The Effectiveness of Dual Task Balance Training in Geriatric Population

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ABSTRACT

Background: Balance issues, which are more prevalent in older persons than in younger people, are one of the obstacles that come with ageing. Falls are a major public health concern because they are a primary cause of death and functional disability in older people. Dual-task training (DTT) have been showed that have satisfying effects on older adults.

Objective: To find the effect of dual task training on balance limitations in geriatric population.

Methodology: A total of 66 patients were selected based on the inclusion criteria of both male and female participants, age more than 65 years, past one year fall history and no neurological problem. 61 out of 66 completed the research, with 5 people dropping out of the study. Out of these 61 patients (28 were males and 33 were females with a mean age of 69 years±4.073). The Timed Up and Go Test (TUGT) and the Berg Balance Scale (BBS) scores were checked pre and post exercise application for any improvement in all the 61 patients. Data of 61 participants after a period of 4 weeks was obtained. The data was analysed using SPSS version 22. Wilcoxon signed ranks test was applied to compare baseline TUGT and BBS with follow up score.

Results: The mean pre TUGT was 16.98 seconds and mean post TUGT was 15.77 seconds and the mean pre BBS was 41 and post BBS was 50 at 95% confidence interval. The results were clinically not significant because the effect size was very small to be noticed, but were statistically significant as was shown p < 0.05.

Conclusion: After comparison of the results of this study with other research studies, it was concluded that though the results were statistically significant, they lacked clinical significance.

Keywords: Animal-assisted Therapy. Kynotherapy, Physical Therapists, Perceptions, Rehabilitation, Animal-assisted Therapy.

Introduction

Aging is a natural and irreversible normal phenomenon that takes place at a molecular level, reflected by changes in cognitive and sensory domains i.e. psychosocial, physical and functional changes, which can lead to balance impairments, resulting in falls.[1] Falls can or may lead to severe outcomes like fractures and fear of falling-which can lead to loss of autonomy, reduced quality of life, hospitalization and ultimately death. It is very prevalent among the elderly posing a significant challenge to the healthcare system. There are many factors responsible for falls, categorized into intrinsic and extrinsic risk factors, the former being age, health status and physical function associated with highest fall risks. The latter on the other hand comprises of surface characteristics, flooring, lights or footwear being used.[2] The ability to maintain balance in the activities of daily living influence the risks of falls particularly among the

elderly.[3] Balance deficiencies are the most common risk factor for falls with individuals being 5.4 times more prone to poor balance and posture. [4] Falls are the leading cause of morbidity and mortality as well as the main contributors to immobility in the elderly population.[5] Elderly adults with an increase in age, experience neuro-muscular and sensory changes that lead to poor postural control in standing and walking.[3] Cognitive impairments together with balance are also regarded as important precursor event of falls in older adults.[6] Cognitive impairments affect the dual task capability, resulting in elderly falls and instability.[7] A United Nation (UN) survey showed that older adult population has increased from 8-10% between 1950-2000 and expected to reach 22% by 2050.[8] Every year about 30-40% people aged 65 and above experience falls.[9]

Dual task training, the simultaneous performance of two tasks, is commonly used to assess multitasking abilities and the impact of such training on executive functions.[10] It helps evaluate the challenges older adults face in complex environments when shifting focus from cognitive tasks to maintaining balance. [11] It helps evaluate the challenges older adults face in complex environments when shifting focus from cognitive tasks to maintaining balance.[12] Studies, including one from the University of Portugal, suggest that advancing age affects body mechanics, influencing both single and dual tasks, consequently leading to postural instability and falls.[3] Research, such as Pellecchia's work, illustrates that incorporating balance training with dual tasks reduces body sway in normal elderly individuals.[11] Studies by Hiyamizu and others demonstrate improved standing postural control and reduced falls when dual tasks are integrated with balance training.[13] Combined interventions have proven more effective for elderly individuals at risk of falls, as shown in a study conducted in Hong Kong.[14] Various research studies, including those by J. Hotta Ansai and Halvarsson, highlighted the significant role of dual task balance training in improving gait, stability, and reducing the risk of falls among the elderly.[5, 15] Additionally, Wollesen's interventional study suggested that incorporating both single and dual task training with gait training diminished the risk of falls and enhanced gait in older individuals.[16] A meta-analysis published in a UK journal underscored the cognitive and functional significance of dual task activities.[17]

As healthcare advances, life expectancy rises, but so do age-related physical complications. One significant issue is instability during walking, which can lead to various health conditions and, in severe cases, even be life-threatening. Research efforts worldwide have aimed to enhance both static and dynamic balance. In Pakistan, the focus has primarily been on determining the prevalence of balance problems among older adults, but there's been limited exploration of interventions to address these issues. Existing studies often concentrate on patients with neurological conditions, overlooking the elderly population who are facing balance challenges while multitasking in their daily activities. This gap underscores the need for more research and interventions tailored specifically for community-dwelling older adults experiencing such balance issues.

