) or at a measured marked end, return and sit down again while the examiner recorded the time required to execute this task. Interpretation: ≤ 10 seconds = normal. ≤ 20 seconds = good mobility, can go out alone mobile without gait aid. ≤ 30 seconds =problems, cannot go outside alone,

requires gait aid. * A score of ≥ 14 seconds has been shown to indicate high risk of fall^[8].

MMSE: the test made of 30 questions with total score 30 points assessing the following: orientation to time, orientation to place, three words registration, attention and calculation, recall, naming, repetition, comprehension, following commands, sentence construction and drawing. The cut off value is 24^[9].

The study was approved by the Ethics Board of Ain Shams University.

Statistical analysis:

Quantitative data are presented as mean and standard deviation. Comparison of quantitative data across groups was done using independent t-test if there were two groups and one-way ANOVA if more than 2 groups were compared. Association between quantitative variables was done through computing Pearson correlation coefficient (r). Comparison between FES-I and modified FES-I score was done using Bland Altman plot as well as Pearson correlation. Agreement between the classification of the two tools was measured by modified Kappa coefficient. Reliability was assessed by Cronbach's alpha and split half method. Item to total correlation was also used and the Cronbach's alpha after deleting the item was calculated. Qualitative data are presented as number and appropriate proportion. Qualitative data association was performed by chi-square or Fisher exact test if appropriate curve technique was used to measure the predictability of the tool (by area under the curve) as well as to measure the appropriate cutoff point with its sensitivity and specificity. Youden's index (= sensitivity +specificity – 1) was also calculated. The two ROC curves were also compared using z-test. In all statistical testing, a two-tailed p-value of 0.5 or less is considered statistically significant.

RESULTS

The modified Arabic FES-I (22 items) was validated by comparing it with the validated original Arabic 16 items FES-I. This was done by: 1- scatterplot curve (figure 1), 2- Bland-Altman plot (figure 2), 3- Inter-rater agreement (kappa) (after making categories for both scores) (table 1).

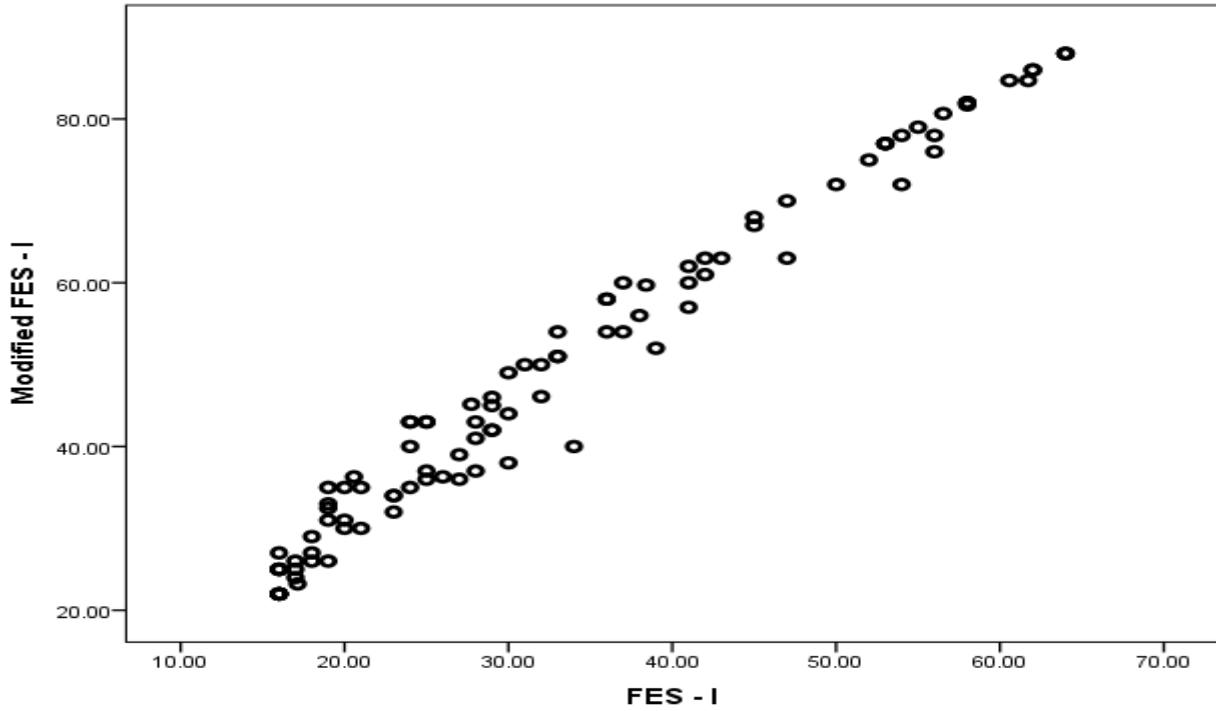


Figure (1): Scatterplot between the modified Arabic FES-I (22 items) and the original Arabic 16 items FES-I

