GENDER INFLUENCE ON BALANCE PERFORMANCES IN THE ELDERLY

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ABSTRACT: *This study was carried out to investigate gender influence on balance performance of apparently healthy elderly using the Sharpened Romberg Test (SRT) for static balance and the Functional Reach Test (FRT) for dynamic balance assessments.*

One hundred and three (103) apparently healthy male and 100 apparently healthy female elderly subjects of age ranging from 60 to 74 years participated in this study. They had no history of neurological deficits, postural hypotension, orthopaedics conditions or injury to the back and / or upper and lower extremities within the past five years.

Descriptive statistics of range, means and standard deviation were used to analyze the physical characteristics and each of the two tests. The independent t-test was used to compare the balance performances in elderly males and females.

The results showed that males performed significantly higher than females in FRT: (31.46 ± 12.34) and (24.00 ± 10.73) respectively. Males performed significantly higher than females in SRT in eyes opened (58.51 ± 4.43) and (56.58 ± 6.03) and eyes closed: (46.98 ± 14.89) and (42.59 ± 14.70) performances respectively.

It was concluded that males performed significantly better than females in both static and dynamic balance performances.

KEY WORDS: GENDER, BALANCE PERFORMANCE, ELDERLY.

INTRODUCTION

Balance is the process by which one controls the body's centre of mass with respect to the base of supports whether it is stationary or moving (Blackburn and Voight, 2001).

Balance control is multi-dimensional, and requires a complex sensory, neuromuscular and central processing system (Light et al, 1995). The ability to maintain balance depends on the visual, vestibular, auditory, somato-sensory and motor systems (Iverson et al, 1990). Disorders involving any of these systems cause disequilibrium (West, 1995).

Balance is either static or dynamic. Dynamic balance involves a combination of stability and mobility which is necessary to hold a position in space or move in a controlled and coordinated manner (Kisner and Colby, 1996). Coordination, balance and functional motor skills are all dependent upon and affected by the sensory systems, particularly the somatosensory and proprioceptive systems if a person is to lean and carry out functional skills (Kisner and Colby, 1996).

The sense of balance declines with age (Harada et al, 1995). The likelihood of having difficulty in carrying out basic life activities increases as individual's ages. The elderly are among those at greatest risk for disequilibrium (Iverson et al, 1990). Therefore balance in the elderly deserves special attention because of its importance in functional mobility and safety.

Various types of balance tests exist ranging from expensive laboratory measures, which are often clinically impractical, to the narrative descriptions used most often by physical therapists (Light et al, 1995). Many of the objective measures used in the clinical setting have focused on an evaluation of static-standing balance (Light et al, 1995). Such a method is the Romberg Test (RT) used to evaluate the ability of a subject to maintain balance. Another one is One-Leg Stance Test (OLST), which is commonly used in the clinical setting. The Sharpened Romberg Test (SRT), which is a modification of the Romberg Test and has been used as a substitute for the RT by some clinicians, is also a static balance test measure. The OLST is more difficult to perform than either the SRT or RT because of the decreased area of weight bearing and the narrow base of support (Briggs et al, 1989).

The Functional Reach Test (FRT), developed and tested by Duncan et al (1990), is one of the more familiar of these newer balance tests used by physiotherapists in the clinical setting today (Arnadottir and Mereer, 2000). Functional reach is a measure of the client's margin of stability during voluntary forward maximal reach (Duncan et al, 1990). They have proposed that this test is a good screening tool for balance problems in the elderly population.

Some factors have been shown to have an effect on balance such as: age (Balogun et al, 1994), physical activity (Iverson et al, 1990) and weight (Smith et al, 1998). The influence of gender needs to be investigated in the balance performance in the elderly population given the importance of balance in functional performance. Therefore, the aim of this study is to investigate the influence of gender on balance in the elderly.

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METHODOLOGY

SUBJECTS

A sample of convenience of 103 males and 100 females who were apparently healthy (those who met the inclusion criteria), and whose consents were sought and obtained were recruited for this study from churches, mosques, homes and markets in Ibadan, Nigeria. Subjects were between 60 and 74 years of age. They did not have any history of postural hypotension, neurological deficits and orthopedics conditions within the past five years. This number was arrived at using the standard equation recommended by World Health Organization (WHO, 2004).

VENUE

The procedures were performed at a comfortable, suitable designated centre (level floor) in churches, mosques, homes and markets in Ibadan, Nigeria.

