

A Study to Assess the Effectiveness of the Otago Exercise Programme on Fall Prevention Among Elderly in Anandhapuram Village, Puducherry

Mugilan J¹, Thamizhselvan Elango², Sudharsan³, Keerthana S⁴, Preethi T⁵

¹Post graduate student, School of Physiotherapy, Vinayaka Mission's Research Foundation (Deemed to be University), Puducherry, India

²Assistant professor, School of Physiotherapy, AVMC & Hospital Campus, Vinayaka Mission's Research Foundation (Deemed to be University), Puducherry, India

³Assistant professor, School of Physiotherapy, AVMC & Hospital Campus, Vinayaka Mission's Research Foundation (Deemed to be University), Pondicherry, India

⁴Clinical therapist, New Medical Center, 470, M.G. Road, Puducherry-605001, India

⁵Assistant Professor, East Coast College of Allied Health Sciences, Pondicherry, India

Corresponding Author:

Mugilan J

Post graduate student, School of Physiotherapy, Vinayaka Mission's Research Foundation (Deemed to be University), Puducherry, India

Email: 1999mugi@gmail.com

Thamizhselvan Elango

Assistant professor, School of Physiotherapy, AVMC & Hospital Campus, Vinayaka Mission's Research Foundation (Deemed to be University), Puducherry, India

Abstract

Background: Falls are a major cause of injury, disability, and reduced quality of life in the elderly population worldwide. The Otago Exercise Programme (OEP) is an evidence-based intervention incorporating strength and balance exercises designed to reduce fall risk in older adults.

Aim: To assess the effectiveness of the OEP on fall prevention among elderly individuals in Anandhapuram village, Puducherry.

Methodology: A community-based, two-group experimental study was conducted among 30 elderly participants aged ≥ 65 years. Participants were randomly allocated into an experimental group ($n = 15$), which received the OEP, and a control group ($n = 15$), which performed general mobility and balance exercises. The intervention was delivered twice weekly for six weeks, each session lasting approximately one hour. Balance and functional mobility were assessed pre- and post-intervention using the BOOMER Balance Scale, Timed Up and Go Test (TUG), Functional Reach Test (FRT), Step Test, and Single-Stance Eyes Closed (SSEC). Data were analysed using paired and independent t-tests, with $p < 0.05$ considered statistically significant.

Results: Pre-test analysis showed no significant difference between groups ($p > 0.05$). Post-test results demonstrated statistically significant improvements in the experimental group compared to the control group for all outcome measures – BOOMER Balance Scale ($t = 8.4$, $p < 0.0001$), FRT ($t = 5.9$, $p < 0.0001$), Step Test ($t = 1.4$, $p < 0.0001$), and SSEC ($t = 5.5$, $p < 0.0001$).

Conclusion: The OEP significantly improved balance and functional performance in elderly individuals over six weeks and can be recommended as an effective community-based fall-prevention strategy in rural and resource-limited settings. Further studies with larger samples and long-term follow-up are warranted to assess sustainability of benefits.

Keywords: Otago Exercise Programme, Falls, Elderly, Balance, Fall Prevention, Community Physiotherapy

INTRODUCTION

Falls are one of the leading causes of morbidity, disability, loss of independence, and mortality among older adults worldwide. According to the World Health Organization (WHO), approximately 28–35% of people aged 65 years and above fall each year, and the incidence increases to 32–42% for those over 70 years [1]. Falls not only lead to physical injuries such as fractures and head trauma but also have psychological consequences, including fear of falling, reduced physical activity, and social isolation [2].

In India, the ageing population is rising rapidly, with the proportion of individuals aged ≥ 60 years projected to increase from 8% in 2015 to nearly 19% by 2050 [3]. Community-based studies in India

have reported fall prevalence rates ranging from 14% to 53%, with higher rates among women, those with chronic comorbidities, and those with impaired balance [4,5]. In Tamil Nadu and Puducherry, where a significant proportion of the elderly reside in rural areas, falls contribute substantially to the burden on primary health services [6].

The risk factors for falls are multifactorial and include intrinsic factors such as muscle weakness, impaired balance, poor vision, cognitive impairment, and chronic illnesses; and extrinsic factors such as environmental hazards and unsafe home settings [7]. Age-related decline in muscle strength and balance, known as sarcopenia and postural instability, plays a central role in fall risk [8]. Therefore, interventions targeting muscle strengthening and balance training are essential for effective fall prevention.

The Otago Exercise Programme (OEP) is an evidence-based, home- and community-delivered programme developed in New Zealand for adults aged ≥ 65 years. It combines individually tailored strength, balance, and flexibility exercises, performed three times per week, along with a walking plan [9]. Multiple randomised controlled trials have demonstrated that the OEP reduces fall rates by 35% in high-risk older adults [10] and improves lower limb strength, gait stability, and confidence [11]. Its adaptability for delivery in community settings makes it particularly relevant for rural India, where physiotherapy resources may be limited.