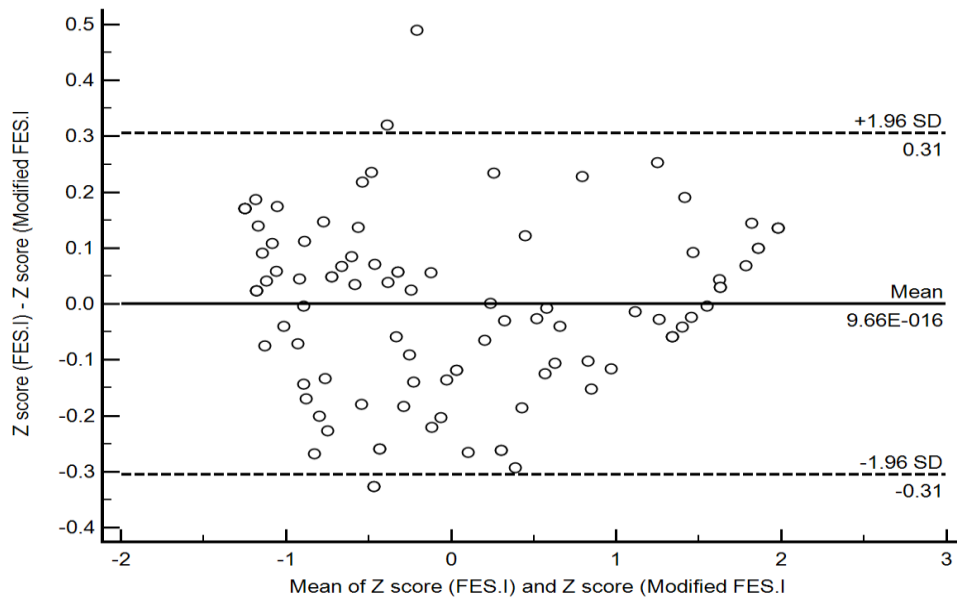


Figure (2): Bland-Altman plot in relationship between the standardized scores of both original Arabic FES-I and modified Arabic FES-I

Table (1): Inter-rater agreement (kappa) it compare between the scores of different categories of the modified Arabic FES-I in relation to the original Arabic FES-I

Arabic EFS	Modified Arabic FES-I			Total	Weighted Kappa	Standard error	95% CI
	No concern	Moderate concern	High concern				
No concern	16	7	0	23 (23.0%)	0.813	0.045	0.726 to 0.900
Moderate concern	0	14	7	21 (21.0%)			
High concern	0	1	55	56 (56.0%)			
	16	21	62	100			
	16.0%	22.0%	62.0%				

The reliability of the modified Arabic FES-I (22 items) was done by: 1- Split-half test and Spearman-Brown Coefficient & Guttman Split-Half Coefficient were done for correlation (table 2) & 2- Cronbach's alpha (after deletion of single item from the questionnaire each time) (table 3).

Table (2): split-half test of the modified Arabic FES-I

Cronbach's Alpha	Part 1	Value	0.932
		N of Items	11 ^a
	Part 2	Value	0.90
		N of Items	11 ^b
	Total N of Items		22
Spearman-Brown Coefficient			0.921
Guttman Split-Half Coefficient			0.921

Question Number	Cronbach's Alpha if Item Deleted
Q14	0.951
Q15	0.954
Q16	0.952
Q17	0.949
Q18	0.953
Q19	0.950
Q20	0.950
Q21	0.951
Q22	0.955

Table (3): Internal consistency by Cronbach's alpha

Question Number	Cronbach's Alpha if Item Deleted
Q1	0.950
Q2	0.951
Q3	0.951
Q4	0.951
Q5	0.950
Q6	0.952
Q7	0.950
Q8	0.950
Q9	0.950
Q10	0.951
Q11	0.951
Q12	0.951
Q13	0.950

There was a positive correlation between age and the scores of original Arabic FES-I and Modified Arabic FES-I (table 4). There was also a significant relationship between categories of both the original Arabic FES-I and the modified Arabic FES-I as regards history of falling (table 5), history of imbalance (table 6).

