**Research Article**

# EFFECT OF 6 WEEKS OTAGO EXERCISE PROGRAM ON BALANCE IN OLDER ADULTS

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**A B S T R A C T**

**Background:** Ageing is a progressive physiological process that is characterized by degeneration of organ systems and tissues with consequent loss of functional reserve of these systems. As a person ages, their anatomy and physiology undergo many changes that become more apparent with increasing chronological age. Otago exercise program helps to improve balance in older adults. Assessing their functional balance using assessment tools like timed up and go (TUG), four stage balance test (FSBT), 30 sec chair stand test (30SCST). The main aim of our study was to assess the effect of 6 weeks of otago exercise program on balance in older adults. These test analyses strength, flexibility, balance and endurance. These components are periodically used in one's daily occupation and thus helpful to estimate static and dynamic balance. It is necessary to understand if there is an effect of otago exercise program on balance in older adults hence this study was undertaken.

**Materials and method:** This interventional study was conducted in older adults and the data was collected from Dwarkamai old age home at shirdi Tal. Rahata dist. Ahmednagar district. The objective of this study was to compare the effect of 6 weeks of otago exercise program and conventional exercise to improve balance in older adults by using 30 second chair stand test, four stage balance test, timed up and go test.

**Result:** Comparison of mean and standard deviation values of timed up and go, 30 sec chair stand test four stage balance test among men and women were calculated. The mean baseline value was evaluated for all test. All test shows the significant improvement after intervention of otago exercise group as compare to conventional exercise group. Otago exercise is more effective than conventional exercise to improve balance in older adults.

**Conclusion:** The study concludes that Otago Exercise Program was found to be effective more than conventional exercises in improving balance in older adults, thus reducing the risk of falls in older adults. It also concluded that the adherence of the Otago exercise program was very good in the older adults.

## INTRODUCTION

Ageing is a progressive physiological process that is characterized by degeneration of organ systems and tissues with consequent loss of functional reserve of these systems. As a person ages, their anatomy and physiology undergo many changes that become more apparent with increasing chronological age. Individuals of the same chronological age may differ significantly in the rate and severity functional decline. Participants who maintain greater than average functional capacity are considered 'physiologically young' and those whose function declines at an earlier age appear to be 'physiologically old'.[8] The elderly population is increasing in size as people are living longer due to advances in medical science and improvements in standards of living.

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Elderly patients have higher rates of hospital morbidity and mortality compared to younger patients. This increased prevalence of coexisting systemic disease.[8]

The age related changes in the control of spontaneous postural sway, suggesting an increase in the amount of correction activity required to maintain stability. Loss of balance is increased when the subjects are asked to make the movement rapidly.[11] This suggest change in the coordination of movement and posture that is age related. A comprehensive description of the task of balancing includes detection of body motion by sensory systems, integration of this sensory information by the CNS and finally execution of an appropriate motor response. Balance is an ability to maintain the line of gravity (vertical line from center of mass) of a body within the base of support with minimal postural sway.[87] Sway is the horizontal movement of the center of gravity even when a person is standing still. A certain amount of sway is essential and inevitable due to small perturbations within the body (e.g., breathing, shifting body weight from one foot to the other or

from forefoot to rear foot) or from external triggers (e.g., visual distortions, floor translations). An increase in sway is not necessarily an indicator of dysfunctional balance so much as it is an indicator of decreased sensorimotor control.[88] Balance can be negatively affected in a normal population through fatigue in the musculature surrounding the ankles, knees, and hips. Studies have found, however, that muscle fatigue around the hips (glutes and lumbar extensors) and knees have a greater effect on postural stability (sway).[89] It is thought that muscle fatigue leads to a decreased ability to contract with the correct amount of force or accuracy. As a result, proprioception and kinesthetic feedback from joints are altered so that conscious joint awareness may be negatively affected.[90]

The major problems in the elderly are falls and they are considered one of the "geriatric Giants". Recurrent falls are an important cause of morbidity and mortality in the elderly and are a marker of poor physical and cognitive status. Most often the cause of fall is multifactorial. Falls are the leading cause of accidental death in the elderly population with more than 11,000 deaths as a result of falls each year.[9] a fall is a complex multifactorial phenomenon. In order to understand the mechanism of falls, it is essential to understand the prerequisites of normal gait. Essential Substrates for a normal gait include fine neural networks such as the Cortical–Basal Ganglia loop and the Basal Ganglia–Brainstem System, exquisite musculoskeletal Structures with appropriately regulated muscle tone, and Proper processing of sensory information (i.e., cerebral Cortex, vision, hearing, fine touch, and proprioception) [67] Effective coordination of those components, along with Adequate cognition and concentration, is needed to prevent Falls and maintain gait. It is not surprising that many of those functions show at least some decline with aging, thus increasing the risk of falls. Moreover, as a person ages, the likelihood of accumulating medical problems and their associated medications increases, and so does the risk of falling. Many changes occur in gait with aging, such as a decrease in gait velocity and step length, a wider base, and a decrease in lower limb strength. These changes are most pronounced when older people walk on irregular Surfaces. [68]

