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The Effect Of Otago Exercise On Gait Walking Speed In Elderly Women At Posyandu Harapan Bunda In 2026

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Abstract

Elderly individuals are prone to a decline in walking ability, which is commonly indicated by reduced gait walking speed and may increase the risk of falls. Gait walking speed is an important parameter in gait analysis as it reflects functional mobility, balance, and lower extremity muscle strength in older adults. One exercise program recommended to improve walking ability and reduce fall risk is the Otago Exercise Program. This study aimed to determine the effect of the Otago Exercise Program on improving gait walking speed in elderly women with a risk of falling at Posyandu Harapan Bunda. This study employed a pre-experimental design using a one-group pretest–posttest approach. The sample consisted of 52 elderly women aged 60–69 years with a risk of falling, selected using total sampling. The Otago Exercise Program was conducted for 8 weeks with a frequency of three sessions per week (12 sessions). Gait walking speed was measured using the 10 Meter Walking Test (10MWT) before and after the intervention. Data were analyzed descriptively and inferentially using the Wilcoxon test. The results showed an improvement in gait walking speed after the Otago Exercise intervention. The mean 10MWT score increased from 65.55 before the intervention to 95.22 after the intervention. The Wilcoxon test results indicated a significant effect of the Otago Exercise Program on improving gait walking speed in elderly women with a risk of falling ($p < 0.05$). In conclusion, the Otago Exercise Program has a significant effect on improving gait walking speed in elderly women with a risk of falling. This exercise program can be recommended as an effective intervention to enhance walking ability and reduce fall risk in the elderly population.

Keywords: ***Otago Exercise Program, Gait Walking Speed, 10 Meter Walking Test, Elderly Women, Fall Risk***

INTRODUCTION

Aging is an inevitable physiological process characterized by a progressive decline in the function of multiple body systems, including the musculoskeletal, nervous, and cardiovascular systems. As individuals grow older, they experience reductions in muscle strength, joint flexibility, and motor coordination, all of which directly affect walking ability or *gait performance* (Howcroft et al., 2021).

Good walking ability is an essential component of maintaining independence and quality of life among older adults. Gait disturbances are considered one of the most significant indicators of declining physical function in the elderly population. *Gait analysis* is commonly used to evaluate various parameters, including *gait walking speed*, stride length, dynamic balance, and gait cycle phases. Among these parameters, *gait walking speed* is regarded as the most sensitive indicator of functional changes and overall health status in older adults (Genc et al., 2023).

Physiologically, the decline in *gait walking speed* among older adults is caused by reduced lower-extremity muscle strength, particularly in the quadriceps and gastrocnemius muscles, decreased proprioception, and slower motor nerve impulse transmission (Montero-Odasso, 2022). In addition, biomechanical changes such as reduced stride length and prolonged stance phase contribute to slower and less stable walking patterns. Other contributing factors include visual impairment, fear of falling, the use of certain medications, and declining vestibular function, all of which negatively affect gait performance in older adults (Howcroft et al., 2021; Kamen & Knight, 2022).

Gait impairment and reduced walking speed have serious consequences. A study by Studenski et al. (2020) reported that every 0.1 m/s decrease in *gait walking speed* is associated with a 12% increase in mortality risk. Furthermore, slower walking speed is linked to a higher risk of falls, hospitalization, and loss of functional independence. According to the *World Health Organization*

(WHO, 2023), approximately 35% of older adults worldwide experience balance and gait disorders, and about 30–40% of them fall at least once each year. In Indonesia, the prevalence of gait disorders among older adults reaches 28.7%, with a higher proportion among elderly women due to the decline in muscle mass after menopause (Kemenkes RI, 2022).

These conditions highlight the importance of structured physiotherapy interventions to maintain and improve walking ability in older adults. One evidence-based intervention is the *Otago Exercise Program* (OEP), a structured exercise program developed at the *University of Otago*, New Zealand. The program focuses on improving lower-extremity muscle strength, balance, and postural stability through simple exercises that can be performed in community settings (Campbell and Robertson, 2003).

Kumar et al. (2022) reported that implementing the *Otago Exercise Program* for 12 weeks, three times per week, significantly improved *gait walking speed* among community-dwelling older adults. Similarly, Han et al. (2024), in a meta-analysis, concluded that *Otago Exercise* consistently enhances physical function, reduces fear of falling, and improves walking ability through better coordination and increased lower-limb muscle strength. Another study by Mansfield et al. (2023) found that balance-based exercises such as the *Otago Exercise Program* were more effective than conventional aerobic exercise in improving *gait walking speed* because they specifically target postural muscles and movement control.

