



THE IMPACT OF THE OTAGO HOME EXERCISE PROGRAM ON FALL RISK REDUCTION IN OLDER ADULTS

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ABSTRACT

Background: The elderly, defined as individuals aged 60 years and older, experience various physiological changes associated with aging. One significant change is the decline in bodily functions, which affects the body's ability to adapt to the environment and often leads to impaired balance. This condition increases the risk of falls, making fall prevention efforts essential. One such effort is the Otago Home Exercise Programme (OHEP), a structured balance and strength training intervention. **Purpose:** This study aimed to determine the effect of OHEP on fall risk in the elderly. **Methods:** A quasi-experimental design with two groups and pretest–post-test. The samples involving 60 participants selected through purposive sampling. The intervention was conducted three times a week for three weeks, and fall risk was measured using the Timed Up and Go Test (TUGT). Data were analysed using the Wilcoxon and Mann-Whitney tests. **Results:** Results showed that there was a significant reduction in fall risk in the intervention group, with high risk decreased from 10% to 0%, moderate risk from 90% to 80%, and an increase in low risk from 0% to 20% ($p = 0.000$). **Conclusion:** It can be concluded that OHEP was effective in reducing fall risk among the elderly and is recommended for wider implementation in elderly care settings.

Keywords: elderly, fall risk, Otago Home Exercise Programme, TUGT

ABSTRAK

Latar Belakang: Lansia, yang didefinisikan sebagai individu berusia 60 tahun ke atas, mengalami berbagai perubahan fisiologis yang terkait dengan penuaan. Salah satu perubahan penting adalah penurunan fungsi tubuh, yang memengaruhi kemampuan tubuh untuk beradaptasi dengan lingkungan dan sering kali menyebabkan gangguan keseimbangan. Kondisi ini meningkatkan risiko jatuh, sehingga upaya pencegahan jatuh menjadi penting. Salah satu upaya tersebut adalah Program Latihan di Rumah Otago (Otago Home Exercise Programme/OHEP), sebuah intervensi pelatihan keseimbangan dan kekuatan yang terstruktur. **Tujuan:** Penelitian ini bertujuan untuk mengetahui efek OHEP terhadap risiko jatuh pada lansia. **Metode:** Desain kuasi-eksperimen dengan dua kelompok dan pretest–post-test. Sampel sebanyak 60 peserta dipilih melalui purposive sampling. Intervensi dilakukan tiga kali seminggu selama tiga minggu, dan risiko jatuh diukur menggunakan Timed Up and Go Test (TUGT). Data dianalisis menggunakan uji Wilcoxon dan Mann-Whitney. **Hasil:** Hasil menunjukkan bahwa terdapat penurunan risiko jatuh yang signifikan pada kelompok intervensi, dengan risiko tinggi menurun dari 10% menjadi 0%, risiko sedang dari 90% menjadi 80%, dan peningkatan risiko rendah dari 0% menjadi 20% ($p = 0,000$). **Kesimpulan:** Dapat disimpulkan bahwa OHEP efektif dalam mengurangi risiko jatuh pada lansia dan direkomendasikan untuk diterapkan secara lebih luas di layanan perawatan lansia.

Kata kunci: lansia, risiko jatuh, Otago Home Exercise Programme, TUGT

INTRODUCTION

The Central Statistics Agency (Badan Pusat Statistik) reported in 2023 that the proportion of the elderly population in Indonesia had reached 11.75%. This figure indicates an increase compared to the previous year's 10.48%, reflecting a rise of approximately 1.27%. This growing proportion of the elderly has also led to an increased dependency ratio, reaching 17.08% in 2023 (Badan Statistik Indonesia, 2023). The elderly population in Indonesia is projected to reach 33.69 million by 2025 and will continue to rise to approximately 48.19 million by 2035. This significant demographic shift is inevitable (Noor et al., 2023). In older adults, the musculoskeletal system is closely associated with fall risk due to age-related declines in function that impair mobility (Rudi & Setyanto, 2019). Data indicate that over 80% of deaths resulting from falls occur in developing regions such as Southeast Asia and the Western Pacific, with individuals aged 60 years and above accounting for 60% of those deaths. According to the World Health Organization, one in every four older adults experiences a fall (WHO, 2021). Data from the Indonesian Family Life Survey (IFLS) show that the annual prevalence of falls among older adults aged 65 and above is approximately 30%, increasing to around 50% in those aged 80 and older (Nugraha, 2020).

