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EFFECTS OF THE OTAGO HOME EXERCISE PROGRAM ON FALL RISK AMONG OLDER ADULTS

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ABSTRACT

Background: Aging is accompanied by progressive physiological changes that reduce physical function, balance, and mobility, thereby increasing the risk of falls among older adults. Falls are a major cause of morbidity, functional decline, and reduced quality of life in the elderly population. Effective and feasible fall-prevention interventions are therefore essential. The Otago Home Exercise Program (OHEP) is a structured strength and balance training program designed to reduce fall risk in older adults. **Objective:** This study aimed to examine the effect of the Otago Home Exercise Program on fall risk among older adults. **Methods:** A quasi-experimental study with a two-group pretest–posttest design was conducted involving 60 participants aged 60 years and older, selected using purposive sampling. The intervention group received the OHEP three times per week for three weeks, while the control group received usual care. Fall risk was assessed using the Timed Up and Go Test (TUGT). Data were analyzed using the Wilcoxon signed-rank test and the Mann–Whitney U test. **Results:** A significant reduction in fall risk was observed in the intervention group following the program ($p = 0.000$). High fall risk decreased from 10% to 0%, moderate risk decreased from 90% to 80%, and low fall risk increased from 0% to 20%. **Conclusion:** The Otago Home Exercise Program is effective in reducing fall risk among older adults and is recommended for implementation in elderly care and community health settings.

Keywords: Otago Home Exercise Program; fall risk; older adults; balance training; fall prevention

INTRODUCTION

The growing elderly population presents a significant public health challenge, especially in countries like Indonesia, where the proportion of individuals aged 60 years and above continues to rise. This demographic shift is accompanied by age-related physiological decline, including reduced muscle strength and balance, which can significantly affect an older person's ability to perform daily activities safely. One of the most serious consequences of this decline is the increased risk of falls, which are among the leading causes of injury and

death in older adults. The World Health Organization estimates that one in four elderly individuals experiences a fall annually, with even higher rates reported in individuals over the age of 80. Falls not only lead to physical injury but also to psychological trauma, reduced independence, and increased health care costs.

Multiple factors contribute to fall risk in the elderly. These include intrinsic factors such as impaired vision, balance disorders, decreased mobility, and chronic health conditions, as well as extrinsic factors like unsafe home environments and inappropriate footwear. Although falling is often viewed as an inevitable part of aging, it is largely preventable through structured interventions. Regular physical exercise, especially those focused on balance and strength, has been shown to play an important role in fall prevention among older adults. Among various exercise interventions, the Otago Home Exercise Programme (OHEP) has gained attention due to its simple structure and proven effectiveness. Developed to be performed at home with minimal supervision, the OHEP focuses on strengthening lower extremity muscles and improving balance through specific, repetitive movements.

Given the growing need for effective and accessible fall prevention strategies in the aging population, this study aimed to examine the effect of the Otago Home Exercise Programme on reducing fall risk among elderly individuals.

METHOD

Study Design

This study employed a quantitative quasi-experimental design using a two-group pretest–posttest approach to evaluate the effect of the Otago Home Exercise Program (OHEP) on fall risk among older adults. This design was selected to compare outcomes between an intervention group and a control group while allowing assessment of changes over time. The study was conducted in January 2025 in the working areas of UPTD Puskesmas Ibrahim Adjie, specifically Kebonwaru and Kebongedang subdistricts, Batununggal District, Bandung, Indonesia.

Study Population and Sample

The study population comprised older adults aged 60 years and above residing in the study area. A total of 60 participants were recruited using purposive sampling based on predefined inclusion criteria. Eligible participants were required to be aged ≥60 years, have adequate visual and auditory function, and demonstrate muscle strength of at least grade 4 in both upper and lower extremities. Older adults with severe mobility limitations or acute medical conditions were excluded.

Participants were divided into an intervention group (OHEP) and a control group, with each group consisting of 30 respondents.

Research Instruments

Fall risk was assessed using the Timed Up and Go Test (TUG), a validated and widely used tool developed by Podsiadlo and Richardson. The TUG measures functional mobility and balance through a timed task involving standing from a seated position, walking three meters, turning, returning, and sitting down. The instrument demonstrates excellent reliability, with reported inter-rater and intra-rater intraclass correlation coefficients (ICC) of 0.99, indicating high measurement consistency.

Data Collection Procedure

Data collection consisted of three phases: preparation, implementation, and evaluation. During the preparation phase, research permits and ethical approval were obtained. Written informed consent was secured from all participants prior to data collection.

At baseline, pretest TUG assessments were conducted for both groups. The intervention group participated in the Otago Home Exercise Program three times per week for three weeks, with each session lasting approximately 30 minutes under supervision. The control group received standard health education regarding morning walking without structured exercise intervention. Following the intervention period, posttest assessments were performed using the same TUG procedure.

