

ORIGINAL ARTICLE

Effect of Dual Task Training on Balance and Gait Ability In Geriatric Patients

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ABSTRACT

Dual task training is defined as simultaneous execution of two activities that require coordination. With aging, various systems of the body weaken such as, musculoskeletal, cardiovascular, neuromuscular etc. Geriatric population benefits from physical exercises and various interventions, that helps to improve their balance, correct stability issues, and enhance gait ability. This study aimed to assess the efficacy of dual task training on balance and gait in the geriatric population. An experimental study was done in an old age home. 30 subjects were divided into 2 random groups; group 1 was experimental group who received dual task training program along with conventional exercises. Group 2 was controlled group, who received conventional exercises only. Study duration was four weeks, thrice in a week for both the groups. Pre and post assessment was done with the help of TUG test, FRT and FGA. The statistical analysis was done by using the t-test and the result was generated. Student independent T test was used in this study. P value <0.05. There was a significant improvement in balance, and gait in both the groups. But when both groups compared, experimental group was found to be significantly improved. The study revealed that dual task training might be utilized to improve the balance ability in geriatric population, the second finding of the study suggested that dual task training in elderly improves the gait ability as well as the quality of life in geriatric population.

Keywords-Balance, Dual task training, Gait, Geriatric population, Motor skills.

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INTRODUCTION

The term Motor skills have developed by emphasizing more attention to the process of motor development in terms of different aspect of motor behavior. Motor skills, can be defined as the function that involves activity of the muscles resulting a movement to performing a task. According to Wickstrom (1977) Motor domain can be explained as the basic movement activity that is based on a general goal that serve as simple to more advanced and highly specific activity.[1] Individual with movement difficulty cannot perform normally defined movements according to one's age. Movement difficulty in a series leads to significant effect on lifespan and ADLs of the individual.[2] Global population of age 60 years and older are considered as the geriatric population. Global population is increasing rapidly. According to the records of union health ministry, geriatric population age group was increased by 100 million in 2013, and will increase by 198 million in 2030. Fall is considered as the major injury or giant of geriatric. Fall in geriatric leads to many other diseases such as non-healed fractures, or life threatening conditions.[3] Growing age also leads to many types of disability, like movement, hearing, vision, sensory loss due to some intrinsic and extrinsic factors. Intrinsic factors involving age related changes that occurs in side of the body in various system and extrinsic factor includes environmental factor such as slippery surface, that results to falls and lead to disability in geriatric population. Approaches that are designed to decreasing this disability should be disease specific, training awareness, building blocks from simple to complex environment.[4] Balance can be defined as maintaining the projection of the body or maintaining

the body in equilibrium stage in response to various forces that are acting in the body at the same time. Maintenance of center of mass within manageable base of limit is termed as balance. Balance also includes maintaining the center of mass of the body in various situation like walking, climbing the stairs, running, jumping, or standing.[5] Walking can be described as one of the natural and common characteristics in human being but it is one of the most complex phenomena because it includes contributed efforts of various systems of our body such as nervous system musculoskeletal system, cardiovascular system and others. Gait can be described as coordinated activity of the muscles that lead to forward or backward translation of the body. When pattern of walking with the coordinated movements of upper and lower limbs combined with the posture known as the gait.[6]

With the aging, gait ability decreases. According to the researches one third subjects of the geriatric population fall at least once in a year that indicates during walking a large number of geriatric populations falls. Older people have more risk of fall during gait because they walk with lower stride frequency, lower gait intensity, and lower dynamic stability. Quality of gait and gait characteristics can be used as the main factor of identification for the individuals for risk of falls. [7] Older individuals are more prone to fall, for challenging or improving the balance ability during performance of a functional task one can do 2 tasks simultaneously for example walking while answering the simple question like yes or no. This task is known as the dual task. It is suggested that dual task improves the functional ability, and balance with decreasing the dependency in older individuals.[8] Dual task training under various condition is further divided into two types, Fixed priority dual task training and variable priority dual task training. In fixed priority is described as when the subject is asked to place same attention in both the task at the same time whereas variable priority is when the attention is switches during the both tasks, more attention towards one task and less attention towards the another one. [9] Tool or scale used for measuring the balance in geriatric population is timed up and go (TUG)test, this tool is widely use to access the functional balance and mobility in geriatric populations.[10] Functional reached test (FRT) is another measurement tool for measuring the standing balance, as elderly people have experienced more fall, it is important to access the balance in both standing and walking. FRT can be defined as the maximum distance achieved by the subject reaching forward beyond the arm length with maintain the fix base of support.[11] The length is measured by measuring the length from the acromion process of the shoulder of the subject to the third metacarpal while flexing the arm 90° , now instruct the subject to reaching forward with the fix base of support as maximum as he or she can. The initial recording is then subtracted from the final recording for getting the final score of FRT. [12] The functional gait assessment (FGA)is defined as the tool or scale to measure the dynamic gait in the population with the neurological disorder and in geriatric population.[13] The functional gait assessment FGA is a 10-item based functional index that is used to access gait. It includes 7-8 items from Dynamic Gait Index (DGI) and 3 other items as follows- Narrow base of support gait, gait balance and walk with eye closed. Every item has a scored on four-point scale ranging from 3 as normal, 2 as mild impairment 1 graded as moderate impairment and 0 is severe impairment (cannot perform without assistance, or sever gait imbalance.[14] The need of our study is to find out the efficacy of dual task training in the balance and gait ability in geriatric population and reducing the risk of fall that leads to many other sever injuries in older population.[15].