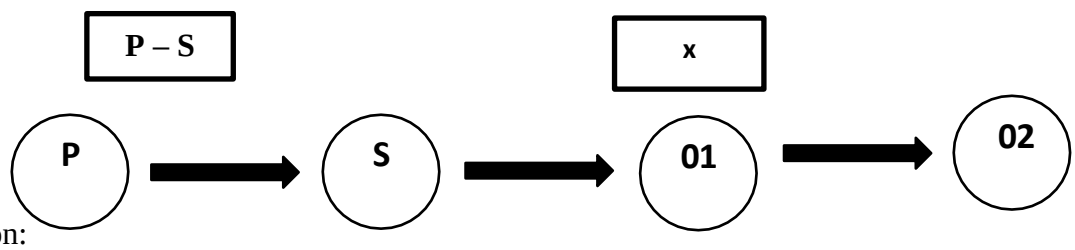
Comparisons across previous studies indicate that the *Otago Exercise Program* is more effective in improving walking performance than conventional exercise or standard walking training. The program is considered safe, easy to perform, and suitable for group implementation in community health posts for older adults (*Posyandu*). Moreover, previous research has shown that *gait speed* is one of the earliest parameters to improve following participation in the *Otago Exercise Program*, making it a highly relevant outcome measure for evaluating intervention effectiveness (Kumar et al., 2022; Han, 2024).

Based on the foregoing discussion, the decline in *gait walking speed* among elderly women represents an important issue requiring preventive physiotherapy interventions. The *Otago Exercise Program* is expected to improve *gait walking speed* by enhancing muscle strength, balance, and neuromuscular efficiency. Therefore, this study is entitled: "The Effect of the Otago Exercise Program on Gait Walking Speed Among Elderly Women at Posyandu Harapan Bunda in 2026."

RESEARCH METHODS

Research Design

This study employed an experimental design with a one-group pre-test post-test design. This design aimed to determine the effect of Otago Exercise on improving gait analysis results, specifically gait walking speed in elderly women. In this design, measurements were taken twice: before (pre-test) and after (post-test) the Otago Exercise. The results of both measurements were then compared to determine the effect of the intervention (Sugiyono, 2022).



Description:
P: Population
S: Sample
PS: Purposive sampling
01: Pre-test

02: Post-test
X: Implementation of the Otago Exercise

Research Location and Timeline

This research was conducted at the Harapan Bunda Elderly Community Health Post (Posyandu) within the Halim 1 Community Health Center (Puskesmas Halim 1), Makasar District.

The research period was planned for January-February 2026, covering the preparation phase, implementation of the Otago Exercise intervention, data collection, and analysis of the results.

Research Population and Techniques

The population in this study was all elderly women aged 60-69 years who were registered as active participants at the Harapan Bunda elderly community health post and had a moderate to mild risk of falling. The total population of elderly women at the Harapan Bunda community health post was 225.

Data were collected through direct observation and measurements using a standard physiotherapy instrument, the 10-Meter Walk Test (10MWT). Each respondent was measured twice (pre-test and post-test) under identical environmental conditions to ensure the validity of the results. Additional data such as age, fall history, and fall risk level were collected through brief interviews and demographic data sheets.

The sample size was determined using the Slovin formula to determine the minimum sample size. The population was drawn from the Harapan Bunda Elderly Community Health Post (Posyandu Lansia Harapan Bunda) with a sampling error of 5%. The Slovin formula was used:

n = N \ 1 + N (e)^2

Note:
n = required sample size
N = population size (number of elderly at the Posyandu)
e = margin of error (sampling error tolerance). Generally used is 0.05 (5%) or 0.10 (10%).

Based on the research conducted, there were 56 sample populations with inclusion and exclusion criteria. Then the required sample size is:

n = N \ 1 + N (e)^2
n = 59 \ 1 + 59 (0.05)^2
n = 59 \ 1 + 59 (0.0025)
n = 59 \ 1 + 0.1475
n = 51.41 rounded to 51 people

Inclusion Criteria

a. Elderly women aged 60 – 69 years.
b. Can walk without assistive devices.
c. Has a mild to moderate risk of falling (based on 10MWT results with results of 0.6 - >1.0 m/s).
d. Willing to take part in the Otago Exercise training program during the research period.
e. Willing to become a respondent by signing the informed consent sheet.

