IJMAHP
International Journal of Medical & Allied Health Professions
INTERNATIONAL JOURNAL OF MEDICAL & ALLIED HEALTH PROFESSIONS
editor.ijmahp@gmail.com

EFFECT OF OBSTACLE TRAINING ON STATIC AND DYNAMIC BALANCE IN OLDER ADULTS

Urmisha Pansuriya[1*], Dr. Gira Thakrar[2]
[1*]MPT Student, JG College of Physiotherapy, Ahmedabad, Gujarat, India
[2]Senior Lecturer, JG College of Physiotherapy, Ahmedabad, Gujarat, India

***Corresponding Author:** urmishapansuriya0@gmail.com

ABSTRACT

Background: Balance impairments are common in older adults and contribute significantly to increased fall risk, reduced mobility, and loss of independence. Age-related decline in sensory integration, muscle strength, and postural control affects both static and dynamic balance. Obstacle training incorporates task-oriented movements such as stepping, direction changes, and weight shifting, closely simulating real-life situations. However, limited studies have examined its effectiveness on both static and dynamic balance in older adults. Therefore, this study aimed to evaluate the effect of obstacle training on static and dynamic balance in older adult age 60 to 75 years.
Objective: To determine the effect of obstacle training on static and dynamic balance in older adults.
Methodology: An experimental study was conducted including 34 participants from 60-75 years. (male:16, female:18) all the participants divided in two groups. each group containing 17 individuals one group underwent obstacle training for a duration of 6 week. the other group was told to carry on with their daily activities. pre and post data of both groups were assessed using four square step test& single leg stance test for dynamic balance and static balance respectively.
Result: From 34 older adults (52.9%female&47.1%male),the experimental group (n=17)statically significant improvement was observed in both static balance(4.11± 1.53 to 7.35± 1.65;t= -12.92,P<0.001)and dynamic balance (12.47± 1.58 to 9.94 ± 1.39,t=11.93,p<0.001)while in the control group (n=17)there was seen significant improvement in static balance (2.70± 1.21 to 3.35± 1.27,t= -2.281, P=0.037)and no significant improvement in dynamic balance (11.47± 1.87 to 11.17± 1.63 ,t=1.159 ,P=0.264). Between group comparisons demonstrated a statistically significant improvement in both static and dynamic balance in the experimental group (p<0.001).
Conclusion: The study concludes that obstacle training is an effective intervention for improving static and dynamic balance in older adults and beneficial in fall prevention.
Keywords: obstacle training, static balance, dynamic balance, older adults, fall prevention.

INTRODUCTION

For older persons to move safely and carry out daily tasks efficiently, balance is essential [1]. People 60 years of age and older are referred to as geriatrics; they are a demographic that experiences gradual age-related changes in their musculoskeletal, neurological, and physiological systems. Reduced muscle strength and power, decreased joint flexibility, poorer proprioception, visual and vestibular deficits, slower reaction time, and altered sensory integration are common age-related alterations in the geriatric population. Together, these alterations weaken postural control systems and dramatically raise the risk of falls and balance issues [2,3].

Falls are one of the main causes of injury, hospitalization, functional decline, loss of independence, and decreased quality of life in the aged population, making them a significant public health concern [4]. The integration of sensory information, cerebral processing, and motor responsesall of which are negatively impacted by aging is necessary for effective balance control. There are two types of balance: dynamic balance and static balance. The capacity to keep the body's center of mass within the base of support when the body is motionless, as in standing or sitting, is known as static balance. The capacity to maintain postural stability when the body is moving or when executing transitional motions, such as walking, turning, reaching, stepping over obstacles, and changing directions, is known as dynamic balance. Functional independence requires both static and dynamic balance, but deficiencies in dynamic balance are especially linked to a higher risk of falls in older persons.

