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Correlation between Fullerton advanced balance scale and timed up and go test in community dwelling older adults

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Abstract
Falls can lead to physical injuries and those which are not resulting in physical injury can install a fear of falling in older adults. This can result in self-imposed limitation of activity and decreasing functional ability. So it is important to assess the risk of fall. Time up and go test assess fall risk and Fullerton advanced balance scale assess balance. This study was aimed to find if there exists any correlation in both the outcome measures. 102 participants were involved from the age group of 60-90 years. Both the scales were assessed on each individual for one time and the scores were further correlated. Data analysis was done using Pearson correlation test. This study proved that there is inverse correlation between Fullerton advanced balance scale and Time up and go test which is statistically significant. So it is concluded that balance is correlated to fall risk.

Keywords: balance, elderly, TUG, FAB

1. Introduction
By the year 2050, approximately 20% of the world's population will be older than 65 years. India is the second most populous country in the world with 76.6 million people. There are about 7.7% of total population at the age of 60 [1]. Aging is well-defined as a process that is genetically determined and environmentally modified or it is simply getting old [2]. Number of cells including the body decrease, and physical compliance is gradually lost, ultimately leading to death. It is associated with a loss in muscle strength and loss of peripheral motor and sensory nerves, loss of both vision and control of the eye through the vestibular and visual cortex. These disabilities can lead to loss of balance and poor gait in the older population [3].
Balance is the ability to maintain an upright posture during static and dynamic tasks which requires complex interactions between peripheral and central factors such as vision, somatosensorial, vestibular sensation, motor output, and musculature. Along with interaction of the nervous and musculoskeletal system, balance and postural control also requires interaction between vestibular system, visual system and somatosensory system [4].
Many problems are faced by this population due to the social and cultural changes that are taking place within the Indian society. The major area of disquiet is the health of the elderly with multiple medical and psychological problems. Falls are one of the main difficulties in the elderly and are replicated one of the "Geriatric Giants". Recurrent falls are an important cause of morbidity and mortality in the elderly [5].
A fall can be defined as an unintended coming to rest on the ground or a lower level. Falls are the leading cause of health hazard and functional limitation in the elderly people over (>65 yrs.) [6]. Falls and fall related injuries can cause limited mobility and functional decline leading to disability and may have a negative effect on the socioeconomic status and quality of life (QOL) in elderly individuals [7].
Falls and their sequalae are potentially preventable and hence the risk factors for falls plays an important role in the elderly. According to the World Health Organization global report on fall prevention in older age, risk factors for falls involve biological, environmental, behavioral, and socio-economic factors. In Indian adults older than 70 years, basic causes for falls and recurrent falls are the most likely factors. Biological (intrinsic) risk factors include sex, race and age-related declines in strength, balance, abnormalities of gait or balance and history of fall in the past year. Compared with elderly without a history of falls, elderly with a history of fall have decreased lower limb strength, impaired balance and functional mobility, decreased balance confidence, and more co morbidities [8, 9].
A recent study has shown that the risk of falling increases in proportion to the severity of chronic musculoskeletal pain, the number of joint groups affected, and the amount of interference with daily activities [10]. Fear of falling is mentioned frequently as an adverse outcome of falling, little is known about it. The individuals at risk of developing fear of falling can be identified and fear of falling proves to be an independent factor in functional decline [11].
However, falls may be prevented if the risk factors are identified through early exact assessment, and interventions

planned to reduce the risk of fall. Valid and reliable clinical assessment methods are needed to identify the fall risk, and to serve as a tool for evaluating outcomes [12, 13, 14].

Among the assessment tools for balance, the Fullerton Advanced Balance (FAB) scale was developed as a performance-based measure to assess the refined changes in multiple element of balance ability. The FAB scale is recommended to predict the balance in higher- functioning older adults as it includes criteria to evaluate multiple dimensions of balance ability [15]. It is a cost effective method to evaluate balance. The time required for this test is 10-12 mins. There are10 performance-based activities in the test. Score of 0-40 points possible (higher scores are better). Items scored on a 5-point ordinal scale (0-4) [16].