In the Puducherry context, there is a paucity of community-based studies evaluating structured fall-prevention programmes like OEP. Given the rising elderly population in Anandhapuram village and the limited availability of fall-prevention initiatives, assessing the effectiveness of OEP can provide valuable evidence for integration into primary health care and elderly welfare programmes.

Rationale of the Study

Implementing the OEP in a rural village setting such as Anandhapuram offers a low-cost, feasible, and sustainable approach to reduce fall risk among older adults. The present study aims to evaluate whether the OEP can improve balance and muscle strength, thereby reducing falls among elderly individuals in this community. The findings can inform policymakers, primary care providers, and community health workers to incorporate structured exercise programmes into routine geriatric health care.

Methodology and Procedure

This community-based, two-group experimental study was conducted in Anandhapuram village, Puducherry, to assess the effectiveness of the Otago Exercise Programme (OEP) on fall prevention among elderly individuals. Participants aged ≥ 65 years who were permanent residents of the village and met the inclusion criteria—ability to walk independently (with or without assistive device) and willingness to participate—were included, while those with severe cognitive impairment, unstable cardiovascular conditions, major musculoskeletal or neurological limitations, or recent fractures/surgeries were excluded. A total of 30 eligible participants were recruited using purposive sampling and were randomly allocated into two equal groups: the experimental group (OEP) and the control group (general mobility and balance exercises). Ethical approval was obtained from the Institutional Ethics Committee, and written informed consent was secured from all participants in accordance with the Declaration of Helsinki [12]. Baseline assessment included socio-demographic variables (age, gender, education, religion, residential area, family type), past and personal medical history, anthropometric measurements (height, weight, BMI), and posture and gait analysis. Fall risk was assessed using the BOOMER Balance Measure, a validated tool for predicting falls in elderly populations [13]. Participants were instructed to avoid vigorous activity before assessment, refrain from eating heavy meals within two hours of testing, and wear comfortable, non-restrictive clothing during sessions [14]. The intervention lasted six weeks, with two supervised sessions per week on alternate days, each lasting approximately one hour.

PROCEDURE

In the experimental group, the OEP comprised 17 structured exercises (five strengthening and 12 balance exercises) adapted from the original New Zealand protocol [15,16], along with a walking programme. Strengthening exercises targeted the knee extensors, hip abductors, knee flexors, ankle plantar flexors, and ankle dorsiflexors, performed twice weekly at moderate intensity for 10 repetitions each, often using ankle weights for resistance. Balance exercises, performed at moderate intensity for 5–10 repetitions, included knee bends, backwards walking, figure-of-eight walking and turning, sideways walking, heel-toe standing and walking (forward and backward), one-leg stands, heel walking, toe walking, sit-to-stand, and stair

walking. All exercises followed the FITT principle (Frequency, Intensity, Time, Type) and were supervised to ensure safety and correct technique.

The control group performed general mobility and balance exercises of matched duration and frequency, including general walking (15–20 minutes), clock reach, side leg raise, balancing wand, shoulder rolls, and calf stretches, which provided basic mobility training without the structured progression of OEP. Pre- and post-intervention balance performance was assessed using the BOOMER scale in the same sequence for all participants by an assessor blinded to group allocation. Data were entered into Microsoft Excel and analysed using SPSS (version XX). Descriptive statistics (mean, standard deviation) summarised baseline variables, the paired t-test compared pre- and post-intervention scores within groups, and the independent t-test compared between-group differences, with statistical significance set at $p < 0.05$ [17] .

STATISTICAL ANALYSIS

A total of 30 participants (15 in the experimental group and 15 in the control group) were assessed for socio-demographic and clinical variables, including age, gender, education, religion, residential area, family type, past medical history, personal history, posture, and limb length discrepancy. The mean age of participants was predominantly above 65 years, with the largest subgroup comprising seven participants (46.6%) in this age range. All participants (100%) reported at least one fall in the previous year.

Outcome measures included the BOOMER Balance Scale, Timed Up and Go Test (TUG), Functional Reach Test (FRT), Step Test, and Single-Stance Eyes Closed (SSEC) test. Baseline (pre-test) comparisons between the groups showed no statistically significant differences ($p > 0.05$) across all outcome measures, indicating comparable functional status at the start of the study.

