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The Effect of Balance Training on the Risk of Falls in the Elderly in Mongolato Village, Telaga District

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ABSTRACT

In the elderly, there is regression and morphological changes in muscles and bones, so that the elderly are at high risk of falling. Methods that can be applied to prevent the impact of falls are physical exercises, one of which is balance exercises with tandem exercises. This study aims to find out how the Effect of Balance Training on the Risk of Falls in the Elderly in Mongolato Village, Telaga District. The quantitative method with the research design used in this study is pre-experiment, one group pre-post test design, where the sample was selected through the purposive sampling method, with a sample of 39 elderly respondents in Mongolato Village. The results of the study showed that there was an effect of Balance Training on the Risk of Falls in the Elderly in Mongolato Village, Telaga District with a p. value of 0.000 < 0.05. Balance exercises are very important in preventing and as a treatment to reduce the risk of falls in the elderly.

INTRODUCTION

The elderly (elderly) are individuals who are 60 years old and older and have experienced an aging process characterized by a decline in various bodily functions. One of the most frequent declines is in the function of the extremities, which has an impact on decreased muscle strength, balance, coordination, and flexibility. This condition increases the risk of falls in the elderly and has the potential to cause serious injuries and even disability. (Pertiwi & Sastrini, 2025)

The World Health Organization (World Health Organization, 2022) reports that the global elderly population has increased significantly, from around 260 million in 1980 to 761 million in 2023. This number is projected to reach 1.4 billion in 2030 and 2.1 billion in 2050, and may even increase to 3.2 billion by 2100. Meta-analysis shows the prevalence of fall risk in the elderly globally by 26.5%. The annual incidence rate is reported to be 28-35% in the elderly aged ≥65 years and 32-42% in the age over 70 years. (World Health Organization, 2022)

In Indonesia, the Central Statistics Agency noted that the number of elderly people in 2024 will reach 22.6 million people or around 11.75% of the total population. This condition marks that Indonesia has entered the ageing population phase. It is estimated that the number of elderly people will continue to increase until it reaches around 20% or 50 million people by 2045. The incidence of falls in the elderly in Indonesia is reported to reach 43-47%, with a frequency of 1-2 times in one year. Central Statistics Agency, (2023)

In Gorontalo Province, data from the Health Office in 2024 shows that the number of elderly people is 93,251 people spread across six regions, and is projected to increase to 100,939 people by the end of 2024. The increase in the number of the elderly is directly proportional to the increase in health problems, one of which is the risk of falling.

Physiologically, the aging process causes structural and functional changes in the musculoskeletal system, including a decrease in muscle mass and strength, elasticity, flexibility, as well as contraction ability, which has a direct impact on postural balance disorders and an increased risk of falls in the elderly. In addition, a decrease in functional ability accompanied by musculoskeletal and neurological changes, such as joint stiffness, impaired stability, and decreased coordination, increases the risk of falls in both the elderly who are still independent and those who have experienced dependence in daily activities. (Cruz-Jentoft et al., 2022) (Ambrose et al., 2023)

The results of a preliminary study in Mongolato Village show an increase in the number of elderly people from 177 people in 2024 to 297 people in the January-June 2025 period, with 55 elderly people (18.5%) living alone. Interviews with 10 elderly people showed that most elderly people rarely receive family assistance in daily activities, have a history of near falls or falls, and have never received education on the prevention of fall risks, including balance exercises.

The impact of falls on the elderly is not only in the form of physical injuries such as pelvic, pelvis, arm, and wrist fractures, but also has an impact on psychological aspects in the form of fear of falling back, decreased confidence, and restrictions on daily activities. (Sulan et al., 2025)

One of the effective prevention efforts is physical exercise, especially balance exercises. Balance exercises aim to maintain muscle strength and function as well as postural stability. (Ayatullah & Wahidah, 2023) *Tandem exercise* or tandem walking is a form of balance exercise that is done by walking straight in which the heel of the foot touches the tip of the other toe in succession, thus challenging postural control and body coordination during movement. Dynamic balance exercises such as tandem walking have been shown to be effective in improving postural stability and significantly lowering the risk of falls in the elderly through improved balance, muscle strength, and neuromuscular control. (Clemson et al., 2021) (Sherrington et al., 2022)

Based on this description, the researcher is interested in conducting research on the effect of balance exercises on the risk of falls in the elderly in Mongolato Village, Telaga District. This study aims to determine the effect of balance exercises on the risk of falls in the elderly in Mongolato, Telaga District.