Table (4): Correlation between age and both scores of original Arabic FES-I & modified Arabic FES-I

		Original Arabic FES - I	Modified Arabic FES - I
Age	Pearson Correlation	0.243	0.244
	Sig. (2-tailed)	0.015	0.014

Table (5): Correlation between history of falls and the categories of both the original Arabic FES-I and the modified Arabic FES-I

		Number of Previous Falls						Fisher exact test	p value
		None		Once		More than once			
		No	%	No	%	No	%		
Original Arabic FES-I	Low concern	21	91.3%	2	8.7%	0	0.0%	16.612	0.001
	Moderate concern	17	81.0%	4	19.0%	0	0.0%		
	High concern	29	51.8%	14	25.0%	13	23.2%		
Modified Arabic FES-I	Low concern	16	100.0%	0	0.0%	0	0.0%	19.026	<0.001
	Moderate concern	19	86.4%	3	13.6%	0	0.0%		
	High concern	32	51.6%	17	27.4%	13	21.0%		

Table (6): Correlation between history of Imbalance and the categories of both the original Arabic FES-I and the modified Arabic FES-I:

		History of Loss of Balance				Fisher exact test	p value
		No		Yes			
		No	%	No	%		
Original Arabic FES-I	Low concern	23	100.0%	0	0.0%	25.189	<0.001
	Moderate concern	18	85.7%	3	14.3%		
	High concern	28	50.0%	28	50.0%		
Modified Arabic FES-I	Low concern	16	100.0%	0	0.0%	31.576	<0.001
	Moderate concern	22	100.0%	0	0.0%		
	High concern	31	50.0%	31	50.0%		

Also, the current study showed a significant positive relationship between the scores of modified Arabic FES-I and Timed Up and Go Test results (figure 3) and a significant inverse relationship between the scores of modified Arabic FES-I and MMSE results (figure 4).

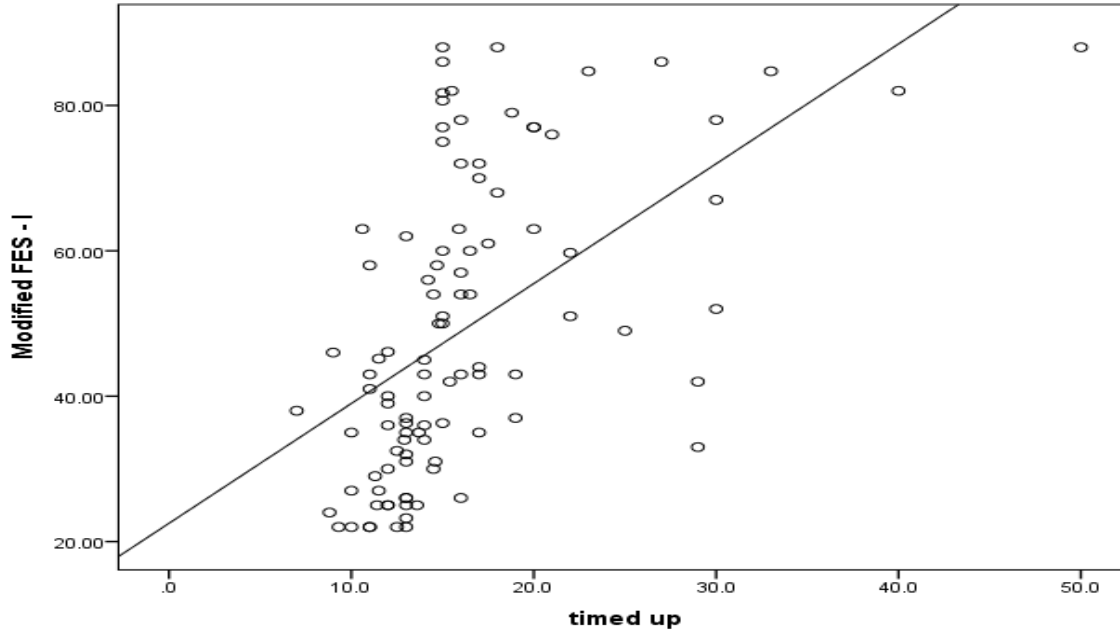


Figure (3): Relationship between the score of modified Arabic FES-I and Timed Up and Go Test

