Lentera Perawat
Volume 6 Number 3: July - September 2025

OPEN ACCESS

Original Article

Implementation of tandem walking and balance exercise combination for fall prevention among older adults with balance disorders : A case study

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Keyword:
Exercise therapy;
Falls prevention;
Older adult;
Postural balance;
Tandem walking;

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DOI:
https://doi.org/10.52235/lp.v6i3.565

Article Info:
Received : August 03, 2025
Revised : August 25,, 2025
Accepted : August 27, 2025

Lentera Perawat
e-ISSN : 2830-1846
p-ISSN : 2722-2837

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Abstract

Background: The aging process leads to a progressive decline in physiological function, including muscle strength and body balance, which increases the risk of falls among older adults. Falls are one of the leading causes of injury-related morbidity and mortality in the elderly, significantly reducing quality of life..

Objective: This study aimed to implement a combination of tandem walking and balance exercises as an intervention to prevent falls in older adults with balance impairments at the Tanjung Agung Community Health Center.

Methods: A descriptive case study design with a nursing process approach was applied. Two elderly participants with moderate fall risk, as assessed by the Berg Balance Scale (BBS), were included. The intervention consisted of tandem walking and balance exercise sessions twice weekly for four weeks. Balance outcomes were measured pre- and post-intervention using the BBS, complemented by structured interviews and direct observation.

Results: Both participants demonstrated improvement in balance performance. The BBS score of Participant 1 increased from 40 to 51, shifting from moderate to low fall risk. Participant 2 improved from 39 to 46, reflecting enhanced postural stability, though still within moderate risk. Both reported greater confidence and stability during standing and walking, with reduced reliance on external support.

Conclusion: The combination of tandem walking and balance exercises was effective in improving static and dynamic balance while reducing fall risk in older adults with balance disorders. This intervention is recommended as a practical fall-prevention strategy in community and primary healthcare settings.

Background

The Ministry of Health of the Republic of Indonesia defines the term elderly as individuals who have reached the age of sixty years and above (Puspitasari et al., 2023). With advancing age, physiological functions in older adults gradually decline. The degenerative process leads to a reduction in muscle strength, loss of connective tissue, bone, joints, bone density, and muscular capacity, which directly impacts body balance (Rekawati et al., 2025). The reduction in bone density further predisposes older adults to various musculoskeletal conditions, including osteoarthritis, rheumatoid arthritis, gout, and joint inflammation. Consequently, older adults are often unable to maintain their center of gravity while standing upright. Impaired postural control contributes to balance disorders, thereby increasing the risk of falls (Listyarini & Alvita, 2018).

In Indonesia, 11.9% of adults experience decreased muscle strength, while 33% encounter other muscular problems. Approximately 26% of adults are categorized as having moderate muscle weakness, whereas 13% are considered to have normal muscle strength. The number of elderly requiring medical attention due to falls is estimated at 7.3 million. Furthermore, balance disorders account for approximately 31%–48% of fall incidents among older adults (Choirunnisa & Pudjianto, 2023).

In 2023, the age distribution of the elderly population in South Sumatra Province was reported as follows: 64.87% aged 60–69 years, 26.37% aged 70–79 years, and 8.75% aged 80 years and above (Badan Pusat Statistik Sumatera Selatan, 2023). The prevalence of falls in this province was 32.4% (Riskesdas, 2013).

Specifically, in Ogan Komering Ulu District, the prevalence was 7.37%, with 10,220 individuals aged 65–69 years, 10,220 aged 70–74 years, and 7,639 aged 75 years and above (Pemkab OKU, 2023). Data from Tanjung Agung Public Health Center in 2021 showed a total of 8,105 older adults: 5,353 aged 45–59 years, 1,826 aged 60–69 years, and 926 aged over 70 years. Of these, 1,797 older adults (24.4%) were categorized as having a high risk of falling (Puskesmas Tanjung Agung, 2021).

Fall prevention strategies include physical exercise aimed at improving and restoring muscle function. Several types of exercises have been proposed, including ankle strategy exercises, balance exercises, core stability training, and tandem walking. Balance exercise focuses on enhancing muscle strength in the lower extremities and vestibular system, thereby improving postural stability (Saraswati et al., 2022). Tandem walking aims to improve body alignment, balance control, muscular coordination, and motor function (Gemini & Yusmaneti, 2022).

