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Gender Differences in Static and Dynamic Postural Stability Parameters in Community Dwelling Healthy Older Adults

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Abstract: To investigate the effects of gender on static and dynamic postural stability in community dwelling healthy older adults. Thirty men and 30 women older than 65 years participated in the study. They completed 4 balance tests, including one-legged stance test (OLST) with eyes open (EO), OLST with eyes closed (EC), Sharpened Romberg (SR) and Dynamic postural stability (Turn 180). Means of static and dynamic balance scores between male and female elderly population were compared using t- test, with equal variances. The significance level used for the study is $p<0.05$(one tailed). No significant differences were found in static and dynamic postural stability parameters. Many studies failed to find any significant difference in relation to gender. Any comparison of results concerning those of effects of gender should be made with caution, as methods and population vary. The results of our present study suggest that there was no difference in static and dynamic balance scores between male and female older adults. The data indicate that there was no gender based differences in static and dynamic postural stability parameters when anthropometric measures were taken into consideration. Therefore balance retraining to implemented is of equal importance for both the gender

Key words: Static Balance · Dynamic Balance · Postural Control

INTRODUCTION

The physical act of falling is a very common occurrence in the elderly population and one that presents a substantial health problem among the elderly due to the overwhelming rise in human life expectancy. Falls present a substantial health problem among the elderly population. Approximately one-third of community-dwelling people over 65 years of age will experience one or more falls each year [1-6]. Postural control is a key element in the execution of daily activities, requires input from the afferent receptor systems, vestibular, visual, proprioception and general exterosensibility, in order to generate a motor response allowing the transition between dynamic and static activities [7].There is a general agreement that postural control involves sensory and motor systems and number of investigators has found age related declines in visual, vestibular and sensory motor functions [8-12]. However little work has been done on assessing the contribution of the demonstrated age and gender relates decline in these systems on the overall decline in postural control. In clinical practice, postural stability is commonly evaluated by scored functional tests, which give information of balance performance in common daily tasks [13-18]. In laboratory settings, postural stability is assessed by recording the spontaneous postural sway on a platform to gain information about postural control mechanism as shifts of the center point of pressure [19, 20]. In specialized centers, posturography is used to diagnose balance impairments. However, the cost, size and complexity of a posturography system make it impractical in some clinics, especially during a bedside evaluation. Gender-related differences are more controversial. Few

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studies have shown no differences in postural sway, while other authors have found that postural sway is higher in women at all ages or under stressing balance conditions [20-25]. In one leg standing, gender differences have been investigated using timed tests and few recent studies show no difference based on gender [26-31] Age and gender has its own effect on balancing system [32-35] However, much literature is not available regarding the differences of balance scores on gender in Indian population. As a person is growing older, physical therapists are going to meet them on a more frequent basis. As increased health, care monies are being spent on rehabilitating the aged individuals. This information could be useful in developing balance evaluation and balance training programs in physiotherapy.

MATERIALS AND METHODS

This is an observational cross sectional design. The two groups where subjects were matched based on similarity of height and grouped 30 in each according to their gender. During the initial interview, demographic data was collected regarding age (M- 69.74 ± 4.32; F- 68.74 ± 2.62), sex, height (M- 168.17 ± 4.95; F- 167.87 ± 4.76), weight (M-65±4.95; F-56±5.68) and number of falls recalled from the past six months and their level of perceived stability. They were asked "how steady on your feet do you usually feel'? (Using your usual walking aid if necessary). Responses were selected from a list of options like not steady = 4; not very steady = 3; fairly steady =2; very steady = 1.

The following were the tests conducted on both sexes to get the balance data for comparison.

Static Postural Stability: One legged stance test (OLST) with eyes open (EO) and eyes closed (EC) conditions, Sharpened Romberg test in both eyes open and eyes closed conditions

Dynamic Postural Stability: Turn 180 in both clockwise and anti-clock wise directions.

After obtaining Jamia Hamdard university ethical committee approval the participants with the following inclusion criteria were recruited. Subjects had to be aged above 65, with level of perceived stability of grade 4, able to walk 3 meters independently, but with usual walking aid if required and did not have any condition which jeopardized their ability to co-operate in the interviews or physical testing. The participants volunteered from different residential areas of Delhi within a time of one year. Three hundred fifty older adults volunteered to participate, 60 subjects were selected who fulfilled the criteria.

Procedure: During the tests, subjects were instructed to keep their arms by their sides. Demonstration regarding each test position was given to subjects prior to testing and an opportunity to practice each test twice before timed trails began. No instructions were given regarding the subject knee position or visual fixation. All tests were performed on level flooring. The static balance tests performed are sharpened Romberg (SR) and one legged stance test (OLST).

Sharpened Romberg (Sr): This test was performed in a heel to toe standing position with dominant foot behind the non-dominant foot. Timing was started after the subjects has assumed the position and will be indicated that they are ready to begin, timing was stopped if subjects moved their feet from the proper position; if they opened their eyes on eyes closed trails or if they reach maximum balance time of 60 seconds. Three trails were performed; the longest balance time of the recorded trails was used for data analysis.

One Legged Stance Test (Olst): This test was performed in standing position with subject's arms by their sides. Timing was started when subjects raised the appropriate foot off the ground and stopped if subjects displaced the foot where standing on, touched the suspended foot to the ground, used the suspended foot to support the weight bearing limb or reached the maximum balance time of 30 seconds.