INSTRUMENTATION

1. A Swiss precision (Herwins) stopwatch was used to measuring balance time of the subjects in seconds to the nearest second.
2. A bathroom weighting scale (Seca Model) was used to measure the subject's body weight in kilogram to the nearest kilogram.
3. A portable height metre (Seca Model) was used to measure subject's height to the nearest centimeter.
4. A plumbline (Swordfish brands) was used to provide for the leveled flooring for the standing landmark.
5. A 3-inch by 48-inch (7.5cm by 120cm) transparent meter rule (built by the Instrument Department U.C.H., Ibadan, Nigeria) was used to measure the functional reach of each subject to the nearest 0.1cm.
6. Plain sheets of paper were used to mark the feet during the tests performances.

PROCEDURE

Prior to testing, the procedure was explained to subjects after their informed consent had been sought and obtained. The subjects responded orally to questions on their general health state with specific questions on whether they had pain in any part of their body or had any recent fractures. Tests such as Romberg test, dysdiadikokenesia and drift test were performed to assess their neurological status. They also answered questions on past and recent events in society to test their mental state (dementia). Any subject who passed these tests participated in the study.

HEIGHT MEASUREMENT: The height metre was placed against the wall. The subjects were asked to stand vertically parallel to the height metre with their backs to it. They stood vertically erect with their hands by their sides while looking straightforward. The height was read-off by gradually lowering the height meter pointer to touch the tip of the subjects' heads.

WEIGHT MEASUREMENT: The weighing scale was placed on a leveled floor and the zero error well corrected for each subject with his or her hands by the side while looking forward. The head was straight in the erect position. Then their weight was read-off. The subjects had minimal clothing and had their shoes-off.

DETERMINATION OF LIMB DOMINANCE

Limb dominance of subjects was assesses from there response to the following questions:

1. Which hand will you preferentially use for?
   Writing?
   Eating?
   Throwing?
   Opening and closing doors and window shutters?
2. Which leg would you preferentially use for kicking a ball?

The favoured limbs of the subject when replying to those questions and actually carrying out those activities with ease were considered to be their dominant limbs. Each of these activities were performed and checked by us before commencing the test procedures.

SHARPENED ROMBERG TEST:

Leveled flooring was confirmed by the use of a plumbline placed on the ground and the indicator liquid settling at the centre was used for testing.

This test was performed as described by Briggs et al (1989). The subject assumed a heel-to-toe standing position. The dominant leg was placed at the back of the non-dominant leg. All the tests were performed with the shoes-off and with the eyes opened or closed while standing on a white plain sheet of paper.

Timing was started after the subjects had assumed the proper test position and indicated their readiness.

Timing was stopped when any of these occurred:

- If subject moved their foot/feet from the proper starting position or swayed.
- If subject opened their eyes in the eyes closed trial.
- If subject reached the maximum balance time of 60 seconds.

All the subjects performed three trials and the longest time was used for data analysis.

FUNCTIONAL REACH TEST:

This test was performed as described by Duncan et al (1990). Subjects stood with their feet apart as wide as the measure of their shoulder girth in a comfortable position. The metre rule was mounted on the wall parallel to the floor with the top edge at the level of the subject's acromion. The subjects stood with the dominant arm near the wall of the metre rule (subjects performed the test with their dominant arm). The subject was asked to make a fist and flex the arm at the glenohumeral joint to 90 degrees and parallel to the metre rule. The initial position of the third metacarpal was recorded as the initial position. Then the subjects were asked to reach forward as far as possible keeping their fist parallel to the metre rule without taking a step. The positions of the feet of the subjects were marked on a plain sheet of paper on which they maintained their stance during the test.

Any strategy except the following was encouraged for the subject:

- Touching the surface of the wall of the metre rule with either the reaching or non-reaching hand;
- Holding the wall or any nearby object with the non-reaching hand
- Taking a step during the test procedure.
- The subject's reach was observed and recorded as the final position. The functional reach was taken by subtracting the initial position from the final position (centimeters).

Any of the two tests were performed without following a specific order. This was done to avoid the subject getting acquitted with the test, which may affect their performances.

DATA ANALYSIS

The Independent t-test was used to establish:

(i) If there was any difference in FR in elderly males and females

(ii) If there was any difference in balance time in elderly males and elderly females.

RESULTS

Refer to Table 1 and Table 2 below.