Another test which is used in this study is Timed Up and Go test. The Timed up and go test is a simple test use to assess the fall risk, it is frequently used in elderly population as it is easy to control and can generally be completed by most older adults. This test is also very cost effective test and can be completed up till 3 mins. Subject does not need any kind of training for this test. Walking on their normal pace is recorded and accordingly the time recorded is evaluated from the normative values of the test [17]. Hence this study is aimed at correlating scores of Timed up and go test and Fullerton advanced balance scale in a group of community-dwelling older adults.

2. Methods and Materials

This study was done using convenient sampling, 102 participants were selected. The participants were selected according to inclusion and exclusion criteria. The study received approval from Institutional Ethical Committee Registration No. BPT/INT/2017/14 of Dr. APJ Abdul Kalam College of Physiotherapy, Pravara Institute of Medical Sciences; Loni. Prior to introduction of the study, all participants were satisfactorily informed about the research procedure. The detailed information regarding the nature of study was given to the participants before participation. Written consents form were taken from the participants. Permission was taken from the participants and screening was done. Those fulfilling the inclusion criteria were requested to participate in study. All participants completed a general characteristics questionnaire documenting their gender, age, and fall frequency. The participants were assessed randomly to investigate their balance function, using the TUG and FAB scale. Outcome measures used for this study were as follows:

1. Fullerton advanced balance scale
2. Timed up and go test

There were 10 performance-based activities in the FAB test. Score of 0-40 points possible (higher scores are better). Items scored on a 5-point ordinal scale (0-4). The cut of scores of FAB is 25. If the score is less than 25, then it is stated as balance is impaired. At a time both the scales were taken from each participants and further the correlation of the scores were done. Fall history was assessed by asking the participants how often they had fallen during the last 6 months, and 2 or more falls were considered to have a positive fall history [7].

The normative values of TUG are as given below.

Table 1

Age Group	Time in seconds	
60-69 years	8.1	(7.1-9.0)
70-79 years	9.2	(8.2-10.2)
80-99 years	11.3	(10.0-12.7)

Table 2: Cut-off Values Predictive of Falls by

Group	Time in Seconds
Community Dwelling Frail Older Adults 2	> 14 associated with high fall risk
Post-op hip fracture patients at time of discharge3	> 24 predictive of falls within 6 months after hip fracture
Frail older adults	> 30 predictive of requiring assistive device for ambulation and being dependent in ADLs [18].

2.1 Images

Fig 1: Here the participant is seen walking For Timed Up and Go test. (TUG)

Fig 2: Here the participant is seen standing on one leg which is the 6th Component of Fullerton Advanced Balance scale. (FAB)

3. Data Analysis

In the study, the total number of participants selected were 102 (n=102). Correlation of the following scores was done by using Pearson correlation test and results were obtained.

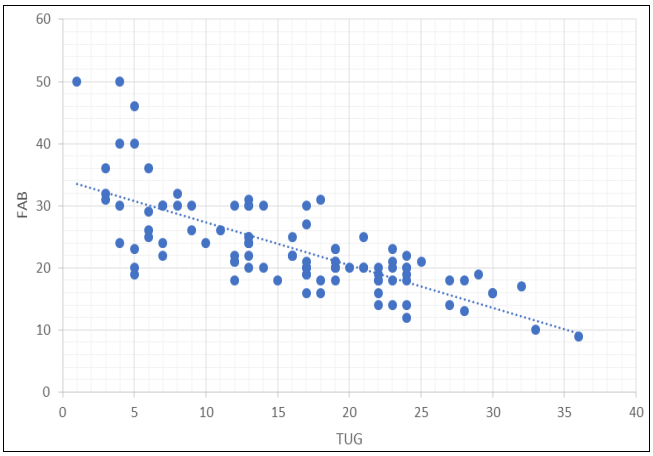

Fig 3: Correlation between Fullerton Advanced Balance Scale and Timed Up and Go test.

The above graph shows, by applying Pearson correlation test that if FAB increases then TUG decreases, both the scales are inversely related to each other and are extremely significant.

Table 1

Outcome measures	Mean	SD	Correlation (r)	p-value
FAB	515.6667	334.5061	-0.7354	<0.0001
TUG	761.3333	323.4337		

4. Discussion

The aim of this study was to determine the correlation between the (FAB) Fullerton advanced balance scale and Timed up and go test (TUG). In this present study, 102 elderly individuals are assessed between the age group of 60 to 90 years. FAB was used to assess the balance in individuals. This scale consist of 10 components and it is graded from 0-4, the maximum score is 40. when a individual scores 25 or less than 25 he or she is at high risk of fall [16]. Timed up and go test which was used to evaluate the fall risk. The cut off score is 12 seconds. If the participants recorded time is more than 12 seconds, it indicates high fall risk [17].