Methodology

This quasi experimental study was conducted at Fauji Foundation Hospital Peshawar after obtaining ethical approval (No.Dir/KMU-EB/TE/000767) from ethical committee of Khyber Medical University (KMU) Peshawar. 66 elderly individuals of their own consent agreed to participate in the study. The following inclusion criteria were set: a) age > 65 years b) having history of fall c) able to ambulate without assistive devices or any other support d) having a TUGT score of >15 minutes and e) a Berg Balance Score of <47. Participants were excluded if they met the following exclusion criteria: a) any other neurological disorder b) any cardiovascular problems c) hearing problems d) dizziness e) severely impaired cognition. Participants signing the consent form were explained the study in detail after which the pre intervention results for BBS and TUG test outcomes were recorded. Sampling was convenient sampling. 66 was the sample size calculated through Open-epi using the following assumptions: Alpha (Threshold for rejecting the null hypothesis: 0.05 Effect size: 0.2 Mean BBS before Dual Task Training in geriatric population: 28.30 (5.27) Mean BBS after DTT in geriatric population: 34.30 (4.69) Mean improvement in BBS before and after DTT: 6 (0.58)[7]

The tools used for assessment include the Timed Up and Go Test (TUGT) and the Berg Balance Scale (BBS). Timed Up and Go Test is a straightforward and quick evaluation tool which uses a stopwatch to measure time taken to complete tasks, such as rising from a chair, walking a short distance, turning, and returning to the chair without support. It's a reliable measure for assessing mobility and stability and for predicting risk of falls, particularly in the elderly population.[18-20] On the other hand, the Berg Balance Scale, established in 1989, assesses both static and dynamic activities related to everyday tasks, examining balance and posture while performing 14 functional activities. This scale is widely utilized in clinical settings and research due to its cost-effectiveness, simplicity, and ability to evaluate fall risks among the elderly.[21] Pre-intervention, baseline scores for TUGT and BBS were recorded. Strength and dual-task balance exercises began from the first day, with a total of 3 sessions per week over 4 weeks, detailed in Table 1. As the population was at a very high fall risk so the

physiotherapist was there full time to support the individuals in case of a fall and to guide them during the exercises. Exercises were performed in close proximity to the wall, such that in case of support needed the elderly could hold on to the wall. Non slip mats were utilized across the exercise room to keep the elderly

at minimum fall risk. After the 4-week period, post-intervention TUGT and BBS scores were measured. Out of the 66 initial participants, 5 were lost to follow-up because of no interest in further continuing the exercises, and the analysis was conducted on the data from the remaining 61. To ensure impartiality, initial and final assessments were performed by one physical therapist while treatment sessions were administered by another therapist available at the hospital.

SPSS version 25 was used to analyze and record the data. Data was not normally distributed, thus all discrete variables were expressed as medians and quartiles, with percentiles. Wilcoxon signed ranks test was used to compare change in data within group before and after intervention. Level of significance was kept at *p<0.05.*

Results

Tabel, I Showing the weekly exercises done in each session and the no. of sets and repetitions. Table II presents the key characteristics of the participants. The Timed Up and Go test (TUGT) scores before and after exercise were 16.97 seconds ± 2.035 and 15.77 seconds ± 1.927, respectively. Regarding the Berg Balance Scale, the scores were 41.23 ± 7.349 before exercise and 49.75 ± 5.169 after exercise.

Table III showed a significant difference between the variables at 95% confidence interval, thus the null hypothesis was rejected and it was presumed that there is difference between

the pre TUGT and post TUGT and between the Pre BBS and Post BBS.

It is also worth mentioning here that the results were statistically significant but not clinically significant because the effectiveness proposed i.e. BBS > 52 and TUGT <14 seconds was not achieved in a one-month time span.

Table II: Background information and study characteristics at baseline and after treatment or exercise application.

VARIABLES	Mean ±SD	N	%
Age(years)	69 years±4.073		
Gender			
Male		28	45.90%
Female		33	54%
Pre-intervention TUG SCORE	16.98s±2.035		
Pre- intervention BBS value	41±7.34		
Post-intervention TUG SCORE	15.77s ± 1.927		
Post-intervention BBS value	49.75 ± 5.169		

Table III: Showing the Pre and Post Intervention changes.

	Pre-intervention Percentile(IQR)	Post-intervention Percentile(IQR)	*P-value*
TUGT	15.99(15.6-17.96)	14.96(14.62s-16.58s)	**0.00***
BBS	44(37-47)	52(46-54)	**0.00***

Table IV: Shows the test for normality for the Pre and Post Timed p and go test (TUGT) and Berg Balance Scale (BBS)

	SHAPIRO WILK TEST		
	STATISTICS	Df	SIGNIFICANCE
Pre TUGT	.795	61	.000
Post TUGT	.895	61	.000
Pre BBS	.896	61	.000
Post BBS	.840	61	.000

Discussion

The main finding of this study were that dual task training comprising of strength training coupled with balance exercises

Table I: Showing the weekly exercises done in each session and the no. of sets and repetitions.

