Original Article

# A comparative analysis of effect of single task Vs dual task in balance training in older adults

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## Abstract

**Aim:** To compare the effect of single task versus dual task training on balance performance in older adults. **Objective:** To study the effect of single task and dual task training and To compare the effect of single task versus dual task on balance performance. **Procedure:** 60 Subjects were collected according to inclusion and exclusion criteria. Written consents were taken from the respective subjects for study. Participants were divided into Group 1 and Group 2 by simple random sampling for 4 weeks Group 1 received single task balance training and Group 2 receive Dual Task Balance Training. Each group received 1 hour individual training sessions 3 times a week. Berg Balance Scale and Dynamic Gait Index were the outcome measures taken before and after the treatment protocol. Statistical test used for analysis were: Paired t and Unpaired t test. **Result:** After 4 weeks, Group 2 showed more improvement in balance ($p<0.0001$) considered extremely significant than group 1. **Conclusion:** This study concludes that dual task training is more effective in improving balance performance then single task training in older adults.

**Key Words:** Single task, Dual task, Balance, Fall.

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## INTRODUCTION

Falls are most common cause of injury in older adults and a serious problem related with ageing.[1]It affect older people in both residential care and home settings but only ten percent cause serious injury. Although some study also showed falls affected thirteen percent of people in 40-59 year age group.[2] Several studies have been performed among both home living and institutionalized populations to define risk factors associated with falls. The risk factors included both intrinsic or personal factors (example- balance impairment, neurological disorders, postural hypotension, and medication use.) and extrinsic or environmental factors (example- ill fitting footwear, poor lighting, slippery surface and inappropriate furniture).[1] The risk of falling increases with the number of risk factors present, suggesting that a multifactorial strategy of risk-factor abatement may reduce the risk of falling.[3] Physical fitness is especially important in old age. When balance is not challenged on a regular basis through physical activity, the individual may demonstrate decreased automaticity of postural control which then require more cognitive processing.[4]Age related changes that may affect postural stability include the reduction of reflex speeds and poor co-ordination, vestibular dysfunction may mean there is overlap between the timing of reflexes and the voluntary responses to correct the loss of balance. Without it, everyday tasks and unforeseen demands such as slopes, uneven ground trips and even everyday tasks such as getting up from the toilet may place insurmountable demands on ageing body.[5] There are multifactorial interventions introduced which include eliminate environmental hazards, improve home support, provide opportunities for socialization and encouragement, modify medications, provide balance training, involve family and provide follow up. Keeping this in mind, this study is designed with the purpose of identifying the most appropriate balance training program under single task and dual task.[1] Guidelines for physiotherapist and occupational therapists working with older people who has fallen include balance training, strengthening the muscles around the hip, knee and ankle, increasing flexibility (range of motion) of the trunk and

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lower limb, teaching how to rise from the floor and the provision of mobility aides and appliances if necessary. Single task training involves performing functional task that require balance in isolation. Here the therapist can vary the condition to increase the challenge to balance during performance like sensory cues or support surfaces can be changed.[1] In order to maintain postural control, humans continuously use information from somato-sensory, visual and vestibular sources resulting in efferent signals that activate appropriate postural muscles.[3] Dual task training under variable priority involves multiple task performing simultaneously with varied attention to task. It has been seen that ability to maintain postural stability is reduced when performing two or more task simultaneously and these deficits are increased in elderly people with balance impairment. Increased difficulty maintaining balance under divided attention situations in older adults may result from : Inability to shift attention between tasks, Reduction in attention capacity, Increased demand for limited intentional resources associated with impairment in postural control system and an interaction of these factors.[4] It has been suggested that training under both single task and dual task condition is necessary to optimize functional independence and reduce falls in elderly people. [1]Although balance function decreases with increasing age. Some studies have shown improved balance in the elderly after short term physical training.[6] Two scales were used to access the outcome of both intervention. They are Berg Balance Scale (BBS) with ICCs 94% and Dynamic Gait Index(DGI) with ICCs 95%.[7,8] This scales helps to compare the effectiveness of dual task condition balance training with single task condition balance training in older adults as it has good reliability. The purpose was to evaluate the more effective balance training to decrease rate of falls in older adults.