Fall prevention is essential to reduce both the incidence and consequences of falls among older adults. Maintaining and improving postural balance is one of the most effective strategies for mitigating fall risk. Balance training has been shown to be effective in reducing falls, as a direct relationship exists between postural stability and the occurrence of falls in the elderly population (Anjelina, 2022). Engaging in physical activity also helps minimize fall incidence, as it supports the function of muscles and joints, thereby aiding older adults in maintaining their balance (Siregar et al., 2020). Various balance training programs, such as Balance Exercises, the Star Excursion Balance Exercise, and the Otago Home Exercise Programme (OHEP), have been

proven effective in improving balance and preventing falls in older adults. The Otago Home Exercise Programme, in particular, serves as a promising alternative for enhancing muscle strength and postural control. Adequate muscle strength combined with proper mechanical structure facilitates effective balance responses (Komang et al., 2023).

A study conducted by Widyantari et al. (2024) found that the Otago Home Exercise Programme is more effective in improving dynamic balance among older adults compared to the Star Excursion Balance Exercise. The OHEP is a fall prevention program that incorporates strength and balance exercises, along with progressive ankle weight loading and increased exercise sets (Martins et al., 2018). This is supported by the findings of Nasri & Widarti (2020), which indicate that the Otago Home Exercise Programme significantly improves dynamic balance in the elderly. Another study showed functional improvement and a 35% reduction in fall risk among high-risk older adults who participated in the program (Tetania et al., 2024). Furthermore, Mutnawasitoh et al. (2021) found a statistically significant effect ($p = 0.025$, $p < 0.05$), suggesting that participation in the Otago Home Exercise Programme significantly reduces fall risk in older adults. Compared to Balance Strategy Exercises, the Otago Home Exercise Programme is superior in enhancing muscle strength due to its isotonic nature and progressive resistance approach, which has been proven effective in increasing muscular strength (Mahendra et al., 2016).

This study provides contributions to nursing practice by demonstrating the effectiveness of the Otago Home Exercise Program (OHEP) in reducing fall risk among older adults. The findings offer evidence-based guidance for nurses in assessing, planning, and implementing fall-prevention interventions within community and home-care settings. By integrating OHEP into routine nursing practice, nurses can enhance patient safety, promote functional independence, and support healthy aging.

METHODS

Study Design

This study was quasi-experimental two-group pretest–posttest design. The research was conducted in January 2025 in the working areas of Public Community Service UPTD Puskesmas Ibrahim Adjie, specifically in Kebonwaru and Kebongedang subdistricts, Batununggal District, Bandung, Indonesia.

Population and Sample

The study population consisted of older adults aged 60 years and above who resided in the study area. The sample size in this study was calculated using G*Power Software Version 3.1.9.7 with the test family *f*-test using the assumptions of $\alpha = 0.05$, effect size $f = 0.5$, power level = 0.85, numerator $df = 1$, number of groups = 2, the minimum required total sample size was 58. A total of 60 respondents were selected using purposive sampling based on specific inclusion criteria: being 60 years or older, having the ability to see and hear well, and having a muscle strength score of at least 4 in both upper and lower extremities.

Instrument

The instrument used to measure fall risk was the Timed Up and Go Test (TUG). The TUG demonstrates strong validity (with correlation coefficients ranging from approximately $r = 0.7$ to 0.9), a reliable and widely accepted tool developed by Podsiadlo and Richardson in 1991. The TUG test evaluates balance and mobility through a timed activity involving standing up from a chair, walking three meters, turning around, walking back, and sitting down. The instrument has excellent reliability, with both inter-rater and intra-rater intraclass correlation coefficients (ICC) recorded at 0.99.

Intervention Protocol

The study procedure consisted of three phases: preparation, implementation, and data analysis. During the preparation phase, ethical approval and research permits were obtained from STIKep PPNI West Java. Informed consent was provided by all participants. During the implementation phase, pretest measurements were

conducted for both the control and intervention groups. The intervention group received the Otago Home Exercise Programme three times per week for three weeks, with each session lasting 30 minutes. The control group received standard educational material about morning walks without structured physical activity. At the end of the intervention period, post-test measurements were taken using the same TUG assessment tool.

Data Analysis

Data analysis was carried out in several stages. The normality of the data was tested using the Kolmogorov-Smirnov test. Since the data were not normally distributed, non-parametric tests were applied. Univariate analysis was used to describe participant characteristics, while bivariate analysis was conducted using the Wilcoxon signed-rank test and the Mann-Whitney U test to determine differences in fall risk before and after the intervention.

Ethic Clearance

This research obtained ethical clearance from the Health Research Ethics Committee of STIKep PPNI West Java with approval number No. III/012/KEPK-SLE/STIKEP/PPNI/JABAR/I/2025. All procedures adhered to the ethical standards of the institutional and national research committee, and all participants signed written informed consent prior to involvement in the study.