EXERCISES	WEEKS			
	WEEK I	WEEK II	WEEK III	WEEK IV
STRENGTH TRAINING (REPS x SETS)	1. Seated calf raise (15x2) 2. Leg curls (15x2) 3. Lunges (15x2) 4. Hip ABD/ADD (15x2)	Repeat same as week I	Repeat same as week I	Repeat same as week I
BALANCE TRAINING INCORPORATED WITH DUAL TASK TRAINING	1. Sitting with eyes open and eyes closed---2 mins each 2. Standing with eyes open and eyes closed---2 mins each 3. Walking forward with head movements left and right---10 rounds 4. Walking backwards---10 rounds 5. Tandem walk----10 rounds 6. Walking and talking while holding a glass of water---10 rounds 7. Sitting on a SWISS ball and naming objects---2 mins	Repeat same as week I	Repeat same as week I	Repeat same as week I
	___REASSESSMENT___			

improved both static and dynamic balance in the elderly as exhibited by improved Timed Up and Go Test (TUGT) and Berg Balance Scale (BBS) scores.

The mean age in this study for the elderly population was 69 years, in a systematic review the mean age group taken was between 60-69 years.[22] In another research on dual task training that was a randomised control trial where the individuals were divided in three different groups, two groups had a mean age of 69.5 and 69.9 years respectively.[23] These mentioned research findings match the mean age of this research study, however, in one research assessing the elderly in an individual adjusted progressive group training program for older adults where the participants were divided in two different groups, the mean ages were 76 years and 78 years respectively this change is likely because the maximum age group individual in that study was 93 years unlike in the current research study where the maximum age was 80 years.[15]

The mean timed up and go test before the application of exercises was 16.98 seconds and after exercise application was 15.77 seconds showing an improvement in the time taken to cover a distance of 3 meters. These finding match the results of an RCT where the pre intervention score was 16.97 seconds in the experimental group and 12.71 seconds post intervention in the same group. Although the study employed static balance training for 12 weeks unlike the present study which utilized dual task training for 4 weeks, still the results showed that exercise can truly benefit individuals especially the elderly or individuals with balance problems. The mean Berg balance score achieved in our research before and after the exercise application were 41 and 50. Comparing these to a research study in the USA a Berg balance score of 27 was found for the pre intervention score in the experimental group and 40 for the post intervention in the same experimental group. The results of the present study improved whereas, the US based study results also improved, but there was a very high increase in the US based study i.e. from 27 to 40 which is a 13 point increase whereas, the present study showed a 9 point increase. Reason

for this difference could be that the US based study looked at individuals with very low BBS scores, it was an RCT so the experimental group treatment also proved beneficial i.e. static balance exercises, and it was a 12 weeks study unlike the present study so interventions over long time proved beneficial[24]

Similarly, in a study conducted to assess the instability in elderly population BBS and TUG test were used where the mean BBS in the balance impaired older adults was 48.18 and in the healthy older adult was 55. This study looked at balance impaired older adults and normal older adults. The present study just looked at balance impaired older adults thus only those results could be compared. Present study had a better score in post intervention (52 BBS) whereas, the mean score in the comparative study for balance impaired older adults was 48.18. This shows that the present study results were significant and led to improvement in fall aversion, with the results being almost same as healthy older adults > 52 BBS. On the other hand the TUG test score in the balance impaired adults and healthy older adults was 8.77 seconds and 7.73 seconds, different to our TUG test score reason being that the research study had compared two groups, the healthy adults and those adults with balance issues whereas, we had compared the different outcome measures within the same group of elderly instead of taking two different groups.[12]

The improvements in the outcome measures TUGT and BBS in our study are regarded to be the novel findings. The exercise session duration was 3 days per week for 4 weeks, and a recent systematic review had suggested that balance exercises performed for at least 3 days per week for 4 weeks and at a duration of 10 minutes minimum had the tendency to improve balance and stability in older adults.[25] A study conducted at the rehabilitation department of Inje University in Korea revealed that elderly individuals undergoing motor dual task balance training (MDBT) experienced greater enhancements in gait speed and balance improvement compared to those undergoing simple task balance training (SBT). While the research shared similarities with our study in terms of session count—12 sessions conducted twice per week for 6 weeks—our research varied by conducting the same number of sessions but three times per week for 4 weeks.

The study's results, showcasing improvements in TUGT and BBS, are considered innovative. They suggest that exercises like those conducted in the study could be integrated into geriatric fitness programs, especially in physical therapy and rehabilitation services for the elderly, aiming to decrease fall risks and enhance their quality of life by improving both static and dynamic posture.

Conclusion

Incorporating dual task training exercises into the daily activities or treatment regimens of older adults at risk of falls can yield positive outcomes for balance. These benefits include improved balance control, a reduction in falls, and increased confidence in individuals who previously feared falling.

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