The correlation between both the scale was -0.7354 which is correlation coefficient r value and the P value was < 0.0001, according to this correlation is negative which means as the score of FAB scale increases the score of TUG test decreases and also vice versa. Hence both the scales are inversely related.

Accumulated data from the previous researches supports the result of the present study. The intrinsic risk factors of falls are sex, race and age-related declines in strength, balance, abnormalities of gait or balance and history of fall in the past year. Elderly who had no history of fall in comparison with who had history of fall had decreased lower limb strength, impaired balance, functional mobility and decreased confidence [8, 9].

Balance is maintained by both sensory and musculoskeletal systems. Sensory information, consisting of visual, vestibular and proprioceptive feedback (i.e., the sense of position), and muscle strength and joint flexibility in the legs are all important in helping to detect and correct balance loss. The loss of any one system, but especially the loss of two or more, affects balance and subsequently increases the risk of falling [19].

A study done by Yong. J and Gyoung-Mo. K on Comparison of BBS and FAB to predict fall in community dwelling elderly stated that the results of the binary regression analysis revealed that a test of the full model was significantly reliable (N=97, χ 2=84.87, p<0.001), and indicated that the total BBS and FAB scores were predictive of fall risk. The Hosmer-Lemeshow test, which used to formally evaluate the goodness of-fit for logistic regression models, was nonsignificant (p=0.99), indicating that the assessed model was good. The overall prediction success rate was 89.7%, and the total BBS and FAB scores were significant (p<0.05) as a predictive variable for evaluating fall risk [20].

A study done by Scott. B, Kathryn. B on Comparison of Time up and go test and Functional reach test with the Bergs balance scale showed that Balance and correlations were based on scores from each of the three balance tests performed. Results were there was a significant correlation between the bergs balance scale and time up and go test (r= 0.42, p= 0.06). paring the timed up and go and functional reach test however revealed a significant correlation (r=0.56, p= 0.04). This study suggest that the timed up and go test alone or the combination of the timed up and go and functional reach test can be used as a simple measure of balance comparable to the bergs balance scale.[21]

The reliability of Timed up and go test (TUG) is excellent test-retest reliability (ICC=0.97) in community dwelling older adults. Adequate test-retest reliability for all subjects (ICC = 0.56). Adequate test-retest reliability for the cognitively unimpaired (ICC = 0.50). Adequate test-retest reliability for the cognitively impaired (ICC = 0.56). In community-dwelling elderly people with a variety of medical conditions there is good between rater reliability (ICC 0.99). Older people residing in residential care facilities is excellent interrater reliability (ICC = 0.92; 95% CI = 0.86 - 0.95) excellent interrater reliability (ICC = 0.91; 95% CI = 0.86 - 0.94).

The validity of TUG in older adults is excellent correlation between the TUG and Berg Balance (r = -0.81) excellent correlation between the TUG and gait speed (r = -0.61) excellent correlation between the TUG and Barthel Index of ADL (r = -0.78). Excellent correlation between the TUG and Functional Gait Assessment (r = -0.84, p < 0.001) The TUG test was able to predict fall risk (slip outcomes): Sensitivity 56%, Specificity 60% [22].

The reliability of FAB in Older adults is excellent interrater reliability (ICC=0.955 - 0.999). Excellent interrater reliability for total score when administered by trained raters (r = 0.94-0.9) excellent interrater reliability for total score (r = 0.93-1.00). Excellent test re-test reliability (r = 0.96) for total score. The validity of FAB in Older adults is excellent correlation with BBS scores (r = .75). Predictive validity: Using retrospective self-report fall history and logistic regression, a

cutoff score of 25/40 predicts fallers. In 7 out of 10 cases an individual who scores 25 or lower is at a high risk for falls [23]. Hence this study showed that balance is correlated to fall risk.

5. Conclusion

This study proved that there is inverse correlation between Fullerton advanced balance scale and Timed up and go test which is statistically significant. Thus it is concluded that balance is correlated to fall risk.

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Conflict of interest: None declared

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