DISCUSSION

There was a significant difference between the performances of male and female elderly on SRT in both the eyes opened and eyes closed ($p<0.05$) with the males performing better. This shows that male elderly can perform better in SRT than elderly female. It was however noted that 80.58 % elderly male completed the maximum 60-second on the eyes opened performance as compared with 56.00% elderly females who completed the maximum 60 seconds on the same test. Thirty-nine percents of the elderly males were able to complete the maximum 60 second on the eyes closed performance as compared with 29.00% elderly females who completed the maximum 60 second on the same test. This further strengthens the fact that male elderly can perform significantly better than female elderly in SRT.

The higher percentages observed in the eyes-opened performance in both the males (80.58%) and females (56.00%) as compared with lower percentages in the eyes closed in males (39.00%) and females (29.00%) shows the importance of visual input on the balance performance and control in the elderly Therefore the elderly should be taught how to compensate for balance when there is distortion in the centre of equilibrium. They should also be routinely screened for visual acuity so that impairment would be detected early and visual aids could be prescribed to prevent falls and their associated complications. Early detection of balance problem in the elderly will go a long way in preventing fall and its complication frequently occurring in the elderly. It will also help in limiting or preventing activity limitation or participation limitation, which is usually associated with aging (Briggs et al, 1989).

Males performed significantly better in the FRT than females ($p<0.05$). This implies that elderly male can perform better in FRT than elderly females. In this study, males were significantly taller than females with mean values of 168.12 (±7.13) and 159.33 (±8.47) respectively. This could have contributed to the better reach observed in the males than the females. This is in agreement with Duncan et al (1990) who concluded that there existed a positive significant relationship between height and functional reach in a sample of 156 volunteer elderly. The significantly better reach observed in males also agrees with Duncan et al (1990) who noticed that gender was one of the most significant factors that influences functional reach with the males having a better reach. This shows that at the elderly age: from 60 to 70 years, females are likely to surfer balance deficit than their male counterparts.

Therefore the balance in the elderly population should be screened routinely to avoid fall and its related complications that may be experienced by this set of population as a result of the disturbance in their sense of balance. The female elderly should be given more attention in balance screening. It will be highly expedient for the elderly to be screened for any balance impairment as they approach the age of 60 years so as to envisage their likely problem and to teach them balance compensatory mechanism which they may adopt when balance seems to be distorted. Balance should also be included as one of the primary screening for the elderly when being clinically examined in normal and routine clinical practice.

CONCLUSION

There were significantly better performances in both the static and dynamic balance tests performances by the male elderly. The elderly performed better in eyes opened performance than eyes

Table 1: Performance of subject in sharpened. Romberg Test

	EO60	%EO60	EC60	%EC60	DE60	%DE60	DEC60	%DEC60	NO
Male	83	80.58	41	39.00	20	19.42	62	60.19	103
Female	56	56.00	29	29.00	44	44.00	71	71.00	100

N.B:
E060 = Total number that reached 60 seconds in eyes opened performance
% E060 = Percentage of the total number that reached 60secs in eyes opened performance
EC60 = Total number that reached 60secs in eyes closed performance
%EC60 = Percentage of the total number that reached 60sec in eyes closed performance
DE060 = Total number that didn't reach 60secs in eyes opened performance
%DE060 = Percentage of total number that didn't reach 60secs in eyes opened performance
DEC60 = Total number that didn't reached 60secs in eyes closed performance
%DEC60 = Percentage of total number that didn't reached 60secs in eyes closed performance

Table 2: Comparison between the performance of male and female (Independent t-test) in FRT and SRT.

Parameter	Sex	No	Range	Mean ± S D	p-Value
Eye Opened (Sec)	Male	103	32.00 - 60.00	58.51 ± 4.43	0.010*
	Female	100	25.00 - 60.00	56.58 ± 6.03	0.010*
Eye Closed (Sec)	Male	103	12.00 - 60.00	46.98 ± 14.89	0.036*
	Female	100	8.00 - 60.00	42.59 ± 14.70	0.036*

N.B: * Indicates Significant difference.

closed performance in SRT. It was however observed that a high percentage of the elderly had a low performance in both balance tests. This shows the need to pay more attention to balance performance in the elderly population in order to prevent complications that may result from balance impairment in this group of individuals. If balance problem is addressed in the elderly, it is likely that their visit to the hospital will be reduced. They might be able to perform all their activity of daily living without any fear of fall. This may consequently improve their quality of life. The elderly is then likely to have little or no activity restriction or limitation when their balance sense is not impaired or when they can adequately compensate for any disturbance imposed on their balance while engaging in their normal activity of daily living.

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