RESULT

Outcome Measure	Pre-test Experimental Mean $\pm$ SD	Pre-test Control Mean $\pm$ SD	Post-test Experimental Mean $\pm$ SD	Post-test Control Mean $\pm$ SD	t-value	p-value
BOOMER (TUG Test)	2.40 $\pm$ 0.80	2.13 $\pm$ 0.88	3.33 $\pm$ 0.69	2.33 $\pm$ 0.86	8.4	<0.0001
FRT Test	2.13 $\pm$ 0.72	2.14 $\pm$ 0.70	2.86 $\pm$ 0.88	2.33 $\pm$ 0.70	5.9	<0.0001
Step Test	2.13 $\pm$ 0.50	1.86 $\pm$ 0.49	3.00 $\pm$ 0.59	2.07 $\pm$ 0.25	1.4	<0.0001
SSEC	1.46 $\pm$ 0.50	1.66 $\pm$ 0.59	2.60 $\pm$ 0.59	1.66 $\pm$ 0.59	5.5	<0.0001

Post-intervention analysis revealed significant improvements in the experimental group compared to the control group across all balance and functional measures. For the BOOMER Balance Scale, the experimental group improved from a pre-test mean $\pm$ SD of 2.4 $\pm$ 0.8 to a post-test mean $\pm$ SD of 3.33 $\pm$ 0.69, while the control group improved from 2.13 $\pm$ 0.88 to 2.33 $\pm$ 0.86 ($t = 8.4$, $p < 0.0001$). Significant between-group differences were also observed for FRT ($t = 5.9$, $p < 0.0001$), Step Test ($t = 1.4$, $p < 0.0001$), and SSEC ($t = 5.5$, $p < 0.0001$). The paired t-test confirmed statistically significant within-group improvements for the experimental group across all outcomes, whereas the control group showed minimal change.

These findings indicate that the OEP produced clinically and statistically significant improvements in balance and functional mobility compared to general mobility and balance exercises.

DISCUSSION

The present study demonstrated that a six-week Otago Exercise Programme significantly improved balance and functional performance in elderly participants, as measured by the BOOMER Balance Scale, TUG, FRT, Step Test, and SSEC. These results are consistent with earlier trials showing the efficacy of OEP in reducing fall risk through targeted lower limb strengthening, balance training, and walking exercises [15,16] .

In our study, the absence of significant baseline differences between the groups ensured that post-intervention gains could be attributed to the OEP. The improvement in the experimental group's post-test scores reflects enhanced neuromuscular control, postural stability, and lower limb strength, which are critical for fall prevention [16,18] . This aligns with Sherrington et al. [16] , who reported

that exercise programmes incorporating balance and strength components reduce fall rates by up to 35% in community-dwelling older adults.

Our findings also corroborate Chandler et al. [19], who demonstrated that structured strength and balance training improves functional reach, gait speed, and confidence in older adults. Similarly, Delbaere et al. [20] highlighted that reducing fear of falling through targeted exercise contributes to greater mobility and independence. The present study's qualitative observations—participants reporting increased confidence and social engagement—mirror the psychosocial benefits described by Schoene et al. [21] and Thiamwong et al. [22].

The observed benefits may be attributed to the programme's FITT-based progression, which gradually increased challenge while maintaining safety, and to its multimodal design addressing multiple fall-related risk factors. Neuromuscular adaptations induced by repetitive practice likely enhanced proprioceptive feedback and reduced postural sway, as suggested by Neil et al. [23].

Moreover, the strong adherence in our cohort—supported by family encouragement and peer interaction—likely amplified the intervention's effectiveness. Social support has been identified as a facilitator of sustained physical activity engagement in older adults [24].

While the results are promising, the study's small sample size limits generalisability, and the relatively short intervention period precludes conclusions on long-term fall reduction. Nevertheless, the magnitude of improvement across multiple balance measures supports incorporating OEP into community-based geriatric health programmes, particularly in rural Indian settings where access to physiotherapy resources is limited.

CONCLUSION

The findings of this study demonstrate that the Otago Exercise Programme (OEP) is an effective, low-cost, and community-feasible intervention for improving balance and functional mobility among elderly individuals in Anandhapuram village, Puducherry. Over a six-week period, participants in the experimental group who received the OEP showed statistically and clinically significant improvements in BOOMER Balance Scale, Timed Up and Go Test, Functional Reach Test, Step Test, and Single-Stance Eyes Closed performance compared to the control group, which performed general mobility and balance exercises. These results align with previous evidence indicating that structured, progressive strength and balance training can reduce fall risk by enhancing neuromuscular control, postural stability, and lower limb strength [15,16,18].

Given its adaptability for home and community settings, the OEP can be effectively incorporated into primary healthcare and geriatric wellness programmes, especially in rural and resource-limited areas. Beyond physical benefits, the programme also fostered social interaction and increased participants' confidence in mobility, which may indirectly contribute to fall prevention. Future studies with larger sample sizes, longer follow-up, and direct fall incidence monitoring are recommended to confirm long-term efficacy and sustainability of the intervention.

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