Based on the evidence presented above, it can be concluded that falls among older adults represent a significant health problem requiring urgent attention. Balance training, particularly through tandem walking and structured balance exercises, has the potential to reduce the risk of falls. Therefore, this study aims to implement a combination of tandem walking and balance exercises to minimize fall risk in older adults with balance disorders.

Methods

Study Design

This study employed a descriptive case study design with a nursing process approach. The design was chosen because it allows for an in-depth exploration of the implementation of interventions in individuals or small groups with specific characteristics. A descriptive case study is particularly suitable when the aim is to thoroughly explore processes, responses, and outcomes of an intervention in a real-world context, thereby providing a basis for the development of broader nursing practices. The nursing process approach was applied to emphasize systematic assessment, planning, implementation, and evaluation of patient needs, ensuring a holistic perspective on fall prevention among older adults.

Sampling and Setting

Participants were recruited using purposive sampling, whereby the researcher deliberately selected individuals who met predefined criteria to align with the study objectives. This technique was considered appropriate since the study targeted a specific population, namely older adults at moderate risk of falls. Two participants were included based on the following inclusion criteria: aged 60–90 years, able to stand without assistive devices, able to communicate effectively, having a Berg Balance Scale (BBS) score within the moderate category (30–40), and providing written informed consent. Exclusion criteria included severe chronic conditions such as advanced stroke, end-stage renal disease, or severe heart disease, which could increase the risk of complications during exercise and compromise the validity of the findings. The study was conducted at the Tanjung Agung Community Health Center, Ogan Komering Ulu District, South Sumatra, an area with a high prevalence of fall risk among the elderly population. The study period extended from April to June 2025, comprising six intervention sessions across four weeks.

Instruments

The primary instrument used in this study was the Berg Balance Scale (BBS), a standardized, valid, and reliable tool for evaluating balance and fall risk among older adults. The BBS consists of 14 activity items with a total score ranging from 0 to 56, categorized into high risk (0–20), moderate risk (21–40), and low risk (41–56). This tool provided an objective basis for assessing pre- and post-intervention changes. In addition, structured interview forms were used to collect demographic information, medical history, and functional status, while observation sheets were developed to record activity levels, movement accuracy, and participant responses during the exercises. The combination of these instruments ensured comprehensive data collection, encompassing both quantitative (BBS scores) and qualitative (interviews and observations) aspects.

Intervention

The intervention consisted of a combination of tandem walking and balance exercises. This intervention was selected based on empirical evidence indicating that both dynamic and static balance training can effectively reduce fall risk

among older adults. The exercises were delivered twice weekly, with each session lasting 15 minutes, over a four-week period. This frequency and duration were adopted from literature suggesting that short but consistent repetitive training enhances neuromuscular adaptation without inducing excessive fatigue in older adults. The procedure included initial education on the benefits of the exercises, demonstration by a nurse, supervised practice by participants, and periodic evaluations to monitor progress.

Data Collection

Multiple methods were employed to ensure accuracy and completeness of the data. First, structured interviews were conducted to obtain demographic and health-related information. Second, direct observation was carried out to document participants' responses during the exercises, such as postural stability, adherence to instructions, and comfort levels. Third, BBS measurements were conducted before the intervention (pre-test) and after the intervention (post-test) to assess balance changes. Finally, progress notes were maintained for each session to track individual developments and identify patterns over time. The use of these complementary methods enabled data triangulation, thereby enhancing the credibility of the findings.

Data Analysis

Data were analyzed descriptively. The analysis process involved data reduction by selecting relevant information from interviews, observations, and BBS results. Data were then presented in tabular and narrative formats to illustrate participant profiles and changes in BBS scores. The final step involved interpreting the results by comparing pre- and post-intervention conditions and linking the findings to balance theories and previous studies. Descriptive analysis was deemed appropriate because of the limited sample size and the study's emphasis on generating in-depth understanding rather than population-level generalization.

Ethical Considerations

This study adhered to ethical principles of nursing research. First, the principle of respect for persons was applied by providing complete information about the study's objectives, procedures, benefits, and potential risks prior to obtaining written informed consent. Second, beneficence was ensured by implementing safe interventions tailored to the participants' conditions, with the expectation of improving balance and reducing fall risk. Third, justice was upheld by selecting participants based on clear inclusion criteria without discrimination. Anonymity was maintained through the use of participant codes, while confidentiality of personal information was safeguarded. The study also obtained official approval from the community health center, and participation was voluntary without coercion.