Data Analysis

Data analysis was conducted using statistical software. Normality testing was performed using the Kolmogorov–Smirnov test, which indicated non-normally distributed data. Descriptive statistics were used for univariate analysis of participant characteristics. Wilcoxon signed-rank tests were applied to compare pretest and posttest outcomes within groups, while the Mann–Whitney U test was used to evaluate differences between the intervention and control groups. Statistical significance was set at $p < 0.05$.

Ethical Considerations

This study received ethical approval from the Health Research Ethics Committee of STIKep PPNI West Java (No. III/012/KEPK-SLE/STIKEP/PPNI/JABAR/I/2025). All research procedures complied with institutional and national ethical standards. Participation was voluntary, confidentiality was maintained, and all respondents provided written informed consent prior to study participation.

RESULTS

Table 1 Demographic characteristics of respondents in the intervention and control groups

Characteristic Variable		Control	Intervention	Total
		n (%)	n (%)	n (%)
Age (years)	60–74	24 (80.0)	27 (90.0)	51 (85.0)
	75–90	6 (20.0)	3 (10.0)	9 (15.0)
	>90	0	0	0
	Min–max	60–84	60–76	60–84
	Mean ± SD	69.37 ± 6.504	67.27 ± 4.733	68.32 ± 4.716
Sex	Male	8 (26.7)	5 (16.7)	13 (21.7)
	Female	22 (73.3)	25 (83.3)	47 (78.3)
Marital Status	Married	22 (73.3)	12 (40.0)	34 (56.7)
	Never married	0	1 (3.3)	1 (3.3)
	Widowed/Divorced	8 (26.7)	17 (56.7)	25 (41.7)
Living Arrangement	With family	30 (100.0)	28 (93.3)	58 (96.7)
	Alone	0	2 (6.7)	2 (3.3)
Medical History	None	10 (33.3)	13 (43.3)	23 (38.3)
	Present	20 (66.7)	17 (56.7)	37 (61.7)
History of Falls	Yes	8 (26.7)	10 (33.3)	18 (30.0)
	No	22 (73.3)	20 (66.7)	42 (70.0)

Source: Primary Data, 2025

Based on Table 1, a total of 47 respondents (78.3%) were female and 13 respondents (21.7%) were male. Most of the participants were aged 60–74 years, accounting for 51 individuals (85%), with 24 individuals (80%) in the control group and 27 individuals (90%) in the intervention group. The remaining 9 respondents (15%) were aged 75–90 years, including 6 individuals (20%) in the control group and 3 individuals (10%) in the intervention group. The minimum age of participants was 60 years, and the maximum age was 84 years. The average age in the intervention group was 67.27 ± 4.733 years, while the control group had an average age of 69.37 ± 6.504 years.

The majority of respondents were married (56.7%), followed by widowed

or divorced (41.7%), and a small portion who had never married (3.3%). Most respondents lived with their families, totaling 58 individuals (96.7%), while only 2 respondents (3.3%) lived alone. Regarding health history, 23 respondents (38.3%) reported no history of chronic illness, while 37 respondents (61.7%) had chronic health conditions. Furthermore, 18 respondents (30%) had experienced a fall, while 42 respondents (70%) had not.

Table 2 Comparison of pre-test and post-test percentages of fall risk in the control group and intervention group

Fall Risk	Mild	Moderate Risk	High Fall Risk
	F(%)	F(%)	F(%)
Intervention			
Pre-test	0	27(90)	3(10)
Post-test	6(20)	24(80)	0
Control			
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%.

Table 3 Differences in fall risk scores before and after the Otago Home Exercise Program intervention was given to the control and intervention groups

Fall Risk	Z	*p-value*
Pretest Control - Posttest Control	-.021	.984
Pretest Intervention - Posttest Intervention	-4.782	.000

Based on Table 3, the analysis 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.

Table 4 Effect of the Otago Home Exercise Programme intervention on the control and intervention groups

Fall Risk	Z	*p-value*
Control Intervention	-3.763	.000

Based on Table 4, the analysis showed a p-value of 0.000 ($p < 0.05$), indicating a significant effect on the post-test TUGT scores after the intervention was administered. The mean rank in the control group was higher (38.98) compared to the intervention group (22.02), suggesting that participants in the control group took a longer time to complete the Timed Up and Go Test.

Therefore, it can be concluded that the alternative hypothesis was accepted and the null hypothesis was rejected, indicating that the Otago Home Exercise Programme had a significant effect on reducing fall risk among the elderly.