Exclusion Criteria

a. Not participating in research activities more than 3 times
b. Not in good health when the research took place

Seniors who do not complete all Otago Exercise training sessions.

RESULTS AND DISCUSSION

Description of the Research Site

The Harapan Bunda Integrated Health Post (Posyandu) is a community-based health service facility that plays a role in promotive and preventive efforts, particularly for the elderly. This Posyandu serves as a health service platform that involves active community participation and is supported by local health workers to improve the health of the elderly.

The Harapan Bunda Posyandu is located at Kebon Pala II, RT 07 RW 08, Halim Perdana Kusuma Village, Makasar District, East Jakarta. The Posyandu is located in a residential area, making it easily accessible to the surrounding community, especially the elderly, who are the primary target of the health service.

Activities carried out at the Harapan Bunda Posyandu include routine health checks, monitoring the physical condition of the elderly, health education, and other supporting activities aimed at improving the quality of life of the elderly. Given these characteristics, the Harapan Bunda Posyandu was deemed suitable as a research location because it has a population of 225 elderly and pre-elderly individuals who actively participate in health activities and support the implementation of physical exercise interventions such as the Otago Exercise.

Univariate Analysis Results

Descriptive Analysis Results of Elderly Characteristics

Elderly by Age

The age distribution of the elderly can be seen in the following table:

Table 1. Elderly by Age

Age	
Mean	64,51
Median	65.00

Referring to Table 1 above, the average age of elderly people at the Harapan Bunda Integrated Health Post (Posyandu) is 64.51 years, with a minimum age of 60 and a maximum age of 69.

Elderly by Education

The distribution of elderly people's education can be seen in the following table:

Table 2. Elderly by Education

No.	Education Level	Frequency	Percentage
1.	No Formal Education	2	3.9%
2.	Elementary School	8	15.7%
3.	Junior High School	3	5.9%
4.	Senior High School	33	64.7%
5.	Bachelor's Degree	5	9.8%
Total		**51**	**100%**

Referring to the table above, the education level of the elderly at Harapan Bunda Integrated Health Post (Posyandu Harapan Bunda) is dominated by those with a high school education (no schooling), with a total of 33 individuals representing a frequency of 64%.

Results of Descriptive Analysis of Variable Characteristics

Descriptive Analysis Table Based on Gait Walking Speed with 10 MWT results multiplied by 100 to input the data into SPSS.

Table 3. Descriptive Analysis Based on Gait Walking Speed

	Mean	Median	STD	95% CI	Min	Max
Before Intervention						
	65.55	65.00	4.632	64.25 ± 66.85	60	79
After Intervention						
	95.22	90.00	10.672	92.21 ± 98.22	80	135

Based on the results above, it states that the average before the intervention was 65.55, Median 65.00, Standard deviation 4.632, and the interval estimation test with 95% confidence was 64.25 ± 66.85 with a minimum score of 60, a maximum score of 79. The average after the intervention was 95.22, Median 90.00, Standard deviation 10.672, and the interval estimation test with 95% confidence was 92.21 ± 98.22 with a minimum score of 80, a maximum score of 135. So it can be interpreted that before the intervention the respondents experienced Gait Walking Speed in the moderate category or 0.6 - 1.0 m / s and after the intervention the respondents experienced an increase in the Gait Walking Speed value. V.3 Bivariate Analysis Results

Bivariate analysis in the context of intervention effects is a statistical analysis method used to examine the differences or relationships between two variables: the intervention variable (treatment) as the independent variable, and the result or impact (outcome) as the dependent variable. The main objective is to determine whether the intervention has a significant effect on the outcome variable.

Normality Test

After entering the bivariate analysis test, the data must be tested for normality to determine whether the data being tested is normally distributed. The normality test in this study used the Kolmogorov-Smirnov test, where data from more than 50 data samples were tested. The resulting hypothesis is: if the P-value is <0.05, the data are not normally distributed (H0 is rejected), and conversely, if the P-value is >0.05, the data are normally distributed (H0 is accepted). The results of this test analysis can be seen in Table 4.

Table 4. Normality Test

	***p*-Value**	**Interpretation**
Before Intervention	0,014	Non-Normal Distribution
After Intervention	0,000	Non-Normal Distribution

The table above shows that the normality test results before the Otago Exercise intervention yielded a P-value of 0.014, or <0.05, confirming the hypothesis that the data were not normally distributed (H0 was rejected). After the Otago Exercise intervention, the P-value was 0.000, or <0.05, confirming the hypothesis that the data were not normally distributed (H0 was rejected). Therefore, all data were not normally distributed. The resulting data can be further analyzed bivariately using the nonparametric Wilcoxon test.