Obstacle training is a task-oriented intervention that challenges balance control in dynamic and unpredictable situations by incorporating functional motions such stepping, weight shifting, direction changes, and navigating environmental impediments [5]. Conventional balance training, on the other hand, frequently concentrates on static postures or repetitive exercises carried out in controlled settings, which might not have the task specificity to address functional issues encountered in the real world. Obstacle training may improve motor coordination, anticipatory postural adjustments, and sensory integration, but there is currently little data on how it affects both static and dynamic balance in the elderly population. The need of the study was to effect of obstacle training static and dynamic balance in older adults.

METHODOLOGY

Study Design: experimental study

Study setting: old age home in Ahmedabad

Study duration: 6 weeks

Sampling method: purposive sampling
Participants: 34 older adults aged 60 to 75 years were selected for this study

Inclusion criteria:

- Age:60 to 75 years both genders
- Four square step tests>15 sec
- Older adults who were willing to participate
- able to understand and follow instruction
- Berg balance scale with low risk of fall:41-56

Exclusion criteria:

- Acute upper or lower limb amputation/surgery/injury
- Psychiatric disorder/difficulty in understanding
- Any severe cardiovascular disorder, pulmonary condition and neurological disorder
- Participant who are using assistive device (wheel chair, walker etc.) for ambulation
- Patient having diabetic neuropathy

Intervention/Procedure:

GROUP A – ADLs activities

GROUP B-Obstacle training protocol (10 set/session for 2days/week for 6 weeks,10 obstacles, block of different size, colour, block width 8-inch, length 18-inch, height 4/5.5/7 inch)

Protocol for Group B: Obstacle training	
Week	Time
Week 1 & 2 **Crossing obstacle with pause in between every obstacle, crossing obstacle without pause**	Pause – 5 seconds 10 reps (20 to 25 mins)
Week 3 & 4 **Front, side back stepping around the obstacle**	10 reps (20 to 25 mins)
Week 5 & 6 **Walking around in figure of eight pattern, sideways crossing obstacle**	10 reps (20 to 25 mins)

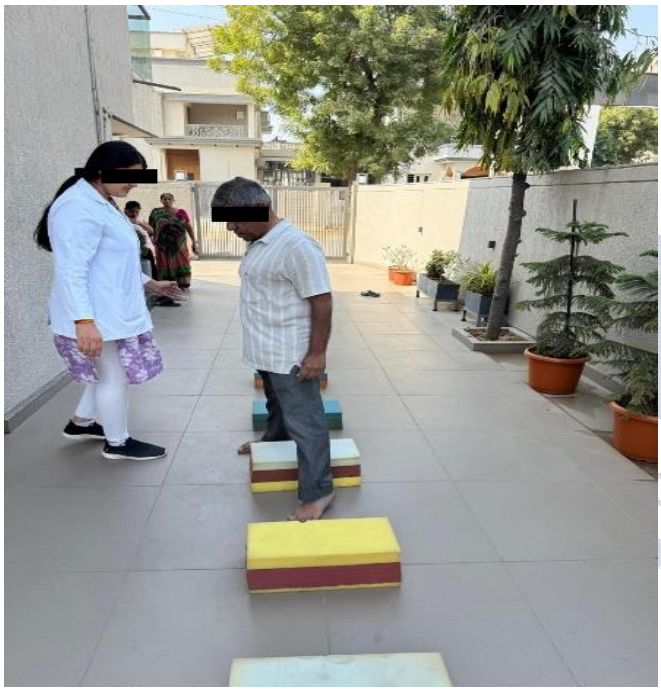


Figure 1: obstacle training -side walking

Figure2: obstacle training -crossing obstacle

Outcome Measures:

The Single Leg Stance Test (SLST) is a clinical assessment of postural stability in older individuals. It was used to evaluate static balance. The test assesses a person's ability to manage their center of mass within a fixed base of support by having them maintain balance on one leg without the need for outside assistance. For evaluating static balance and forecasting fall risk in older persons living in the community, the SLST has shown strong test-retest validity and reliability [7, 8].