Results

This study presents the findings of a descriptive case study involving two older adult participants with balance impairments who were provided with a combined intervention of tandem walking and balance exercises. The results are described in five stages of the nursing process, namely assessment, data analysis, intervention, implementation, and evaluation, to comprehensively illustrate the effectiveness of the program.

Assessment

A comprehensive assessment was conducted on two older adults experiencing balance disorders and at risk of falls, both residing in the Tanjung Agung Community Health Center catchment area. The first client, Mrs. S, a 71-year-old woman living alone in Saung Naga Village, reported frequent dizziness and loss of balance when rising from a seated position. She admitted to relying on nearby objects for support to maintain stability. Physical examination revealed blood pressure of 130/80 mmHg, pulse rate of 97 beats per minute, respiratory rate of 22 breaths per minute, and body temperature of 36.5°C. Her initial Berg Balance Scale (BBS) score was 40, indicating a moderate risk of falls. She also had a medical history of gastritis but no visual impairment or lower extremity injury. Psychosocially and spiritually, she reported being consistent in her worship practices but often felt lonely because she lived alone.

The second client, Mrs. H, a 75-year-old woman living with her children and grandchildren in

Kebun Jeruk Village, complained of knee pain when bending and an inability to stand for extended periods without support. Physical examination showed blood pressure of 150/80 mmHg, pulse rate of 93 beats per minute, respiratory rate of 22 breaths per minute, and body temperature of 36.5°C. Her initial BBS score was 39, also indicating moderate fall risk. She had a five-year history of hypertension but no history of falls or other severe chronic conditions. Mrs. H actively participated in weekly religious gatherings at the mosque and received strong family support in her daily activities. Both participants met the inclusion criteria, namely being over 60 years of age, able to communicate effectively, and capable of standing without assistive devices.

Nursing Diagnosis

Data analysis from the assessment indicated that both clients had a significant risk of falling due to balance impairment. Subjective data included complaints of dizziness, loss of balance, and joint pain, while objective data such as BBS scores ranging from 39 to 40 confirmed the need for preventive intervention. Based on these findings, the nursing diagnosis established for both clients was Risk for falls related to impaired balance (D.0143). This diagnosis was further supported by observational data from daily activities, where both clients appeared unstable when standing or walking and demonstrated reliance on nearby objects for support.

Nursing Intervention

The nursing intervention provided referred to the standardized intervention Fall Prevention (I.14540). This intervention was designed in the form of a combined tandem walking and balance exercise program, conducted over six sessions during four weeks, with a frequency of twice per week and a duration of 15 minutes per session. Exercises were performed at each client's home, tailored to their physical ability and environmental conditions. The intervention components included an initial observation using the BBS, education on fall risk and the importance of maintaining balance, and physical movement training according to standard operating procedures. Tandem walking was aimed at training lateral balance by walking in a straight line, while the balance exercises consisted of five main movements: plantar flexion, hip flexion, hip extension, knee flexion, and side leg raise. Prior to exercise, clients received education regarding the procedures and benefits of the intervention, as well as advice on using non-slip footwear.

Nursing Implementation

The intervention was delivered in a structured manner. During the first session, informed consent, initial assessment, and scheduling were completed. The second and third sessions focused on education and demonstration of tandem walking and balance exercises, with clients practicing slowly under supervision and family assistance. In the fourth and fifth sessions, clients practiced more independently with light evaluation of movement accuracy. In the sixth and final session, post-intervention evaluation of BBS scores and balance condition was performed. Throughout the implementation, both clients demonstrated enthusiasm and strong adherence to the intervention. Mrs. S showed gradual improvement in performing the movements, although corrections were required initially. Similarly, Mrs. H demonstrated notable progress despite early difficulties in following the exercise sequence.

Nursing Evaluation

Evaluation was performed by comparing pre- and post-intervention BBS scores. Mrs. S's score increased from 40 to 51, indicating an improvement from moderate to low fall risk. She reported increased confidence in standing and walking, though occasional reliance on support remained. Mrs. H's score improved from 39 to 46, which, although still categorized as moderate risk, demonstrated significant improvement in postural stability. She reported feeling more balanced while standing and being able to walk longer distances than before. Overall, the combined tandem walking and balance exercise intervention proved effective in improving balance and reducing fall risk among older adults with balance disorders. This program may serve as a simple yet effective fall-

prevention strategy that can be applied in community settings.