## MATERIALS AND METHOD

Total twenty participants both male and female who were included in the study. Participants were screened according to the inclusion and exclusion criteria. Participants with age group in older adults, who have risk of fall and willing to participate were selected for the study. Participants with physical and cognitive limitation were excluded from the study. The study received approval from Institutional Ethical Committee of Dr. APJ Abdul Kalam College of Physiotherapy, Pravara Institute of Medical Sciences, Loni. Written informed consent was taken from all the participants selected for the study.

### Procedure

The study received approval from Institutional Ethical Committee (Ref no. PIMS/CPT/IEC/2018/195) of Dr. A. P. J. Abdul Kalam College of Physiotherapy, Pravara Institute of Medical Sciences, Loni. Total twenty participants (n=20) were selected and screened according to inclusion and exclusion criteria. Informed written consent form was obtained from the patient.

### Outcome Measure

The specific assessment was computed by using timed up and go test, 30 sec chair stand test, four stage balance test in older adults.

### Data Analysis and Result

The objective of this study was to compare the effect of 6 weeks of Otago and conventional exercise to improve balance in older adults. The results were analyzed on basis of data obtained pre and post intervention using timed up and go test (TUG) , 30 sec chair stand test (30SCST) , four stage balance test (FSBT). Data was analyzed in INSTAT version 12. Descriptive statistics for all outcome measures were expressed as mean, standard deviations and test of significance such as paired "t" test used for comparing the data within each group and unpaired "t" test for comparing the data between the groups.

**Table 4.1** Demographic profile of all participants

| Demographic Characteristics | |
|---|---|
| Age | Above 60 years |
| Gender | No. of Participants |
| Male | 12 |
| Female | 8 |
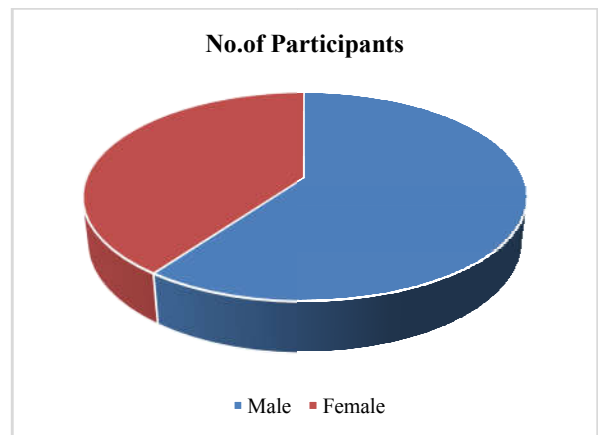


**Graph 4.1** Represents Demographic Data

Result 4.1 The above Pie Diagram shows that there were 20 participants in which 12 were males and 8 were females.

The above Pie Diagram shows that there were 20 participants in which 12 were males and 8 were females.

**Table 4.14** Comparison mean between Group A and Group B (TUG)

| Comparison Between Group A And Group B (Tug) | | | | |
|---|---|---|---|---|
| | Group A | Group B | P value | T value | Result |
| Mean | 11.84 | 14.21 | 0.0209 | 2.53o | Considered significant |

**Mean of TUG in Group A and Group B**

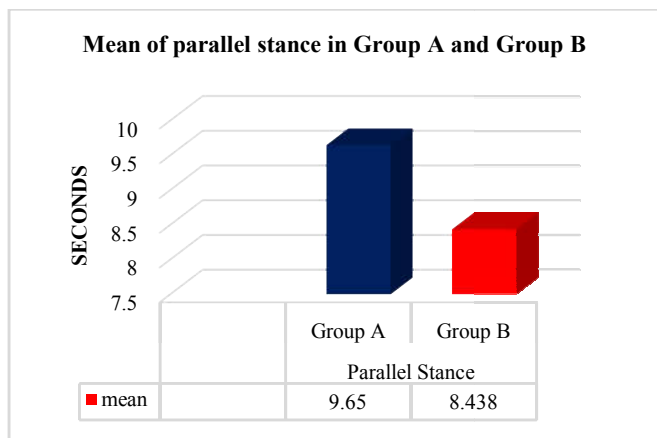| | 1 | 2 |
|---|---|---|
| Series1 | 11.84 | 14.21 |
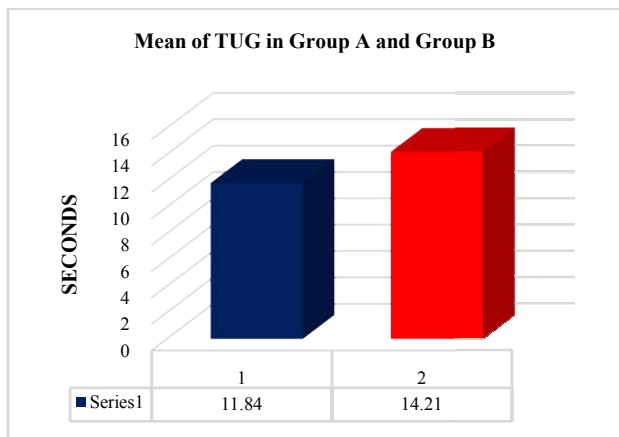
**Graph 4.14** Represents comparison of mean of TUG in Group A and Group B