Wilcoxon Test

The hypothesis test used to further confirm the results of the normality test hypothesis, which stated that all data were not normally distributed (H0 was rejected), used the Wilcoxon test. The purpose of this hypothesis test was to determine whether there was a difference in the average between the two paired samples or whether there was a correlation between the increase in gait walking speed in the elderly using the Otago Exercise intervention. The resulting hypothesis is that if the Asymp. Sig. (2-tailed) value with a P-value <0.05, it indicates that the data is statistically significant. Conversely, if the Asymp. Sig. (2-tailed) value with a P-value >0.05, it indicates that the data is statistically insignificant.

Table 5. Wilcoxon Test

	Gait_Post – PostTest
Z	-6.219
Asymp. Sig. (2-*tailed*)	,000

Based on the table above, it is stated that the Wilcoxon test results show that there is a difference in the 10MWT pre-test and post-test scores after participating in the Otago Exercise. The Asymp. Sig (2-tailed) value is 0.000 (P Value <0.05), which indicates that the increase in Gait Walking Speed scores is statistically significant after the Otago Exercise intervention.

Discussion

Description of Research Variables

Characteristics of the Elderly Participants

The descriptive data were collected from elderly participants at Posyandu Harapan Bunda in 2026. The study sample consisted of older adults aged 60–69 years, with a mean age of 64.51 years, a minimum age of 60 years, and a maximum age of 69 years. All respondents were female. Based on educational attainment, 2 respondents (3.9%) had no formal education, 8 respondents (15.7%) had completed elementary school, 3 respondents (5.9%) had completed junior high school, 33 respondents (64.7%) had completed senior high school, and 5 respondents (9.8%) held a bachelor's degree.

The respondents were elderly women aged 60–69 years, with an average age of 64.51 years. This age group falls into the young-old category and generally begins to experience a decline in physical function, particularly walking ability. Previous research by Verghese et al. (2021) reported

that gait walking speed in older adults begins to decline after the age of 60 due to reduced lower-extremity muscle strength and impaired postural control.

All respondents in this study were female. Elderly women have a higher risk of gait impairment and falls than elderly men, particularly after menopause. Previous studies by Ambrose et al. (2019) and Beauchet et al. (2020) reported that reductions in muscle mass and bone density among older women contribute to slower gait speed and an increased risk of falls, making this population particularly relevant for the present study.

Most respondents had completed senior high school, followed by those with elementary, junior high, and higher education. Educational level is associated with older adults' understanding of healthy active lifestyles and adherence to exercise programs. According to Cesari et al. (2021), older adults with higher educational attainment generally possess better health literacy. Nevertheless, the Otago Exercise Program can be implemented among older adults with various educational backgrounds because its exercises are simple and easy to understand.

Gait Walking Speed Test (10MWT)

The descriptive analysis presents the frequency distribution of Gait Walking Speed scores measured before and after the intervention. Before the intervention, the 51 participants had a mean 10 Meter Walking Test (10MWT) score of 65.55, with a minimum score of 60 and a maximum score of 79. After the intervention, the mean 10MWT score increased to 95.22, with a minimum score of 80 and a maximum score of 135.

These findings indicate that the elderly participants at Posyandu Harapan Bunda experienced an improvement in their 10MWT scores following the intervention. However, not all participants demonstrated changes in their gait walking speed category. Although all participants completed 12 sessions of the Otago Exercise intervention, differences in baseline gait walking speed resulted in varying post-intervention 10MWT scores among individuals.

The descriptive analysis demonstrated an improvement in gait walking speed, as measured by the 10 Meter Walking Test (10MWT), following the Otago Exercise intervention. The mean 10MWT score increased from 65.55 before the intervention to 95.22 afterward, accompanied by increases in both the minimum and maximum scores. These findings suggest that the Otago Exercise intervention generally had a positive effect on walking ability among the elderly participants. This result is consistent with the findings of Sherrington et al. (2020), who reported that the Otago Exercise Program significantly improves gait walking speed and mobility function in community-dwelling older adults.

However, the results also indicate that not all participants experienced changes in their gait walking speed category following the intervention. Previous studies have shown that individual responses to physical exercise interventions among older adults are influenced by baseline gait walking speed, muscle strength, balance, and overall physical fitness. Beauchet et al. (2019) and Studenski et al. (2021) explained that older adults with lower baseline gait walking speed tend to demonstrate greater improvements than those with relatively good walking ability before the intervention. Consequently, changes in gait walking speed categories may not occur in every individual.