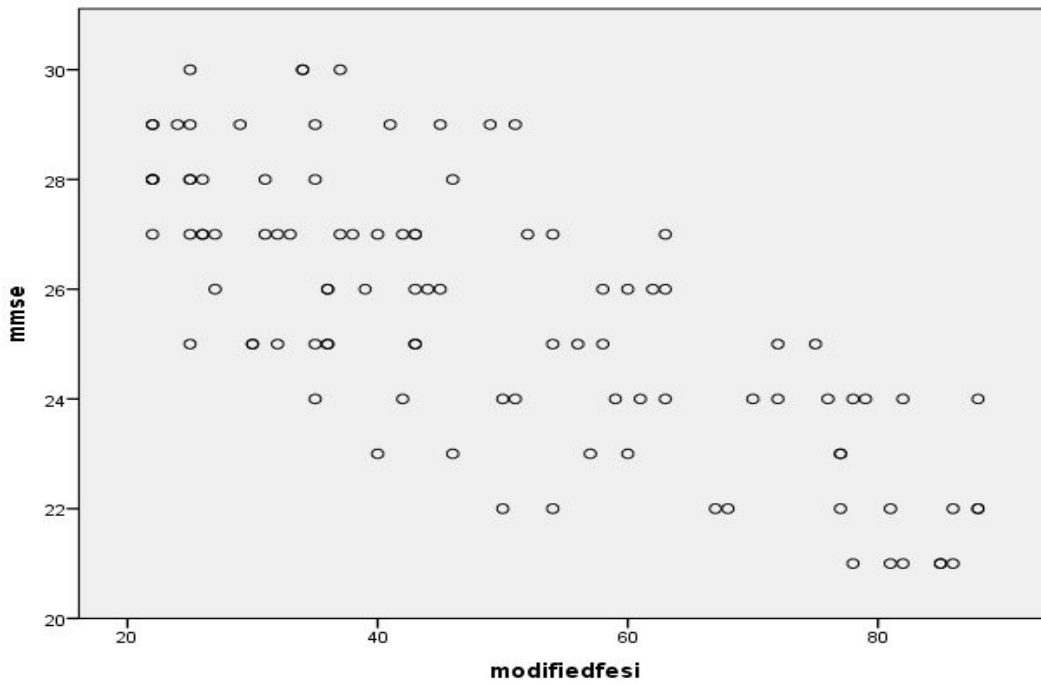


Figure (4): Relationship between the score of modified Arabic FES-I and MMSE

The ROC curve between original Arabic FES-I and modified Arabic FES-I in the prediction of history of falls (history of one or more falls) showed that, the modified Arabic FES-I is more sensitive than the Original Arabic FES-I (90.91% vs 72.73 respectively) (figure 5), tables (7) & (8).

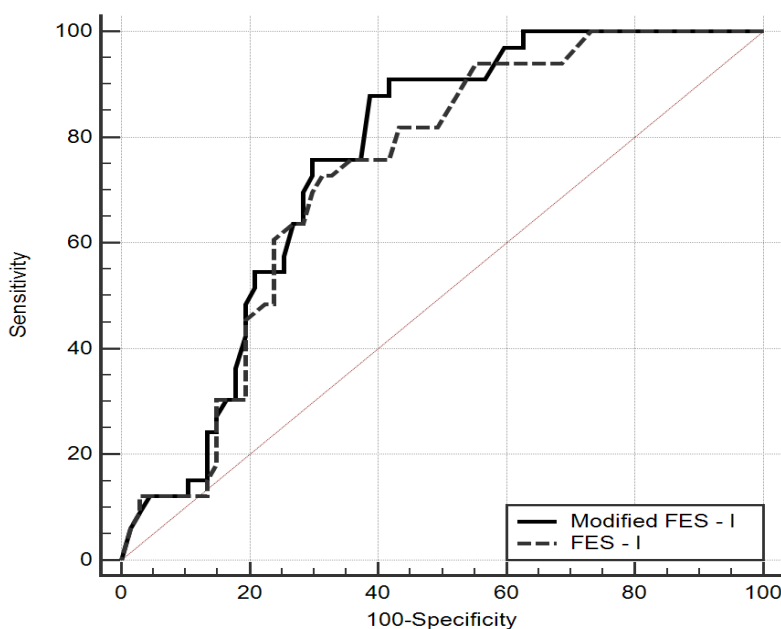


Figure (5): comparison between original Arabic FES-I and modified Arabic FES-I ROC curves.

