COMPARISON OF BALANCE PERFORMANCE BETWEEN DIABETIC AND ELDERLY POPULATION

Saima khan1, Arshad Nawaz Malik2, Imran Amjad3, Hina Tariq4

Abstract

Objectives: The primary objective of the study was to compare the balance performance of elderly and diabetics in Rawalpindi and Islamabad.

Methodology: A comparative cross sectional survey conducted from 01 January and 30 June 2015. Samples of 414 participants were recruited through non probability convenient sampling technique, out of which 207 were in elderly group and 207 belonged to diabetic group. Different constructs of balance performance were assessed and measured through Berg Balance Scale; Timed up and Go test and Dizziness Handicap Inventory. Data was analyzed through SPSS version 21 and differences between both groups were observed through Independent t test.

Results: The results demonstrated significant differences between both groups on all measures of balance. The mean score of elderly and diabetic subjects on Berg Balance scale was 42.20±9.59 and 46.23±8.99 respectively (p value <0.05). Mean time taken by the elderly and diabetics on Timed Up and Go test was 15.63±5.16 and 11.71±3.84 respectively (p value <0.05). The average score of elderly and diabetics on Dizziness Handicap Inventory was found to be 52.81±21.83 and 37.65±22.51 respectively (p value <0.05).

Conclusion: Non-elderly diabetic population has better dynamic balance and mobility level as compared to elderly population without diabetes. Elderly population suffered from balance issues independent of accompanying diabetes mellitus.

Key words: aged; diabetes mellitus; postural balance; dizziness

Introduction

Balance is a vital component of daily life functioning which requires the awareness of the body position relative to the environment and generates appropriate motor responses in order to control movement (1). Balance deficits and dizziness in the old age are one of the major chronic problems being reported to the clinicians(2,3). Good balance with both static and dynamic components requires synergistic input from somatosensory, visual and vestibular systems(4).

With advancing age, these systems get compromised progressively due to normal physiological changes that occur in the process of aging(1). In addition to this, the elderly population usually suffers from multiple issues such as cardiovascular problems, metabolic syndromes, long term drug use (1), reduction in lower limb strength(4) etc. Every year, approximately 30 to 60% of the elderly population experience falls, out of which 10-20% cause injuries, hospital admission or even death. A number of studies have explored other potential risk factors for falls and diabetes mellitus is one of the most frequently associated among them(5). Individuals with diabetes have 5 times more risk for falls as compared to healthy people(6). Diabetic population experience a number of complications which could explain the potential mechanisms behind balance disorders and falls. These include peripheral neuropathy, retinopathy, postural hypotension, foot ulcers (5, 7). Diabetic population affected with sensory neuropathy have shown increased body sway when compared to unaffected diabetic individuals(8).

Agrawal et al conducted a study on balance and vestibular function and reported that the risk of occurrence of vestibular dysfunction increases with older age and is 70% higher in diabetic population (9). Studies on microscopic level have also suggested alterations within the vascularure and connective tissues along changes in inner ear fluid metabolism in diabetes which consequently lead to otolithic damage(10) explaining the higher incidence of dizziness in the respective population. Teasdale et al in their study demonstrated that changes in any two systems from visual, vestibular and somatosensory would affect the older individuals more than their younger counterparts (4).

This study aimed to determine the differences between the balance performance of elderly population with non-elderly diabetic individuals. There is insufficient literature on balance issues in elderly that have excluded accompanying comorbidities with age to study the individual effect of age on balance and dizziness. This study therefore, will help understand the balance deficits that occur in both elderly and non-elderly diabetics independent of diabetes mellitus and old age respectively.

Method

A comparative cross sectional study was conducted for a period of 6 months (1st January-30th June 2015) in Rawalpindi and Islamabad. Two groups of elderly and diabetics with a total of 414 participants were
recruited in the study through non-probability convenient sampling after they met the eligibility criteria. For diabetic group, participants with diagnosed cases of diabetes from at least 3 years, aged 30-50 were included while for the elderly group, individuals above 60 years of age without diabetes were included. Any individuals having any neurological deficit, musculoskeletal problems, inflammatory diseases, diabetic foot and tumors were excluded from the study. Balance performance of the both groups was assessed through Berg Balance scale (BBS), Timed up and go test (TUG) and Dizziness handicap inventory (DHI).

BBS is 14 item and 5-point ordinal scale designed to assess different functional balance (11). Total time required to complete the test is 15 minutes with a total score of 56. The generalized cut off score for BBS is 45; those who score higher than this score are less likely to fall(12). BBS has demonstrated good test-retest and inter-rater reliability(13).

TUG is designed to assess the mobility which requires both static and dynamic balance(14). It is a well-documented measure of balance for adults with good specificity and sensitivity to identify fall risk(15). A generalized cut off time for fallers on TUG is 15 seconds(15).