**Procedure**

In this study 60 participants were selected on the basis of inclusion and exclusion criteria and were divided into two groups including both male and female. A detailed explanation of procedure was given to the patient after which consent was signed. A pre and post experimental study was conducted prerna bhavan (orphanage) were participants with age between 55-65years were included. Total 30 samples were randomly allocated in respective groups i.e. group 1(single task training ) and group 2(dual task training). They were all trained by same coach. Respective protocol was followed for group 1 and group 2; and protocol was programmed for 4 weeks. Participants were evaluated before and after the training program by using BBS and DGI. Warm up phase of 5-7mins was given initially for both group1 and group 2 followed by respective balancing task for 30-40mins. After task active cool down phase of 5-7 min was performed in which participants were asked to do stretching of muscles (pectorals, trapezius, hamstrings, quadriceps).During the balance activities, a passive break of 1 to 3 min was given between two consecutive activities. Training occurred using 4 separate training stations each with an instructor so that 4 participants are treated simultaneously. Training was been given for 3 days a week for 4 week.

**A:** **B:** **C:** **D:**

**Figure 1:** Group 1 balance training; **A:** Tandem standing 8 to 10min 1st station; **B:** Marching on one place 8 to 10 min 2nd station; **C:** One leg standing 8 to 10min 3rd station; **D:** Walking on curved line 8 to 10min 4th station

**Figure 1.2:** Group 2 balance training

**A:** Semi tandom standing with arm alteration 8 to 10min 1st station; **B:** Carrying bowl of water while walking 8 to 10min 2nd station
**C:** Walk with horizontal and vertical head turns on command 8 to 10min 3rd station; **D:** Walking sideways with addition /substraction problems 8 to min 4th station

**Material Used**

- Berg Balance Scale
- Dynamic Gait Index
- Data collection sheet
- Consent form
- Bowl of water

## RESULT

The data was managed on excel spread sheet and was analyzed using a 1- way ANOVA for continuous variables. One way analysis of variance was used to analyze the difference among the balance improvement in group 1 and 2. T-test (paired) used to analyze the difference between the balance improvement within the group and unpaired test was used to analyze the difference between the balance improvement between group 1 and group 2. A significant level of p value ($p<0.0001$) was fixed.

**Table 1:** Comparison of pre and post intervention of BBS

| | Pre BBS | Post BBS | T Value | P Value |
|---|---|---|---|---|
| Group 1 | 47.06 | 50.5 | 12.722 | <0.0001 |
| Group 2 | 47.13 | 51.73 | 17.634 | <0.0001 |

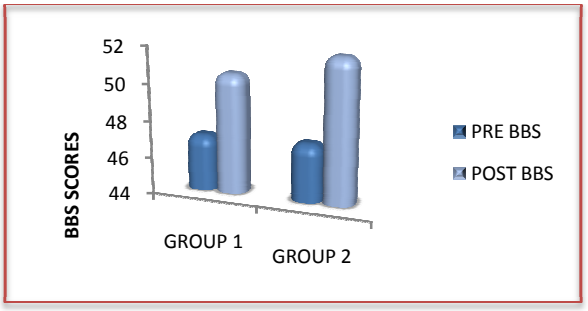


**Figure 1:** Comparison Of Pre And Post Intervention Of Bbs Score Among Group 1 And Group 2

**Table 2:** Comparison of pre and post intervention of DGI

| | PRE DGI | POST DGI | t value | p value |
|---|---|---|---|---|
| Group 1 | 11.6 | 17.7 | 22.369 | <0.0001 |
| Group 2 | 12.33 | 20.33 | 46.885 | <0.0001 |