RESEARCH METHODS

This study is a quantitative analytical study that aims to analyze the effect of balance exercises on the risk of falling in the elderly in Mongolato Village, Telaga District. The quantitative approach is used because the research data is in the form of numbers and is analyzed using statistical methods to see the causal relationship between variables. The research design used was a quasi experiment with a one-group pre-test-post-test design approach.

In the design of this study, the risk of falling was measured before the intervention (pre-test), then the respondents were given balance exercises, and then re-measurements were carried out after the intervention (post-test) as a commonly used approach to evaluate the effectiveness of balance exercises in the elderly. The intervention provided was in the form of balance exercises with (Granacher et al., 2021) the tandem exercise method which was carried out in a short and structured manner, because balance-based exercises and postural control proved effective Research tools and materials were prepared to support the smooth implementation of research and obtain accurate and objective data. The main tools used include a clock or stopwatch to measure the duration of the exercise, a meter to ensure the distance of the exercise, stationery, and a notebook to document the results of the measurement. The research material consists of a Standard Operating Procedure (SOP) sheet for the implementation of tandem exercises and a Morse Fall Scale questionnaire which is used to measure the risk of falls in the elderly.

This research was carried out in Mongolato Village, Telaga District, Gorontalo Regency. The implementation of the research took place from November 18 to November 24, 2025, including the preparation stage, initial data collection, intervention, and final data collection.

The variables in this study consist of independent variables and dependent variables. The independent variable is a balance exercise in the form of a tandem exercise, which is a straight walk exercise with the position of the heel of the foot touching the tip of the other toe. The dependent variable is the risk of falling in the elderly, which is the probability of falling measured based on the level of balance and functional condition of the elderly. The risk of falling is observed as a result of the administration of balance exercises. (Pasaribu et al., 2022)

Operational definitions are used to describe in detail the variables being studied so that they can be measured objectively and uniformly. Balance exercises are defined as the implementation of tandem exercises by walking 3-6 meters for approximately 10 minutes, carried out once per day for three consecutive days in accordance with the Standard Operating Procedures that have been set. Fall risk is defined as the level of likelihood of the elderly experiencing a fall measured using the Morse Fall Scale instrument. Fall risk measurement was carried out using a Morse Fall Scale questionnaire consisting of six assessment components, namely fall history, secondary diagnosis, use of ambulatory aids, intravenous therapy, gait, and mental status. The total score was categorized as non-risk with a value of 0-24, low risk with a value of 25-50, and high risk with a value of ≥51, with an ordinal measurement scale.

The population in this study is all elderly people living in Mongolato Village, Telaga District in the period from January to June 2025 with a total of 297 people. The determination of the number of samples was carried out using the Slovin formula with an error rate of 15%, so that a sample of 39 respondents was obtained. The sampling technique used is non-probability sampling with the purposive sampling method, which is sample selection based on certain considerations that are in accordance with the research objectives. The selected respondents were elderly aged 60-74 years, willing to be respondents and signed informed consent, lived in Mongolato Village during the study, and were able to communicate and be cooperative. Elderly people who are sick, have severe physical disabilities, communication impairments, severe vision impairments, or movement impairments due to stroke were not included in the study.

The data collection in this study includes primary data and secondary data. Primary data were obtained directly from respondents through structured interviews as well as the completion of Morse Fall Scale (MFS) instruments to measure the level of risk of falls in the elderly before and after the administration of balance training interventions, as MFS was proven to have good validity and accuracy in identifying the risk of falls in the elderly and adult populations in various healthcare settings. In addition, the use of (J. H. Kim & Park, 2021) *the Morse Fall Scale* (MFS) is supported by recent research findings showing that this instrument has good predictive validity as a fall risk screening tool and can be used as the basis for planning structured and systematic fall prevention interventions in at-risk populations. Meanwhile, secondary data in this study was obtained from documents and administrative data sourced from the Mongolato Village Office, Telaga District, which was used to complete demographic information and characteristics of the research respondents. (S. Y. Kim et al., 2023)