Results no 4.14: Comparison of mean TUG in group A and group B where t value is 2.530 and p Value is 0.0209 which is considered significant.

**Table 4.15** Comparison mean between Group A and Group B in parallel stance in four stage balance test

| Comparison Between Group A And Group B Of Parallel Stance In Four Satge Balance Test | | | | |
|---|---|---|---|---|
| | Group A | Group B | P value | T value | Result |
| Mean | 11.84 | 14.21 | 0.0209 | 2.53o | Considered significant |

**Mean of parallel stance in Group A and Group B**

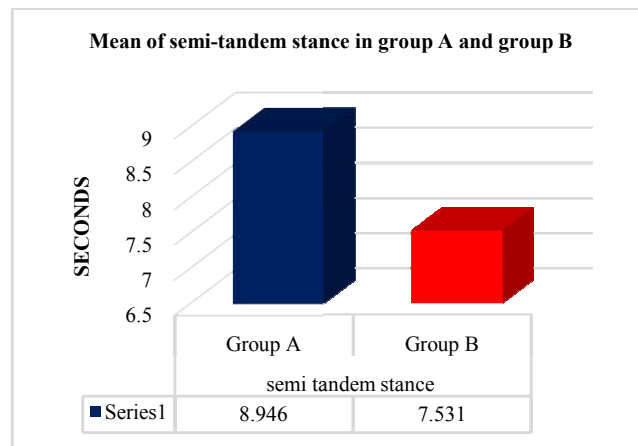| | Group A | Group B |
|---|---|---|
| | Parallel Stance | |
| mean | 9.65 | 8.438 |

**Graph 4.15** Represents comparison of mean of four stage balance test in parallel stance between Group A and Group B

Results no 4.15: Comparison of mean of four stage balance test in parallel stance between Group A and Group B where t value is 3.563 and p Value is 0.0022 which is considered significant.

**Table 4.16** Comparison mean between Group A and Group B in semi-tandem stance in four stage balance test

| Comparison Between Group A And Group B Of Semi-Tandem Stance In Four Satge Balance Test | | | | |
|---|---|---|---|---|
| | Group A | Group B | P value | T value | Result |
| Mean | 8.946 | 7.531 | 0.0058 | 3.130 | Highly significant |

**Mean of semi-tandem stance in group A and group B**

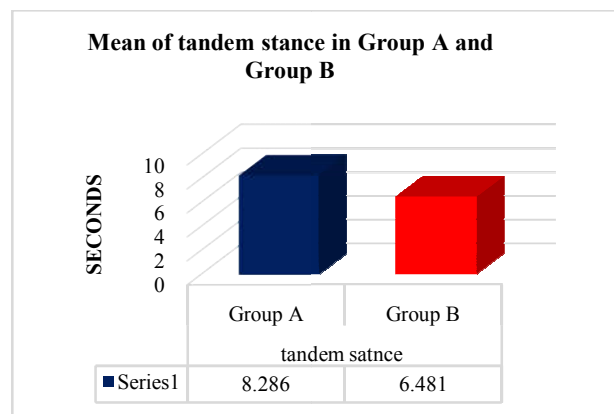| | Group A | Group B |
|---|---|---|
| | semi tandem stance | |
| Series1 | 8.946 | 7.531 |

**Graph 4.16** Represents comparison of mean of four stage balance test in semi-tandem stance between Group A and Group B

Results no 4.16: Comparison of mean of four stage balance test in semi-tandem stance between Group A and Group B where t value is 3.130 and p Value is 0.0058 which is considered highly significant.

**Table 4.17** Comparison mean between Group A and Group B in tandem stance in four stage balance test

| Comparison Between Group A And Group B of Tandem Stance In Four Satge Balance Test | | | | |
|---|---|---|---|---|
| | Group A | Group B | P value | T value | Result |
| Mean | 8.286 | 6.481 | 0.0100 | 2.877 | Considered significant |

**Mean of tandem stance in Group A and Group B**

| | Group A | Group B |
|---|---|---|
| | tandem satnce | |
| Series1 | 8.286 | 6.481 |

**Graph 4.17** Represents comparison of mean of four stage balance test in tandem stance between Group A and Group B

Results no 4.17: Comparison of mean of four stage balance test in semi-tandem stance between Group A and Group B where t value is 3.130 and p Value is 0.0058 which is considered significant.