DISCUSSION

The results of this study showed a significant improvement in the intervention group following the implementation of the Otago Home Exercise Programme. The p-value obtained was 0.001 in the first week and 0.000 in the second and third weeks ($p < 0.05$), indicating that the null hypothesis (H_0) was rejected and the alternative hypothesis (H_a) was accepted. These results confirm that the intervention had a significant effect on the participants' health condition, particularly in reducing fall risk. 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).

Physiologically, strength training (stretching) enhances muscle power through synthetic muscle contraction. This process increases the production of actin and myosin within the myofibrils, resulting in muscle fiber hypertrophy. The addition of new muscle fibers also improves metabolic systems, including the production of ATP (adenosine triphosphate) and phosphocreatine. Consequently, both aerobic and anaerobic metabolic activity increases, generating the energy and muscular strength required to support physical movement. Furthermore, 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).

The results of the Mann-Whitney U test analysis demonstrated a significant effect on the post-test scores of the Timed Up and Go Test (TUGT) following the intervention, with a p-value of 0.000 ($p < 0.05$). This finding indicates that the group receiving the Otago Home Exercise Programme experienced greater improvements in mobility and balance compared to the control group. Therefore, the

alternative hypothesis (H_a) is accepted, and the null hypothesis (H_0) is rejected, confirming that the intervention significantly contributed to reducing fall risk among the elderly.

These findings support existing literature suggesting that structured exercise programs can enhance muscle strength and balance—two key elements in fall prevention. 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.

In this study, the Otago Home Exercise Programme was conducted regularly in the intervention group, three times per week over a period of three weeks. This consistent schedule contributed to a reduction in fall risk following the intervention. 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, with high-risk levels dropping from 57.1% to 33.3%. The significance value of p = 0.000 using the Wilcoxon test confirmed a significant difference before and after the intervention, further validating the effectiveness of the Otago Home Exercise Programme in improving balance and reducing fall risk in older adults.

Clinical Implications

The findings of this study demonstrate that the Otago Home Exercise Programme (OHEP) is an effective, structured intervention for reducing fall risk among older adults, particularly those with moderate fall risk living in community settings. These results support the integration of OHEP into routine primary care, community health nursing, and geriatric rehabilitation programs. Nurses and physiotherapists can play a pivotal role in implementing and supervising OHEP, as the program is simple, low-cost, and adaptable to home-based environments.

Given that educational interventions alone showed minimal impact on fall risk, this study highlights the importance of active, supervised exercise programs rather than passive health education. Regular strength and balance training may improve neuromuscular coordination, postural control, and mobility, thereby promoting independence and reducing fall-related morbidity among older adults. Incorporating OHEP into elderly health promotion initiatives may contribute to safer aging and reduced healthcare burden associated with falls.

Study Limitations

Several limitations should be considered when interpreting the results. First, the quasi-experimental design and use of purposive sampling may limit causal inference and generalizability to broader elderly populations. Second, the relatively short intervention duration of three weeks does not allow assessment of

long-term adherence or sustained fall risk reduction. Third, fall risk was measured using a single functional assessment tool (TUG), which may not capture all dimensions of fall risk. Additionally, the study did not control for confounding factors such as medication use or environmental hazards. Future studies with randomized designs, longer follow-up periods, and comprehensive fall risk assessments are recommended

CONCLUSION

This study demonstrates that participation in the Otago Home Exercise Programme leads to a meaningful reduction in fall risk among older adults. In the intervention group, the proportion of participants classified as high risk decreased from 10% to 0%, while the proportion at moderate risk declined and the low-risk category increased, indicating a favorable shift in overall fall-risk profile. In contrast, the control group showed only minimal improvement, with a slight reduction in the high-risk category and no meaningful increase in the low-risk group.

Statistical analysis confirmed a significant effect of the Otago Home Exercise Programme on fall risk, supporting the acceptance of the alternative hypothesis and rejection of the null hypothesis. These findings indicate that the Otago Home Exercise Programme is an effective intervention for reducing fall risk in older adults and support its implementation as a community- and home-based strategy to promote safe mobility and healthy aging.

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.

For institutions, this research can serve as a reference for future studies and contribute to the development of scientific knowledge, particularly in the field of gerontological nursing.

For future researchers, the results of this study may provide a useful foundation for further investigation into the effectiveness of the Otago Home Exercise Programme on fall risk reduction in elderly populations, encouraging more comprehensive and advanced studies in this area.

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Author Contributions

VL contributed to the study conception and design, data collection, intervention implementation, data analysis, and manuscript drafting.

PBR contributed to data collection, data interpretation, critical revision of the manuscript, and supervision of the research process.

Both authors read and approved the final manuscript and agreed to be accountable for all aspects of the work.

Conflict of Interest

The authors declare that there are no conflicts of interest related to this study.

Data Availability Statement

The datasets generated and analyzed during the current study are available from the corresponding author upon reasonable request, subject to ethical approval and participant confidentiality considerations.

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