RESULTS

Table 1. Demographic Data of Respondents (N=60)

Variable	Control Group (n=30) F (%)	Intervention Group (n=30) F (%)
Age		
60-74	24 (80 %)	27 (90 %)
75-90	6 (20 %)	3 (10 %)
Gender		
Male	8 (26.7 %)	5 (16.7 %)
Female	22 (73.7 %)	25 (83.3 %)
Marital Status		
Married	22 (73.7 %)	12 (40 %)
Single	0 (0 %)	1 (3.3 %)
Widow/widower	8 (26.7 %)	17 (56.7 %)
Living/Stay with		

Variable	Control Group (n=30) F (%)	Intervention Group (n=30) F (%)
Family	30 (100 %)	28 (93.3 %)
Alone	0 (0 %)	2 (6.7 %)
Personal Medical History		
No	10 (33.3 %)	13 (43.3 %)
Yes	20 (66.7 %)	17 (56.7 %)
History of falls		
Ever	8 (26.7 %)	10 (33.3 %)
Never	22 (73.3 %)	20 (66.7 %)

Based on Table 1, a total of 47 respondents (78.3%) were female and most of the participants were aged 60–74 years. The majority of respondents were married (56.7%), followed by widowed or divorced (41.7%). Most respondents lived with their families (96.7%). Regarding personal medical history (38.3%) reported no history of chronic illness, while (61.7%) had chronic health conditions. Furthermore, 30% had experienced a fall.

Table 2. Risk of Fall the Responden (N=60)

Risk of Fall	Low F (%)	Moderate F (%)	High F (%)
Intervention Group (n=30)			
Pre-test	0 (0 %)	27 (90 %)	3 (10 %)
Post-test	6 (20 %)	24 (80 %)	0 (0 %)
Control Group (n=30)			
Pre-test	1 (3.3 %)	27 (90.7 %)	2 (6.7 %)
Post-test	1 (3.3 %)	28 (93.3 %)	1 (1.7 %)

Based on Table 2, a comparison of fall risk levels in the intervention group before and after receiving the Otago Home Exercise Programme showed a reduction in risk. The proportion of participants classified as high fall risk decreased from 10% to 0%, while those in the moderate risk category decreased from 90% to 80%. Meanwhile, the proportion of participants in the low-risk category increased from 0% to 20%. In the control group, the pre-test and post-test results indicated a slight change: high fall risk decreased from 6.7% to 1.7%, moderate risk increased from 90.7% to 93.3%, and the proportion in the low-risk category remained at 3.3%. These differences indicate that the intervention group experienced a more meaningful

improvement in fall risk compared to the control group. The Otago Home Exercise Programme not only eliminated the proportion of participants in the high-risk category but also substantially increased the number of individuals classified as low risk. In contrast, the control group showed only minimal changes, suggesting that natural variation or routine activities alone did not significantly reduce fall risk.

Table 3. Effectiveness of Otago Home Exercise Program

Risk of Fall	Z	P-value
Pre-Post-test Control Group	-.021	.984
Pre-Post-test Intervention Group	-4.782	.000

Based on Table 3, the analysis using Mann-Whitney U test showed a p-value of 0.984 ($p > 0.05$) in the control group. This indicates that the null hypothesis was accepted and the alternative hypothesis was rejected, meaning there was no significant change in fall risk before and after the morning walk education intervention. In contrast, the intervention group showed a p-value of 0.001 in the first week and 0.000 in the second and third weeks ($p < 0.05$). These findings indicate that the null hypothesis was rejected and the alternative hypothesis was accepted, meaning there was a significant difference between the pre-test and post-test scores in the intervention group after participating in the Otago Home Exercise Programme.

DISCUSSION

The study found that falls are a significant concern among the elderly. Falls may occur when the body's postural control system fails to detect and respond appropriately to shifts in the center of gravity. The physiological mechanisms involved in maintaining balance are critical in preventing falls, especially in older adults who are more vulnerable. Age-related decline in sensory and motor functions contributes to increased fall risk (Kirana et al., 2024). The results of this study revealed a difference in fall risk within the intervention group before and after receiving the Otago Home Exercise Programme. The study findings indicate a

decrease in fall risk among the elderly who participated in the Otago Home Exercise Programme, shifting from higher to lower risk levels. In contrast, the control group showed minimal change after receiving morning walk education.