MATERIAL AND METHODS

An experimental study was conducted for geriatric population at Institutional old age home in Moradabad, Uttar Pradesh. Normal elderly individuals of age 60- 70 years were recruited from an affiliated institutionalized residence After the ethical clearance from College Ethics Committee, TMU College of Paramedical Sciences ethical clearance certificate with reference no. PM/ETHICAL/PT/2023/009 obtained. Subject were urged not to engage in any activity two hours before to the exam or training session in order to minimise potential weariness and pain. Inclusion criteria for this study was 60 to 70 years older age having ability to walk independently with or without assistive device and able to do simple counting. Exclusion criteria included any musculoskeletal disorder i.e. Recent fractures, dislocation, spinal disorders, Neurological conditions such as Parkinson's, Alzheimer's, dementia, Cardiac conditions i.e. Recent congestive heart failure, Myocardial Infarction, Recent Surgeries. Total 30 subjects were allocated randomly in the two different exercise groups by using chits' method.

Procedure: The groups were Group 1, Dual task training and Group 2, Controlled group. Participants were totally unaware of their groups. Each participant received an explanation of the study based on the group to which they had been assigned. All participants received consent from prior to the tests and training. The study was thoroughly explained to all subjects. Thereafter Pre assessment of both the groups was done with the help of 3 different outcome measure. Measures used were TUG (Timed UP and Go) test, FRT (Functional reach Test) and FGA (Functional gait assessment). Experimental Group received

dual task training for 4 weeks, thrice in a week for 45 minutes, whereas Control Group received conventional exercises for four weeks thrice in a week for 45 minutes. Post 4 weeks of training, post assessment was done for both the groups with the help of outcome measures FRT, TUG and FGA. The changes were recorded carefully.

Experimental Group – involves a session of 45 minutes, 3 times in a week for 4 weeks.

- 10 minutes of Warm up- Self stretching of Calf, Hamstrings, Quadriceps, Biceps, Triceps, Side bending, Side twisting, Marching 10 repetitions each
- Gait training- 10m walk with backward counting from 100.
- Comfortable speed 3 round with the rest period of 3 minutes.
- After rest subjects will be instructed to clear the obstacles between walkway like cones, ropes, and wooden blocks without counting.
- 05 minutes of Cool down- Relaxation and breathing exercises.

Controlled Group – received basic conventional training. Each session will be assigned as 10 minutes of Warm up- Self stretching of Calf, Hamstrings, Quadriceps, Biceps, Triceps, Side bending

- 10 minutes of Upper limb exercises- ROM exercises (shoulder flexion-extension, abduction adduction, biceps curl, elbow extension, forearm pronation- supination, wrist flexion-extension 10 repetitions each)
- 10 minutes of Lower limb exercises- ROM exercises (Ankle-toe movements, Inversion eversion, Knee flexion- extension, hip flexion- extension, hip abduction- adduction, Squats 10 repetitions each)
- 10 minutes of Core exercises- bridging, pelvic rotations, unilateral knee to chest, bilateral knee to chest, spinal extension on elbows, prone knee bending.
- 05 minutes of Cool down- Relaxation and breathing exercises.

RESULTS

All study data were recorded and entered in the SPSS V.21 with the level of significance set as $p \leq 0.05$. Descriptive statistics were calculated using Mean $\pm$ SD. The mean score of Group -1 and Group-2 for the Age was 63.20 ± 2.00 and 63.33 ± 2.46 respectively. The frequency distribution of both the genders for group-1 (Experimental group) was 9 ± 30 and 6 ± 20 respectively. The frequency distribution of both the genders for group-2 (controlled group) was 1 ± 3.33 and 14 ± 4.67 respectively. T test was used for the finding difference between the group for observing balance and gait ability in geriatric population.