Differences in the final gait walking speed scores may also be attributed to individual characteristics, despite all respondents completing the same 12 intervention sessions. Liu et al. (2021) reported that neuromuscular adaptation to walking and balance exercises varies among individuals, resulting in different levels of improvement in gait speed. Therefore, the increase in 10MWT scores observed in this study indicates the effectiveness of the Otago Exercise Program in improving walking ability among older adults, although the magnitude of improvement differed between individuals.

The Effect of Otago Exercise on Gait Walking Speed in Elderly Women

The findings of this study indicate that the Otago Exercise Program had a positive effect on improving gait walking speed among elderly women at risk of falls at Posyandu Harapan Bunda. This was demonstrated by the increase in the mean 10 Meter Walking Test (10MWT) score from 65.55 before the intervention to 95.22 after the intervention. The increases in both the minimum and

maximum scores further indicate an overall improvement in walking ability among the respondents. Previous studies have identified gait walking speed as an important indicator of mobility function and fall risk in older adults; therefore, improvements in 10MWT scores reflect enhanced walking performance and postural stability.

The improvement in gait walking speed observed after the Otago Exercise intervention is consistent with previous research demonstrating that the Otago Exercise Program effectively enhances lower-extremity muscle strength, balance, and motor coordination, all of which directly contribute to faster walking speed. Studies by Sherrington et al. (2020) and Liu et al. (2021) reported that regular participation in the Otago Exercise Program improves gait performance and reduces the risk of falls among community-dwelling older adults. The muscle-strengthening, balance, and walking exercises included in the program contribute to improved neuromuscular control, which is essential for efficient walking.

Although all respondents completed the same 12 intervention sessions, not all participants experienced changes in their gait walking speed category. Previous research indicates that individual responses to physical exercise in older adults are influenced by baseline gait walking speed, physical fitness, muscle strength, age, and comorbidities. Beauchet et al. (2019) and Studenski et al. (2021) reported that older adults with lower baseline gait walking speed generally exhibit greater improvements than those with relatively better walking ability at baseline. This finding explains the variation in post-intervention 10MWT scores despite identical intervention protocols.

Overall, the results of this study demonstrate that the Otago Exercise Program significantly improves gait walking speed among elderly women at risk of falls. Improved walking ability is expected to contribute to a reduced risk of falls and enhanced functional independence among older adults. These findings further strengthen existing scientific evidence that the Otago Exercise Program is an effective and practical exercise intervention for improving mobility function in community-dwelling elderly women.

Research Limitations

The limitations of this study are as follows:

1. Difficulty in scheduling research sessions that accommodated all respondents at the same time.
2. Difficulty in maintaining respondents' consistency in attending all 12 intervention sessions.

The research schedule frequently changed due to adverse weather conditions.

CONCLUSION

Based on the findings of this study, the following conclusions can be drawn:

1. The Otago Exercise Program had a positive effect on gait walking speed among elderly women at Posyandu Harapan Bunda.
2. There was an improvement in gait walking speed, as measured by the 10 Meter Walking Test (10MWT), after 12 sessions of the Otago Exercise Program.
3. The mean 10MWT score after the intervention was higher than the pre-intervention score, indicating improved walking ability among the elderly women.
4. Although an overall improvement in gait walking speed was observed, not all participants experienced changes in their gait walking speed category, indicating individual variation in response to the exercise intervention.
5. The variation in improvements in gait walking speed was influenced by differences in baseline walking ability, physical fitness level, and individual characteristics of the elderly participants, despite all participants receiving the same intervention.
6. The findings support the use of the Otago Exercise Program as an effective and practical intervention for improving walking function among community-dwelling elderly women.
7. The results are consistent with previous studies demonstrating that the Otago Exercise Program is effective in improving balance and reducing the risk of falls among elderly women. However, this

study provides additional value by specifically evaluating the effect of the Otago Exercise Program on gait walking speed using the quantitative 10 Meter Walking Test (10MWT) among community-dwelling women aged 60–69 years.

8. Unlike many previous studies that focused primarily on fall risk or general balance, this study emphasizes changes in gait walking speed as an objective and measurable functional indicator (from **<0.6 m/s to >1.0 m/s**), thereby providing more specific clinical evidence regarding improvements in mobility among elderly women.

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