The Four-Square Step Test (FSST), which measures the capacity to quickly step over obstacles in several directions while maintaining balance, was used to measure dynamic balance. The test tests participants' dynamic postural control, coordination, motor planning, and ability to change direction safely by having them step forward, sideways, and backward over low obstacles in a predetermined order. The FSST has a substantial correlation with fall risk and has been demonstrated to be reliable indicator of dynamic balance and mobility

in older persons. Reduced functional mobility and worse dynamic balance are indicated by longer completion times [9,10].

Figure3: FOUR SQUARE STEP TEST

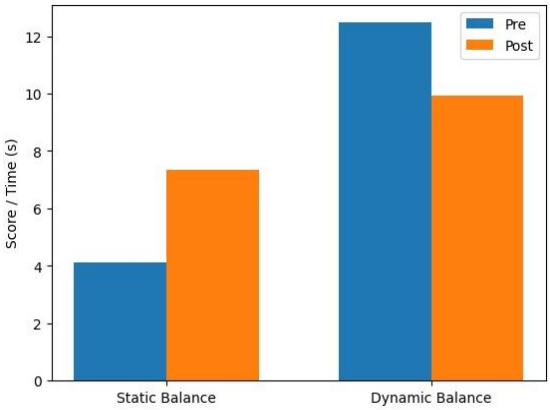
Figure4: SINGLE LEGSTANCE TEST

Statistical Analysis: SPSS was used for data analysis.

RESULTS

Experimental group

Mean and Standard Deviation of static and dynamic balance of experimental group.



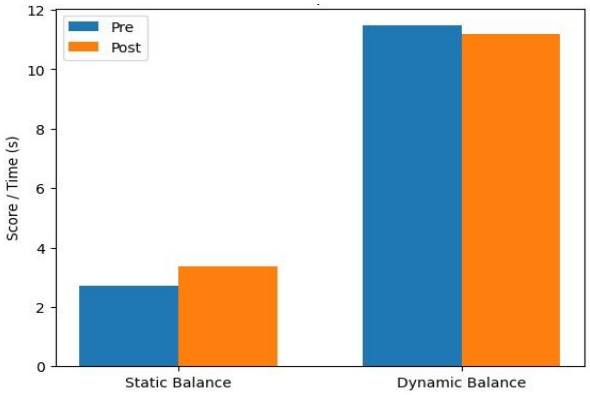
Graph 1: Pre and Post Values of Static and Dynamic balance in Experimental Group

	Mean ± SD		P-Value
	PRE	POST	
Static Balance	4.11±1.53	7.35 ± 1.65	p<0.001
Dynamic Balance	12.47±1.58	9.94 ± 1.39	p<0.001

Table 1: Mean and SD values of Static and Dynamic Balance in Experimental Group

Control group

Mean and Standard Deviation of static and dynamic balance of control group



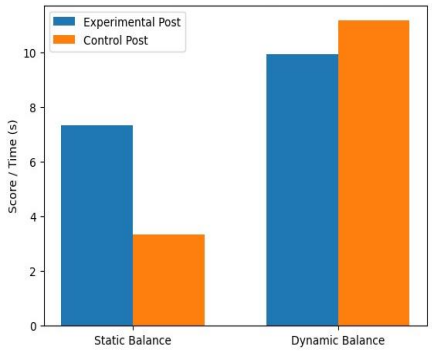
Graph 2: Pre and Post Values of Static and Dynamic balance in Control Group

	Mean ± SD		P-Value
	PRE	POST	
Static Balance	2.70 ± 1.21	3.35±1.27	P=0.037
Dynamic Balance	11.47±1.87	11.17±1.63	p<0.264

Table 2: Mean and SD values of Static and Dynamic Balance in Control Group

Between group comparison

Between group comparisons demonstrated a statistically significant improvement in both static and dynamic balance in the experimental group (p<0.001)



Graph 3: Between group comparison of pre and post values of static and dynamic balance

DISCUSSION

When compared to regular everyday activities, the current study showed that obstacle training significantly improved older individuals' static and dynamic balance. These results corroborate the increasing amount of data indicating that task-oriented, difficult, and functionally relevant balancing therapies are most successful [1,5]. Older persons are more prone to balance issues and falls due to postural control mechanisms being compromised by age-related decreases in sensory integration, muscle strength, and neuromuscular coordination [2–4]. Because obstacle training necessitates constant posture and movement adaptation in response to environmental constraints, it directly treats these deficiencies.