Discussion

The findings of this study demonstrate that the implementation of a combined tandem walking and balance exercise program had a positive impact on improving balance and reducing fall risk among older adults with balance impairments. Both participants experienced an increase in Berg Balance Scale (BBS) scores after undergoing structured interventions over a four-week period. This suggests that structured, simple physical exercises, which can be performed independently at home, provide significant benefits in enhancing musculoskeletal function and balance systems in the elderly.

For the first participant (Mrs. S), the BBS score increased from 40 to 51, reflecting a meaningful reduction in fall risk from the moderate to the low category. This indicates substantial recovery in both dynamic and static balance. For the second participant (Mrs. H), the BBS score improved from 39 to 46, which, although still within the moderate risk category, revealed considerable improvements in body stability and motor function during daily activities. These findings are consistent with Kiik et al. (2018), who reported that balance training improves the quality of life among older adults by reducing fall risk through strengthening of the lower extremities and enhanced postural control.

Tandem walking played a critical role in training lateral balance and coordination of the lower body muscles. This exercise targets the somatosensory and vestibular systems, which are essential for maintaining postural control while standing and walking. The findings of this study align with Siregar et al. (2020) and Gemini & Yusmaneti (2022), who demonstrated that tandem walking effectively improves postural stability and strengthens the quadriceps, which serve as key muscles for mobility in older adults.

In addition, balance exercises comprising five core movements (plantar flexion, hip flexion, hip extension, knee flexion, and side leg raise) were shown to enhance lower body stability comprehensively. These exercises promoted sensory integrity, motor capacity, and the body's ability to adapt to positional changes. This outcome corresponds with findings by Saraswati et al. (2022) and Aprilia et al. (2023), who highlighted that balance exercises significantly improve both static and dynamic stability, as well as overall coordination.

The success of this intervention was also influenced by family involvement in assisting with home-based training, as well as the high level of motivation demonstrated by participants throughout the sessions (Saputra, Fauziah, & Saputra, 2024). Educational support provided at the beginning of the program improved participants' understanding and adherence to the exercises. This reflects the importance of combining therapeutic and educational approaches within nursing interventions to encourage behavioral change and promote independence in older adults (Boibalan, 2024; Cahyani & Nursasi, 2024).

Nevertheless, this study has limitations, including the small number of participants and the absence of a control group for comparison. As such, the results cannot be generalized to a broader population. Future research employing quasi-experimental designs or randomized controlled trials with larger sample sizes is strongly recommended to strengthen the evidence regarding the effectiveness of combined tandem walking and balance exercises as a fall-prevention intervention for older adults.

In conclusion, this study provides an important contribution to gerontological nursing practice by demonstrating that simple, consistent physical exercise can improve quality of life and reduce the risk of falls, which remain a leading cause of injury and dependency among older adults. The intervention also has practical relevance for development in both community and institutional healthcare settings as part of promotive and preventive strategies against functional decline associated with aging.

Conclusion and Recommendation

The implementation of a combined tandem walking and balance exercise program proved

effective in improving balance and reducing fall risk among older adults with balance impairments. The significant increase in Berg Balance Scale (BBS) scores in both participants demonstrated that the intervention gradually enhanced both static and dynamic balance. Furthermore, the program was successful in increasing participants' confidence and independence in performing daily activities, while also encouraging active family involvement in supporting the home-based training process. Conducted in a simple, structured, and consistent manner, this exercise regimen represents a therapeutic approach that is practical and easily applicable in gerontological nursing practice within both community and healthcare facility settings.

Nurses are recommended to integrate tandem walking and balance exercise combinations into routine fall-prevention programs for older adults, particularly those exhibiting signs of balance impairment. This intervention can be incorporated into home-visit programs, elderly health posts (posyandu lansia), or group educational sessions at community health centers and social care institutions. Older adults are advised to engage in balance training at home on a regular basis, with the support and supervision of family members or community health workers, at least twice per week, to maintain postural stability and reduce the risk of falls. Family involvement plays a vital role as both motivator and supervisor in ensuring consistent adherence to the exercise program.

Acknowledgment
The author would like to express deepest gratitude to all respondents who willingly took the time to participate in this research.

Funding Source
None

Declaration of conflict of interest
The authors declare no competing interests.

Declaration on the Use of AI
No AI tools were used in the preparation of this manuscript.

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