**Table 4.18** Comparison mean between Group A and Group B in one leg stance in four stage balance test

| comparison between group a and group b of one leg stance in four satge balance test | | | | |
|---|---|---|---|---|
| | Group A | Group B | P value | T value | Result |
| Mean | 7.287 | 5.64 | 0.0430 | 2.177 | Considered significant |

**Graph 4.18** Represents comparison of mean of four stage balance test in one leg stance between Group A and Group B

Results no 4.18: Comparison of mean of four stage balance test in one leg stance between Group A and Group B where t value is 2.177 and p Value is 0.0430 which is considered significant.

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**Table 4.19** Comparison mean between Group A and Group B in 30 seconds chair stand test

| Comparison Between Group A And Group B Of 30 Seconds Chair Stand Test | | | | |
|---|---|---|---|---|
| | Group A | Group B | P value | T value | Result |
| Mean | 12.2 | 10.5 | 0.0125 | 2.773 | Considered significant |

Graph no 4.19: Represents comparison of mean of 30 seconds chair stand test between Group A and Group B

Results no 4.19: Comparison of mean of 30 seconds chair stand test (30SCST) between Group A and Group B where t value is 2.773 and p Value is 0.0125 which is considered significant.

## DISCUSSION

This study was done to evaluate the effect of Otago Exercise Program on balance with older adults. The study included 12 males and 8 females having a history of fall. The participants were selected according to the selection criteria and randomly allocated in the group A and group B. 6 males and 4 females were allocated in group A and group B each. The duration of the study was 6 weeks. Timed up and Go test, Four stage balance test, 30 Sec chair stand test were used as outcome parameters. Group A received Otago exercise program and group B received conventional exercise program for 2 times in a week for 6 weeks. The intervention intensity of exercise was increased over the period of time according to participants. Post intervention outcome measures were taken at the end of 6 weeks of intervention. The paired and unpaired't' test of significant was used for statistical analysis of within the groups and between the groups for all three parameters. This study found out that there were significant improvement in balance in both groups. Although Consistent improvement was seen more in the group A program than group B. Balance was assessed by timed up and go test the pre intervention reading of both the groups for timed up and go test were comparable. There was a significant improvements seen within and between the groups in the balance in the older adults. The time up and go test average score for group A decreased from 15.43 sec. to 11.84 sec. at the end of 6 weeks of exercise session. and Group B showed decrease from 14.92 sec. to 14.21 sec. at the end of 6 weeks of conventional exercise program. The improvements seen in Group A is better than that of Group B. The time required for the participants to complete the test was reduced in both groups but with more and although consistent improvements noted in the Group A. The increase in muscle strength and size were associated with clinically significant improvements in gait speed, balance and functional independence. TUG assessed ability to maintain balance during timed locomotion and ambulatory transfers. It also correlated with self-efficacy demonstrating that a relationship existed between fear of falling and functional mobility in the elderly population. Similar findings were reported from studies that investigated fear of falling and restriction of activity and self-reported declines in mobility and reduced physical function in people with low fall related self-efficacy. Exercise has been one of the most frequently investigated interventions to reduce falls among older people living in the community. Meta-analyses have shown that exercise programs with a moderate to strong challenge to balance are most likely to be effective in improving functional and mobility performance among older adults, and reduce risk of falling. Otago exercise program appear to be the most effective interventions for improving the overall health status of frail elderly individuals. The positive effects on functional capacity are more often observed when more than one physical- conditioning component (i.e. strength, endurance, or balance) comprises the exercise intervention compared with only one type of exercise. Along with evidence provided, it is reasonable to suggest that Different kinds of stimulus, such as to improve muscle strength and mass, cardiovascular function, gait ability, and balance, and promote a greater increase in independence and in the ability to perform daily activities. It is well known that the resistance exercise programs are recommended to improve neuromuscular function, endurance exercise program are recommended to enhance cardiovascular function, and training stimulates improvements on balance performance.

## CONCLUSION

The study concludes that Otago Exercise Program was found to be effective more than conventional exercises in improving balance in older adults, thus reducing the risk of falls in older adults. It also concluded that the adherence of the Otago exercise program was very good in the older adults.

### Limitations

In the present study, the duration of the intervention was short term, small sample size and unequal number of males and females were taken. Participants were included Individuals who are able to follow the commands

### Suggestions for Future Research

Further study with addition of intervention to improve the balance in older adults and community access is suggested. Also this study only includes the people who having high risk of falling,

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