The data that has been collected is then processed through several stages, namely editing to ensure the completeness and consistency of respondents' answers, coding to group data into certain categories, scoring to provide values according to the provisions of the instrument, and tabulating to present data in the form of tables to facilitate statistical analysis. The systematic and structured questionnaire data processing process is important so that the quality of the data is maintained and the results of the analysis can be interpreted validly and reliably in health research. (McElroy et al., 2024)

Data analysis was carried out using the help of the SPSS version 25.0 program. Univariate analysis is used to describe the characteristics of respondents and the frequency distribution of research variables in the form of percentages. Bivariate analysis was conducted to test the effect of balance exercises on the risk of falls in the elderly by comparing conditions before and after the intervention, as this approach is commonly used to assess the relationship between variables in intervention-based health research. Before hypothesis testing is performed, the data are first tested for normality using (Sarwono & Handayani, 2021) (J. H. Kim & Park, 2021) the Shapiro-Wilk test, given that this test is recommended as the most sensitive and accurate method for assessing the distribution of data at a small sample size, specifically less than 50 respondents (. Ghasemi & Zahediasl, 2022)

This research was carried out by paying attention to the ethical principles of nursing research which emphasizes respect for the autonomy of the respondents through the provision of clear explanations of the objectives, benefits, and procedures of the research as well as written consent prior to participation. The confidentiality of respondents' identities is maintained by using codes on research instruments and restricting data access, as well as ensuring that all interventions provided are safe and do not pose a risk to the respondents' health conditions. (Godskesen et al., 2023) (Narendraputra & Basrowi, 2024)

RESULTS AND DISCUSSION

Table 1. Distribution of Respondent Characteristics

Yes	Respondent Characteristics	Classification	Frequency *(n)*	Present (%)
1.	Age	Elderly (60 - 74 Years Old)	39	100.0
2.	Gender	Male - Male	8	20.5
		Women	31	79.5
3.	Last Education Level	SD	22	56.4
		Junior High School	5	12.8
		High School	3	7.7
		PT	3	7.7
		No School	6	15.4
Total			**31**	**100.0**

Premiere date 2025

In the age group, all respondents were in the elderly (60-74 years) as many as 39 people (100%), with an average female gender of 31 people (79.5%), and the lowest was the male respondent of 8 people (20.5%), at the last level of education most of the respondents had the last education of elementary school as many as 22

people (56.4%), out of school as many as 6 people (15.4%), junior high school as many as 5 people (12.8%), High school and university (PT) each had 3 people (7.7%).

This study is in line with the findings of recent research that shows a significant relationship between gender and the risk of falls in the elderly, where elderly women tend to have a higher risk of falling than older men. This is associated with physiological factors such as decreased muscle mass, bone density, as well as faster balance changes in older women. In addition to biological factors, education level also plays an important role in influencing the risk of falls, as individuals with higher levels of education generally have better knowledge and awareness of fall prevention and safe living behaviors in old age. (Zhang et al., 2022) (Park & Lee, 2023)

The results of this study are also in line with recent epidemiological studies that show that demographic characteristics, particularly gender and education level, are closely related to the risk of falls in the elderly. Older women are reported to have a higher risk of falls than men, which is related to decreased lower extremity muscle strength, decreased bone mineral density, as well as more progressive postural balance disorders in older women. In addition, low levels of education also contribute to an increased risk of falls due to the limited knowledge and ability of the elderly to understand fall prevention strategies and modify the environment to be safer. These findings are consistent with the characteristics of the respondents in this study, where most of them are elderly women with a basic education background or not in school, thus strengthening that sociodemographic factors are an important determinant in the incidence of fall risk in the elderly. (Ambrose et al., 2022) (Yeung et al., 2023)

Table 2. Risk of Falling in the Elderly Before Intervention Balance Exercise: Tandem *Exercise*

Yes	Fall Risk Levels	Frequency *(n)*	Present (%)
1.	No Risk	4	10.3
2.	Low Risk	24	16.5
3.	High Risk	11	28.2
	Total	**39**	**100%**

Premiere date 2025

Based on the table above, the majority of the elderly before the balance exercise was carried out: tandem *exercise* had a low risk of falling of 24 people (16.5%), high risk of 11 people (28.2%) and no risk of 4 people (10.3%).