Pairwise comparison of ROC curves	
Difference between areas	0.0253
Standard Error ^a	0.0100
95% Confidence Interval	0.0057 to 0.0450
z statistic	2.539
Significance level	P = 0.0114

Table (8): comparison between areas under the curve, cut off value, sensitivity and specificity of both the original Arabic FES-I and the modified Arabic FES-I

	The original Arabic FES-I	The modified Arabic FES-I
Area under the curve	0.730	0.755
Cut off value	31	40
Sensitivity	72.73%	90.91% *
Specificity	68.66%	58.21%

The cut off values of the original Arabic FES-I and the modified Arabic FES-I were 31 and 40 respectively.

DISCUSSION

The present study group included 100 participants 46 men and 54 women, with a mean age of 66 years. Medical history revealed that 67 % of participants had no history of falling and 33% with positive history of falling once or more; also 31 % with history of imbalance and 69 % without history of imbalance.

From the participants in our study there were 40% below cut off value of TUG (14 sec) (low risk of falling), and 60% above or equal cut off value of TUG (14 sec) (high risk of falling).

Also 59% with Mild cognitive impairment (21 to 26 points) and 41% with normal cognitive function.

As regards the categories of modified Arabic FES-I; 16% in low concern category, 22% in Moderate concern category, 62% in High concern category.

From the current study, we noticed that the questions of higher scoring are Q11, Q14, Q15, Q18, Q22, indicating that older adults generally experience maximal fear of falling while walking on a slippery surface, walking on an uneven surface, walking up or down a slope using escalators, and walking in a dim light road. While questions of minimal scoring are Q2, Q3, Q6, Q12, Q16, indicating that older adults generally experience minimal fear of falling while getting dressed or undressed, preparing simple meals getting in or out of a chair, visiting a friend or relative and going out to a social event. The previous result indicates that elderly exhibit minimal fear of falling throughout indoor activity and social activities, while they exhibit maximal fear of falling throughout all questions revealing unsafe ground, walking in darkness. **Camargos et al.**^[13] reported that outdoor and social activities are considered the most difficult by older adults and are the first to be given up when there is some balance deficit showing disagreement with current study in social aspect^[10].

This study showed that the modified Arabic FES-I is an internally consistent and reliable instrument to measure fear of falling in Egyptian geriatric population. There is perfect straight-line correlation between 16 items original FES-I and the modified 22 items Arabic FES-I, ($p < 0.001$). The agreement test kappa coefficient reflected good validity of the modified Arabic FES-I in correlation with the original Arabic FES-I as a reference test, it was 0.813.

Results of Spearman-Brown Coefficient and Guttman Split-Half Coefficient were very high indicating good reliability of the modified Arabic FES-I test. Also, Internal consistency by Cronbach's alpha showed very high Cronbach's alpha indicating good internal consistency. These results are in agreement with the study made by **Azad et al.**^[11]. On the original FES-I in which Cronbach's alpha was high, also Spearman values were high indicating high reliability of the original FES-I. Another similar studies were made on original FES-I among community-dwelling elderly in Germany, the Netherlands and the UK by **Kempen et al.**^[12], in Brazil by **Camargos et al.**^[13] and China by **Kwan et al.**^[14], in these studies the Cronbach's alpha were also high.

In the present study comparison between the sensitivity, specificity and cut off points between the original Arabic FES-I and the modified Arabic FES-I according to ROC curves showed a statistically significant difference between the two ROC curves in favor of the modified FES-I regarding sensitivity (90.9% compared to 72.7%) and in favor of original FES-I regarding specificity (68.7% compared to 58.2%). The cut off points of the original Arabic FES-I and the modified Arabic FES-I were 31 and 40 respectively. These results are in agreement with previous studies done by **Camargos et al.**^[13] on Brazilian version of FES-I where the cutoff point to differentiate between elderly who fell from those that did not fall was the point > 23 (47% sensitivity and 66% specificity) and a score > 31 identified an association with recurrent falls (100% sensitivity and 87% specificity). In the Turkish version by **Ulus et al.**^[17] the cutoff was 24 (sensitivity 70%, and specificity 65%). The difference in sensitivity and specificity values may be due to interracial difference.