The Single Leg Stance Test revealed a notable increase in static balance, which suggests improved postural stability and the capacity to keep the center of gravity within the base of support. Improved static balancing performance is probably a result of obstacle negotiation, which calls for regulated weight shifting, repetitive single-limb support, and activation of lower limb and trunk muscles. Reduced single-leg stance time has been found to be an independent predictor of fall risk in older persons [7,8]. Stepping in different directions, managing surface height changes, and modifying gait patterns are all part of obstacle training, which tests anticipatory and reactive postural adjustments. Enhancements in FSST performance are indicative of greater motor planning, quicker reaction times, and enhanced capacity to safely change direction while moving all of which are essential elements of everyday fall prevention [9,10]. The control group, which carried on with their regular daily activities, on the other hand, demonstrated little to no improvement in dynamic balance, underscoring the inadequacy of habitual activities alone in addressing age-related balance deterioration.

The results of this work are in line with theories of motor control and motor learning, which highlight how repeated exposure to activities that are task-specific and increasingly difficult results in brain adaptation and enhanced functional performance [1,5]. Obstacle-based exercises closely mimic real-life challenges like stepping over objects, avoiding hazards, and navigating complex environments, in contrast to traditional balance training conducted in stable and predictable environments. This improves the transfer of training effects to everyday activities.

Overall, the findings point to obstacle training as a useful and functionally relevant intervention for enhancing older individuals' static and dynamic balance. Obstacle-based exercises may improve postural control, lower fall risk, and foster independence and quality of life in the elderly population when incorporated into physiotherapy and fall prevention programs.

CONCLUSION

This study provides evidence that obstacle training significantly improves both static and dynamic balance in older adults when compared to routine daily activities. The task-oriented and function-specific nature of obstacle training likely enhances postural control and movement adaptability under dynamic conditions. These findings support the clinical integration of obstacle training as an effective physiotherapeutic intervention for balance rehabilitation and fall prevention in the older adult population.

REFERENCES

1. Shumway-Cook A, Woollacott MH. Motor control: translating research into clinical practice. 5th ed. Philadelphia: Lippincott Williams & Wilkins; 2017.
2. Lord SR, Sherrington C, Menz HB, Close JCT. Falls in older people: risk factors and strategies for prevention. 2nd ed. Cambridge: Cambridge University Press; 2007.
3. Rubenstein LZ. Falls in older people: epidemiology, risk factors and strategies for prevention. *Age Ageing*. 2006;35 Suppl 2:ii37–ii41.
4. World Health Organization. WHO global report on falls prevention in older age. Geneva: World Health Organization; 2007.
5. Silsupadol P, Siu KC, Shumway-Cook A, Woollacott MH. Training of balance under single- and dual-task conditions in older adults with balance impairment. *Phys Ther*. 2006;86(2):269–81.

6. Muir SW, Berg K, Chesworth B, Klar N, Speechley M. Quantifying the magnitude of risk for balance impairment on falls in community-dwelling older adults. *Age Ageing*. 2010;39(6):697–702.
7. Bohannon RW. Single limb stance times: a descriptive meta-analysis of data from individuals at least 60 years of age. *Top Geriatr Rehabil*. 2006;22(1):70–7.
8. Springer BA, Marin R, Cyhan T, Roberts H, Gill NW. Normative values for the unipedal stance test with eyes open and closed. *J Geriatr Phys Ther*. 2007;30(1):8–15.
9. Dite W, Temple VA. A clinical test of stepping and change of direction to identify multiple falling older adults. *Arch Phys Med Rehabil*. 2002;83(11):1566–71.
10. Whitney SL, Marchetti GF, Morris LO, Sparto PJ. The reliability and validity of the Four Square Step Test for people with balance deficits secondary to vestibular disorders. *Arch Phys Med Rehabil*. 2007;88(1):99–104.