Table 1: Descriptive statistics of the groups TUG, FRT & FGA pre and post respectively

Group Statistics					
	Group	N	Mean	Std. Deviation	Std. Error Mean
TUGPre	Experimental	15	40.1987	3.07520	.79401
	Control	15	38.3440	3.65174	.94288
TUGPost	Experimental	15	25.2827	3.18730	.82296
	Control	15	35.3967	3.80095	.98140
FRTPre	Experimental	15	7.07	1.870	.483
	Control	15	8.33	1.718	.444
FRTPost	Experimental	15	10.33	1.799	.465
	Control	15	10.53	2.386	.616
FGAPre	Experimental	15	10.53	1.246	.322
	Control	15	10.00	2.035	.526
FGAPost	Experimental	15	18.33	1.633	.422
	Control	15	13.27	1.624	.419

The mean score of TUG Pre for both the groups was 40.20 ± 3.07 and 38.34 ± 3.65 respectively and the p-value of TUG Pre for both the groups was 0.14. The mean score of TUG Post for both the groups was 25.28 ± 3.18 and 35.40 ± 3.80 respectively and the p-value of TUG Post for both the groups was 0.00. The mean score of FRT Pre for both the groups was 7.07 ± 1.87 and 8.33 ± 1.71 respectively and the p-value of FRT Pre for both the groups was 0.064. The mean score of FRT Post for both the groups was 10.33 ± 1.80 and 10.53 ± 2.38 respectively and the p-value of FRT Post for both the groups was 0.79. The mean score of FGA Pre for both the groups was 10.53 ± 1.24 and 10.00 ± 2.03 respectively and the p-value of FRT Pre for both the groups was 0.40. The mean score of FRT Post for both the groups was 18.33 ± 1.63 and 13.27 ± 1.62 respectively and the p-value of FRT Post for both the groups was 0.00.

Table 2: Independent sample t test comparing pre and post scores of TUG, FRT & FGA using Levene's test (equality of variances)

Independent Samples Test					
		Levene's Test for Equality of Variances		t-test for Equality of Means	
		F	Sig.	t	df
TUGPre	Equal variances assumed	.264	.612	1.505	28
	Equal variances not assumed			1.505	27.212
TUGPost	Equal variances assumed	.001	.978	-7.897	28
	Equal variances not assumed			-7.897	27.175
FRTPre	Equal variances assumed	.162	.691	-1.932	28
	Equal variances not assumed			-1.932	27.803
FRTPost	Equal variances assumed	.647	.428	-.259	28
	Equal variances not assumed			-.259	26.031
FGAPre	Equal variances assumed	1.224	.278	.866	28
	Equal variances not assumed			.866	23.200
FGAPost	Equal variances assumed	.021	.887	8.520	28
	Equal variances not assumed			8.520	27.999

Table 3: analysis using independent samples test to determine the significant values of TUG, FRT & FGA respectively

Independent Samples Test				
		t-test for Equality of Means		
		Sig. (2-tailed)	Mean Difference	Std. Error Difference
TUGPre	Equal variances assumed	.144	1.85467	1.23267
	Equal variances not assumed	.144	1.85467	1.23267
TUGPost	Equal variances assumed	.000	-10.11400	1.28078
	Equal variances not assumed	.000	-10.11400	1.28078
FRTPre	Equal variances assumed	.064	-1.267	.656
	Equal variances not assumed	.064	-1.267	.656
FRTPost	Equal variances assumed	.797	-.200	.772
	Equal variances not assumed	.798	-.200	.772
FGAPre	Equal variances assumed	.394	.533	.616
	Equal variances not assumed	.396	.533	.616
FGAPost	Equal variances assumed	.000	5.067	.595
	Equal variances not assumed	.000	5.067	.595

Table 4: comparison of the values of Pre and post intervention between the groups

Independent Samples Test			
		t-test for Equality of Means	
		95% Confidence Interval of the Difference	
		Lower	Upper
TUGPre	Equal variances assumed	-.67034	4.37967
	Equal variances not assumed	-.67364	4.38297
TUGPost	Equal variances assumed	-12.73757	-7.49043
	Equal variances not assumed	-12.74116	-7.48684
FRTPre	Equal variances assumed	-2.610	.076
	Equal variances not assumed	-2.610	.077
FRTPost	Equal variances assumed	-1.781	1.381
	Equal variances not assumed	-1.786	1.386
FGAPre	Equal variances assumed	-.729	1.796
	Equal variances not assumed	-.741	1.807
FGAPost	Equal variances assumed	3.849	6.285
	Equal variances not assumed	3.849	6.285