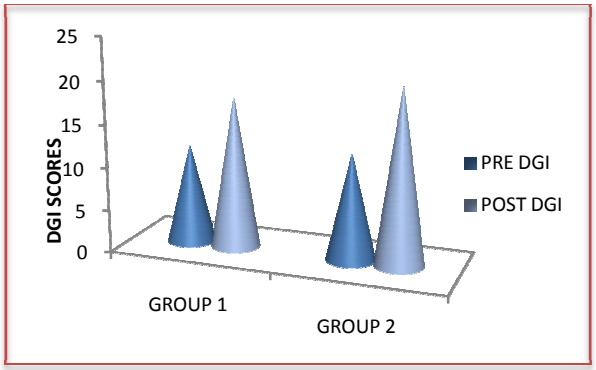


**Figure 2:** Comparison of pre and post intervention of dgi scores among group 1 and 2

**Table 3:** Comparison of group 1 and group 2 using BBS and DGI scores

| | Group 1 | Group 2 | t value | p value |
|---|---|---|---|---|
| BBS | 3.43 | 4.6 | 3.108 | 0.0029 |
| DGI | 6.13 | 7.9 | 5.614 | <0.0001 |

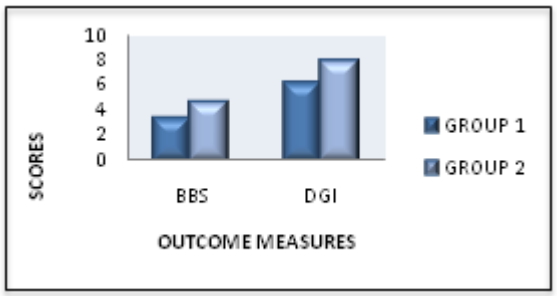


**Figure 3:** Comparison of group 1 and group 2 using BBS and DGI scores

## DISCUSSION

The results of study have revealed that subjects in group 1 (single task condition balance training) and group 2 (dual task condition balance training) both are benefited from balance training intervention with a significant improvement in post- intervention balance scores on berg balance scale and dynamic gait index. We found that participants who received dual-task training demonstrated greater improvements in work speed. In fact, participants who performed balance training along with cognitive functions demonstrated increased functional work speed than participant who performed only balance training. Alternatively, according to the task automatization hypothesis, practicing only one task at a time allows participants to automize the performance of individual tasks. It was found that the training effect on single task performance was maintained at the 12 week follow up in all training groups. However, the training effect on dual task performance was more effectively maintained when the dual task was performed under variable task priority. In variable task priority attention of individual was shifted between the task. It shows the effect of cognitive tasks on postural control and vice-versa. This result may indicate the importance of instructions when training balance control under dual task contexts. After four weeks intervention program, subjects in all training groups significantly improved performance on berg balance scale and dynamic gait index.. It was seen that post intervention scores were highly significant in among the groups but group 2 performed better than group 1.Outcome measures suggest that dual task condition balance training is more effective than single task balance training. Dual task condition training involve use of vision along with proprioceptive and vestibular information. This may involve both static and dynamic

balance of the individual. According to Kramer theory practicing two tasks together allows participants to develop task coordination skills. Thus its is seen that the efficient integration and coordination between the two tasks acquired during dual task training is crucial for improving dual task performance. In the study it was observed that participants in the single task balance training group increased their self reported confidence when performing daily activities. One possible explanation for this finding is that the activities (balance + cognitive tasks) we gave to the participants in dual-task training groups were much more difficult than the single tasks (only balance tasks). So the activities given to the participants in dual task training continuously challenge cognitive function of individual and this may have resulted in a reduced confidence in performing daily tasks. It may be that confidence and self efficacy do not change at the same rate as physical function. This study also found that it was feasible to implement individualized dual-task training, combining a traditional intervention with a variety of cognitive task, in community dwelling older adults with balance impairment. It was also seen that older adults adhere to the instrumental sets regarding attentional focus as no individual with neurological or musculoskeletal or mental impairment were involved. As only older adult group was involved it also added to better results. They were able to allot their attention to the task that was given to them. Hence, can generalize this results to similar type of older adults group with balance impairment so reduce the rate of fall.

## CONCLUSION

This study concludes that dual task training is more effective in improving balance in older adults with balance impairment than single task balance training to decrease the rate of fall in older adults. This study showed effect of dual task on balance while dual task effect on participants daily activities can also be useful for older adults.

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