In the current study, there was significant positive correlation between age and the scores of original Arabic FES-I and Modified Arabic FES-I. Most studies highlight aging as one of the risk factors for the fear of falling on the grounds that advanced age is indicative of a decline in functional reserve and that the perception of these losses can generate a feeling of low self-efficacy and fear of falling **Gillespie et al.**^[18], **Camargos et al.**^[10].

As regarding history of falling, the current study showed a significant relationship between categories of the original Arabic FES-I and modified Arabic FES-I scores and history of

falling. This goes with previous studies which found that there were higher FES-I scores in participants with a history of falls than others with no history of falls **Delbaere *et al.*^[20]**, **Camargos *et al.*^[13]** stated that in the Brazilian population the total score of the FES-I was an important variable for predicting falls. However, this is in contrast with the Turkish version of the FES-I score that was not associated with a history of falls **Ulus *et al.*^[17]**.

Furthermore, there is a significant relationship between high concern category of the original Arabic FES-I and modified Arabic FES-I scores and history of imbalance, this result is in agreement with previous studies made by **Hauer *et al.*^[21]** and **Yardley *et al.*^[1]** who examined the influence of imbalance on FES-I scores in the older adult population.

It was noticed that there was an inverse relationship between MMSE and the score of modified Arabic FES-I, the higher the score of MMSE the lower the score of modified FES-I confirming the relationship between increased risk of falling and poor cognitive function, supported by previous researches by **Härlein *et al.*^[22]**.

Also, there was a direct relationship between the Timed Up and Go in seconds and the modified Arabic FES-I score, the lower scores of modified FES-I were associated with shorter timed up and go (figure 9) revealing that fear of falling while performing daily activities is related to balance and mobility. This result is in agreement with **Arora^[25]** which implies that there is a direct relationship between the poorer performance in Timed Up and Go Test (high TUG score) and the higher fear of performing the activity (high FES-I score). Another study made by **Billis *et al.*^[13]** revealed the direct relationship between FES-I and timed up and go test. Similarly, in a validation study in Turkey among 70 older people, there was direct relationship between the timed up and go in seconds and FES-I score^[17]. In a recent validation of the Chinese version of the FES-I among 399 community-dwelling Chinese older people, the FES-I score was significantly higher in participants with poor physical performance^[14].

Despite the many fall risk assessment tools available in literature, assessing both intrinsic risk factors and functional limitations, there is often a lack of awareness of existing scales among clinicians. The FES-I could be used as a quick

screening tool to assess an individual's self-reported fear of falling in persons with balance and vestibular disorders^[26].

The current study suggest that the validated modified Arabic FES-I can be used as a routine sensitive (good positive test) screening tool for fall risk assessment for elderly in geriatric and vestibular clinic beside routinely used tests in geriatric clinics (TUG test and MMSE).

Also, the Modified Arabic FES-I is a good screening tool for fall risk during situations in which the patient having limitation in walking at time of screening and cannot perform gait and mobility tests (e.g. TUG) for example, acute illness, after operations, lower limb diseases (cellulitis, diabetic foot or deep venous thrombosis), sever joint or muscle pain or after taking medications in hospital admitted patients. Functional gait and mobility assessment tools are quite detailed and can be burdensome to the patient in previously mentioned situations, requiring the patient to walk get up from chair, and/or perform other functional activities. Furthermore, TUG test connected to function while modified Arabic FES-I is a quantifying psychometric scale measuring fear which is a predictor of behavior.

Also, poor scores on the modified Arabic FES-I could facilitate conversations with patients as to why they are afraid of falling as well as guide medical, rehabilitative and psychological treatment. On the other hand, there was some limitations in application of the modified Arabic FES-I e.g. illiteracy, cooperation and concentration of the patient and additional time needed to illustrate the questionnaire to illiterate patients.

CONCLUSION

The validated modified Arabic FES-I can be used in assessment of risk of falling among Egyptian geriatric population.

The modified Arabic FES-I is more sensitive than the original Arabic FES-I but less specific.

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