DHI is a 25-item scale designed to assess dizziness among the geriatric population(16). A score of 16-34 indicates mild handicap; 36-52 moderate handicap while a score of >54 signifies severe handicap for dizziness. DHI also demonstrated good test-retest reliability(17).

Data was collected from the normal population as well as from different hospitals of Islamabad and Rawalpindi after informed consent by the participants and approval by the respective ethical committees. In addition, the study was conducted in accordance with all the ethical principles by Declaration of Helsinki of 2013(18).

Data was analyzed through SPSS version 21 and the mean scores of both groups were compared using independent t test.

### Results
A total of 414 participants were recruited in the study out of which 207 were in the elderly group and 207 belonged to the diabetic group. Out of the total population, 241 were females (58.2%) and 173 were males (41.8%). Table 1 demonstrates the results of mean age and Independent t test which shows significant differences between both groups (P value <0.05). Overall, the diabetic group demonstrated better scores than elderly on all measures on balance i.e. BBS, TUG and DHI.

### Table 1: General characteristics of participants

<table>
<thead>
<tr>
<th></th>
<th>Elderly group n=207 (mean±SD)</th>
<th>Diabetic group n=207 (meansSD)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>48.82±6.33</td>
<td>67.35±6.00</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Berg Balance Scale</td>
<td>42.20±9.59</td>
<td>46.23±8.99</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Timed Up and Go Test</td>
<td>15.63±5.16</td>
<td>11.71±3.84</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Dizziness Handicap inventory scale</td>
<td>52.81±1.83</td>
<td>37.65±22.51</td>
<td>&lt;0.05</td>
</tr>
</tbody>
</table>

Figure 1: Categories of BBS in Elderly and Diabetics

Figure 2: Categories of TUG scores of Elderly and Diabetics

Figure 3 Categories of DHI scores of Elderly and Diabetics
Discussion
Both elderly and diabetic population are known to be affected by balance disorders. The current study is first of its kind that aimed to highlight the differences between balance performance of elderly and diabetic population. Hatch et al. conducted a study on community dwelling elderly people and their results demonstrated that their subjects were generally not at risk of falling because the mean BBS score (46.50) was greater than the established cut off score of 45. On the other hand, the results of the current study have shown the mean BBS score of 42.20 in the elderly group which is lower than the defined cut off score. This difference might be due to the fact that the participants in their study were already enrolled in informative lectures of senior citizen which might have enhanced their balance confidence unlike the participants of the current study. The same study by Hatch et al. showed the mean score of the participants on TUG (16.00) was longer than the established cut off score of 15 for fallers which is in agreement to the results of the current study.

The mean BBS score of the diabetic group in the present study (46.23) shows that they were not at risk of falls. This is contradictory to the results of another study conducted by Timar et al which showed the mean scores of diabetic population as 43.7 (at risk). This contradiction might be because most participants in their study were borderline elderly; therefore, age might have played a role in higher balance deficits in diabetics. Conversely, their TUG scores were similar to the results of the current study i.e. lower than the predefined cut off scores for fallers. The results demonstrated moderate handicap on DHI which are in accordance with the results of a previous study conducted on.

Overall, the elderly group demonstrated to have higher balance deficits on BBS, TUG and DHI as compared to the younger diabetic group. The potential reason for this might be that when compared to diabetics, the elderly population have an additional lack of hip and stepping strategies used to maintain balance and avoid falls. In addition to this, according to systems theory, normal walking with correct balance is also dependent upon the integrity of multiple systems working together including mobility of joints, timing and intensity of muscular actions, appropriate gait pattern, and normal sensory function of visual, proprioceptive and vestibular systems. With increasing age, these systems get compromised unlike the diabetic younger population in which the causes of balance issues are usually limited to peripheral neuropathy and vestibular dysfunction.

One of the limitations of the current study was that the elderly population was mostly not well educated and had difficulty in interpretation of the instructions given by the therapist, which might have affected their balance performance. Another limitation was that the elderly population included in the study were generally healthy and had very few comorbidities, therefore, this sample might not have fully represented that general elderly population.

Conclusion
Non-elderly diabetic population have better dynamic balance and mobility level as compared to elderly population without diabetes. Elderly population suffered from balance issues independent of accompanying diabetes mellitus. Future studies with elderly individuals more representative of the age group with prospective designs should be carried out to make robust conclusions.

References


**Authors’ contributions:**

**Saima Khan**: Conception and design of the work, the acquisition, analysis, interpretation of data, drafting the work and revising it for final approval. Responsible for data integrity.

**Arshad Nawaz Malik**: Conception and design of the work and revising it critically for final approval. Responsible for data integrity.

**Imran Amjad**: Revising article critically for important intellectual content for final approval. Responsible for data integrity.

**Hina Tariq**: Revising article critically for important intellectual content for final approval. Responsible for data integrity.