The results of this study showed a significant improvement in the intervention group following the implementation of the Otago Home Exercise Programme. The Otago Home Exercise Programme was specifically designed to improve muscle strength and balance—two key factors that support postural control and fall prevention in older adults. Previous research by Ariyanti et al. (2024) also found this program to be effective in enhancing lower limb strength and balance, thereby reducing fall risk. As individuals age, the ability to maintain balance naturally declines due to muscle weakness, difficulty coordinating body movements, and impaired gait. This deterioration in balance control is often the result of degenerative processes, which increase the likelihood of falling (Thomas et al., 2019). Muscle strength plays a critical role in postural stability, particularly in the lower extremities. Movement relies heavily on muscular tension to generate power and allow the body to move through space. Female muscles, in terms of size and weight, are generally about half that of males during adulthood. Muscle mass accounts for approximately 43% of body weight in men, compared to only 36% in women. Postmenopausal women also experience a decline in estrogen levels, a hormone essential for maintaining soft tissue integrity. Hormonal factors, such as fluctuations in estrogen and progesterone, can affect tendon health, making menopausal women more susceptible to musculoskeletal decline (Azizah et al., 2021).

The Otago Home Exercise Programme has demonstrated positive effects on the physical condition of the elderly. Its warm-up phase includes movements involving the head, neck, shoulders, back, and joints to prepare the body for further exercise and to maintain flexibility. The strengthening component targets muscles in the knees, ankles, and

heels, which are essential for maintaining bone and muscle health, enabling older adults to walk and perform daily activities independently (Manohare & Hande, 2019). Balance training in older adults at risk of falling helps the body adapt to movement changes via compensatory processes in the brain, which enhance the functions of the visual, vestibular, somatosensory, and muscular systems (Hasibuan et al., 2021).

Throughout the Otago Home Exercise Programme, progressive contraction of the lower limb muscles improves neuromuscular function. This leads to better synchronization of motor unit recruitment through consistent muscular activation. As a result, there is an increase in the strength of muscles such as the gastrocnemius, hamstrings, soleus, trunk extensors, tibialis anterior, quadriceps, and others. In the macula utriculi, vestibular nerves play a role in detecting head position while standing. Balance-specific movements in the program trigger automatic postural responses, including tandem stance, tandem walking, heel walking, toe walking, backward heel walking, and sit-to-stand exercises (Mutnawasitoh et al., 2021).

In addition, the walking exercises included in the Otago Home Exercise Programme help elderly individuals improve postural control in confined spaces such as inside the home and support balance recovery during unconscious movements. Hip strategy becomes essential when the body moves quickly across longer distances. These activities also help improve gait posture and enhance balance control in weight-bearing areas (Segita et al., 2021). This aligns with research by Ikhsan et al. (2020), who found that regular physical activity improves muscle strength and agility, prevents fall risk, and enhances overall health and independence in daily activities among older adults. Similar results were reported by Ariyanti et al. (2024), who observed a decrease in fall risk among elderly participants after engaging in the Otago Home Exercise Programme.

The demonstrated benefits of OHEP underscore the need for nurses to integrate structured, evidence-based fall-prevention exercises into routine care, particularly for community-dwelling older adults. Nurses play a pivotal role in assessing fall risk, educating patients, and facilitating adherence to home-based exercise programs. Implementing OHEP can enhance patient safety, reduce reliance on assistive devices, and support healthy aging by maintaining functional mobility. Furthermore, the program offers a practical, low-cost intervention that can be seamlessly incorporated into home-care services, enabling nurses to address fall risk proactively rather than reactively.

Overall, the study reinforces that the Otago Home Exercise Programme is not only effective but also clinically relevant, offering a scientifically grounded strategy that nurses can utilize to strengthen balance, reduce fall risk, and improve the overall quality of life for older adults.

CONCLUSION

The findings of this study demonstrate that the Otago Home Exercise Programme is an effective intervention for reducing fall risk among the elderly. Participants who engaged in the program showed a significant shift from high and moderate fall risk levels to lower risk levels, with improved balance and muscle strength. This improvement is attributed to the program's structured exercises, which target postural control, lower limb strength, and neuromuscular coordination. From a broader perspective, the results emphasize the importance of integrating OHEP into geriatric nursing practice and community-based health initiatives. Implementing this program within elderly community centres, home-care services, and primary healthcare settings could serve as a practical, low-cost strategy to reduce fall-related injuries. Policymakers and healthcare administrators are encouraged to support routine screening for fall risk and to adopt OHEP as part of standardized fall-prevention protocols.

RECOMMENDATIONS

For the nursing profession, this study is expected to be applied in clinical practice, recognizing the positive impact of the Otago Home Exercise Programme on reducing fall risk among the elderly. It may serve as an effective intervention strategy to help prevent falls and improve geriatric care outcomes.

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