DISCUSSION

The purpose of this study was to determine the effect of dual task training on balance and gait ability in geriatric population. This part focused on hypothesized outcomes, effect of the training, and how result compare to current literature. The subjects were taken from institutionalized old Age home including

with the age group of 60-70 years. First objective of this study was to find out the effect of dual task training in balanced ability in elderly population. Resulting from the analysis of the present study the mean score of TUG in group 1 pre training was 40.20 ± 3.07 and post training was 25.28 ± 3.18 . Mean score of group 2 pre training was 38.34 ± 3.65 and post training was 35.40 ± 3.80 . The significant difference of p value in group 1 (experimental) pre training was 0.14 and post training was 0.00. *Noorolla Zahedian-Nasab et al. (2021)* in their study stated that according to result balance exercises results improvement in balance, by improving the TUG and Falling efficacy scale (FES) score in geriatric population. The result of the investigation shows improvement in mean score of TUG and balance; it enhances the BBS score respectively. On comparing the variables of pre and post TUG and FES test the mean score is significantly improved by p value <0.001 in post intervention group. The result clearly shows that the 2 groups were not significantly similar after and before the interventions in balance ability. the study suggested that TUG was improved by 2.33 sec in interventional group [16]. *Magdalena Hagovska et al. (2015)* in this study stated that result of the combination of two exercises results better performance in gait speed, balance, and lifestyle quality. The effect of training positively improves the fear of fall in elderly rather than single task training group. The result further explains that brain of the group that receives dual task training was working better, investigations show a great improvement in physical fitness of the group that improves the self-confidence and reduces fear of fall in elderly [17]. The mean score of FRT pre training in group 1 (experimental) was 7.07 ± 1.87 and post training 10.33 ± 1.80 . The mean score of FRT pre training in group 2 (controlled) was 8.33 ± 1.71 and post training was 10.53 ± 2.38 . The significant difference of p value in group -1 (experimental) pre training was 0.064 and post training was 0.79. That results FRT is not significant for this study. *Ayelet Dunskey et al. (2017)* in this study focuses on examine what factor improves the ability to control static balance and dynamic balance. The study explains that there is a low connection between static and dynamic balance as measured by TUG and FRT. The study found low correlation in static and dynamic balance among geriatric population, in addition to that the study shows the improvement in dynamic balance by TUG but no improvement in static balance by FRT. The finding of the study suggested that the parameters of static balance is linked by vestibular function to some extent. The study further stated that it could be possible the individual with the decreasing sensitivity to head position changes as a series of progressive worsening of vestibular function that results a decrease in performance and task that involve body and head position changes [18]. *Srikanth Laddhiperla et al. (2017)* stated in their study that the study shows moderately co relation between functional reach and lateral reach. Study explains that functional reach measures the reach value in one direction only a person with good anterior and posterior stability could do this, while fall occurs in multi direction, reaches that access the stability in multi direction should be used for accessing the stability [19]. The second objective of this study was to find out the effect of dual task training to improving gait ability in geriatric population. As per the result of present study the mean score of FGA pre training in group-1 (experimental) was 10.53 ± 1.24 and post training was 18.33 ± 1.63 Mean score of FGA pre training in group-2 (controlled) was 10.00 ± 2.03 and 13.27 ± 1.62 . The significant difference of p value in group -1 (experimental) pre training was 0.40 and post training was 0.00. *Marianne Beninato et al (2014)* in this study evaluated the minimal clinical difference of FGA based direct survey. This was the first study that use the FGA survey before and after balance training in older adults. While investigating the finding. It is important to consider that minimal clinical difference of FGA depends on some several factors i.e anchor, setting, patient population and diagnosis. On comparing the pre and post result 4 point of minimal clinical difference FGA shows the difference in post calculation by 8 points. Study stated that this can be used for the program access as well as measuring the individual progress [20]. *Volkan Yuzlu et al (2021)* Claimed that study shows a positive improvement in balance and gait in older adults after the dual task training. The study claims that when the tasks are performed in form of dual tasks an automatic improvement builds the component of dual activity. In this study the gait speed is increased in dual task training group but no improvement was noticed in single task training group. The improvement in dual task training group can be explained as the integration of dual task training results improvement in gait transferring, in addition to these cognitive skills, balance also effects the gait speed positively. Study results a significant improvement in dual task training group in balance and gait speed. Study suggested that this method can be used as the improvement in the balance and gait speed in older adults [21].

CONCLUSION

While finding the effect of Dual Task Training in improving balance and gait in geriatric population the present study concluded that there is a significant improvement in individual's balance after 4 week of dual task training as well as after 4 weeks of conventional training as it was observed through the outcome Timed Up and Go test in Experimental Group (Group 1), but there was no significant

improvement in Functional reach test. There is not only an improvement in balance but also a significant difference in gait observed after the Functional gait assessment in experimental Group (Group 1). As per the results of the study, dual task training can be used as another approach for balance improvement and gait ability in geriatric population.

STUDY LIMITATIONS & RECOMMENDATIONS

The sample size recruited was small and the duration of the study was short. Selected age group of the sample was approached from only one old age home. Similar study can be done by doing it as gender specific & it can be done with use of more functional tests determining performance outcomes.

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