Three trails were performed, longest was used for data analysis.The investigator stood near the subjects all the time to prevent fall attributable to low off balance. The order of balance tests will be random. Four test sequences were possible:

- SR, Right OLST; Left OLST.
- SR, left OLST; Right OLST
- Right OLST, Left OLST, SR
- Left OLST, Right OLST, SR

These results were later regrouped and analyzed according to foot dominance instead of right or left OLST conditions Leg Dominance was found out by a short questionnaire (5 questions) based on daily living activities = foot used to; 1) Kick a ball 2) Jump off 3) Climb the first stair step 4) Get up from the bed 5) The dominant hand. For dynamic postural stability the test performed was turn 180 in clock wise and anti-clock wise directions.

Participants dressed with well-fitting footwear were seated comfortably. The chair has arm rests and seat was high enough for the subject to stand with minimal effort, although necessary help was given to avoid fatigue. Before assuming the starting position, the test was explained and demonstrated if necessary repeated using the same words. Trails were considered invalid if subject takes support while stepping (As opposed to briefly touching the support) or give up before completing the turn. Light fingertip touches are tolerated but not encouraged. No feedback was given about the number of steps taken.

When subjects complete the turn and face the observer indicates the test is finished. Stepping with only one foot and pivoting on the other was not considered. Steps must be taken or attempted with each foot in turn. The observer records the direction in which the subject turns clockwise towards the right, anti-clockwise towards the left and the number of steps taken to complete the turn 180.

The steps taken in clockwise and anti-clock wise direction of both male and females were compared without, due consideration regarding their initial direction of turn [15]. Instrumentation for data collection include digital stopwatch, stadiometer, supporting handrails, chairs/tables.

RESULTS

Data analysis was performed using SPSS software. The characteristics of the sample such as age, height, weight, number of falls were measured (Table 1).

Means of static and dynamic balance scores between male and female elderly population were compared using t' test, with equal variances. The significance level was set at $p<0.05$ (One tailed) (Table 2).

Table 1: Characteristics of the Sample N=60 (M=30, F=30)

Variables	Mean M ±SD	Percentage (%)
Age (Years)		
M	69.74 ± 4.32	
F	68.74 ± 2.62	
Height (cm)		
M	168.17± 4.95	
F	167.87± 4.76	
Weight (Kg)		
M	65± 6.95	
F	56± 5.68	
Gender (Sex)		
M	30	50%
F	30	50%
Falls in Last six months		
M	None	0%
F	None	0%
Use of walking aids		
M	3	10%
F	2	6.7%

Table 2: Comparison of Static and Dynamic Balance Scores Between Male and Female Older Adults

	Variables	Males(N=30)M ±SD	Females(N=30)M ±SD	't' Value	'p' Value
Static Tests	OLST (D) EO	16.52±9.4	13.86±8.53	1.14	0.25*
	OLST (ND) EO	14.41±9.62	12.30±8.65	0.89	0.37.*
	OLST (D) EC	6.57±6.06	5.73±4.71	0.60	0.55*
	OLST (ND) EC	5.76±4.06	5.034±.04	0.70	0.48*
	SRT EO	48.89±17.78	42.88±19.49	1.24	0.21*
	SRT EC	30.12±21.20	27.61±21.06	0.46	0.64*
Dynamic Tests (Turn 180)	Clock wise (Right)	4.6±1.43	4.27±0.95	1.06	0.29*
	Anti-Clock wise				
(Left)	4.5±1.48	4.271±.08	0.69	0.48*	

Note: * indicates that p value is not significant

The results suggested that there were no significant differences either in the static or dynamic balance tests between male and female older adults.

DISCUSSION

This study was an attempt to determine significant differences in static and dynamic balance scores based on gender differences. The results suggest that there was no significant difference in static and dynamic balance scores between male and female older adults, in all the conditions. Gender-related differences are more controversial: some studies have shown no differences in postural sway, while other authors have found that postural sway is higher in women at all ages. Some traditional functional tests and force platforms and found women to be more stable than men [11, 29]. They found that functional balance tests discriminated significant difference between younger and older subjects, but no significant difference with reference to gender [20- 25, 29]. It has been postulated that the gender bias in postural ability might stem from gender-related distinctions in physical ability such as strength, although others argue that accounting for anthropometric differences eliminates any distinction in physical performance between men and women [6, 17, 21, 28-30]. Further, many studies failed to find any significant difference with relation to gender. Any comparison of results concerning those of effects of gender should be made with caution, as methods and population vary. Comparison of these results with previous studies was limited because of different methods, population and protocol followed. [31-34]. The significant sex difference obtained by force platforms and no sex difference was evident in the functional test results; it might be argued that each of the two types of test reveals information not revealed by other. The results of the present study can be explained by biomechanical model, anthropometric factors, inverted pendulum model. According to inverted pendulum model a longer lever arm, e.g. Lengthy height would cause greater amplitude of movement than a shorter height [6].

Body characteristics have been assumed to influence the boundaries of individual postural stability and this variability may affect the selection of motor strategies to maintain postural balance. Therefore, body characteristics, anthropometric measurements must be considered in measurement settings. In this study anthropometric factors that are height of subjects had been matched to find out the difference in balance scores based on gender. The limitation of study was non-availability of extreme aged adults and fallers who were reluctant to participate and moreover matching the subjects of other parameters would have improved the reliability of outcome measures.

Relevance to Clinical Practice: Results suggest that there was no difference in static and dynamic balance scores between male and female older population. Strategies such as bone loading, gait, dynamic posture, balance reactions and coordination training functional floor activities should be incorporated along with a basic fitness program of both male and female older adults to improve their postural stability.

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