Based on the results of the study, most of the elderly before being given a balance exercise intervention in the form of *tandem exercise* were in the low-risk category of falling, while some others were in the high-risk and non-risk category, which showed a variation in functional conditions in the respondents. These findings are in line with recent research that states that comorbid conditions, particularly diabetes mellitus, play a significant role in increasing the risk of falls in the elderly through peripheral neuropathy mechanisms, decreased muscle strength, as well as impaired production and energy utilization that impact lower extremity stability and postural balance during activity. The disorder causes a decrease in the ability of the legs to support body weight and maintain dynamic balance, so that the elderly with diabetes mellitus tend to have a higher risk of falling than the elderly without comorbidities. (Alam et al., 2022) (Zhao et al., 2023)

In line with the theory that states that diabetes mellitus is a risk factor for falls in the elderly, diabetes mellitus has an impact on muscle weakness and lack of strength in energy formation, so it will affect the strength of the extremities, weakness in the lower extremities will affect the ability of the legs to withstand the load and balance of the body when doing activities. (Saputra & Rahadian Syah, 2021)

Table 3. Risk of Falling in the Elderly After Balance Exercise Intervention: Tandem *Exercise*

Yes	Fall Risk Levels	Frequency *(n)*	Present (%)
1.	No Risk	9	23.1
2.	Low Risk	29	74.4
3.	High Risk	1	2.6
	Total	**39**	**100%**

Premiere date 2025

Based on the table above, the majority of the elderly after balance exercises: tandem *exercise* had a low risk of falling on average of 29 people (74.4%), no risk of 9 people (23.1%) and no risk of 1 person (2.6%).

Based on the results of the study, the majority of elderly people after being given balance training interventions in the form of *tandem exercises* were in the category of low and non-risk fall risk, which showed an improvement in balance skills and postural control after exercise. These findings are in line with the results of recent experimental research reporting that tandem walking exercise was able to significantly improve dynamic balance and lower the risk of falls in the elderly, with the results of statistical tests showing significant differences between pre- and post-intervention conditions ($p < 0.05$). The effectiveness of the (Kuo et al., 2022) *tandem exercise* was associated with improved neuromuscular coordination, lower extremity strength, and the ability of the elderly to maintain body stability during daily functional activities. (Sherrington et al., 2023)

In line with the research conducted by showing that there was a reduction in the risk of falling in the elderly with bivariate analysis using Sari et al., (2024) *the Wilcoxon Test*, *a p value* = 0.005 was obtained, which means that there is an effect of *the intervention of Tandem Walking Exercise* on the risk of falling in the elderly at the Tresna Werdha Social Home, Pagar Dewa, Bengkulu.

Table 4. The Effect of Balance Training on the Risk of Falls in the Elderly in Mongolato Village, Telaga District.

Groups	Red	SD	Δ (Difference)	*p.value (z)*
Pretest	46.79	24.454	19.10	0.000
Postest	27.69	14.320		

Premiere date 2025

Based on the results of the study, it showed that the average score of the elderly before tandem exercise was 46.79 (low fall risk category), then after being given tandem *exercise* the fall score decreased to 27.69 (low fall risk category), this shows a difference in score decrease of 19.10 between before and after treatment. The results of statistical analysis using *the wilcoxon signed rank test* obtained a *p-value* of 0.000 (≤0.05).

Based on the results of the analysis, the average risk score of the elderly before being given *the tandem exercise* intervention was in the low-risk category, then experienced a significant decrease in score after the intervention, which showed an improvement in balance and postural control in the respondents. The results of a statistical test using *the Wilcoxon signed rank test* showed a p value of ≤ 0.05, which indicates that *tandem exercise* has a significant influence on reducing the risk of falls in the elderly. These findings are in line with recent experimental research that reports that balance exercises performed in a structured and repetitive manner are able to significantly improve lower extremity muscle strength, neuromuscular coordination, and physical function of the elderly, thus having a direct impact on reducing the risk of falling. In addition, recent intervention studies also confirm that balance-based exercises and postural stability are effective in improving functional ability and independence of daily activities in the elderly, especially through improved dynamic stability and movement control. (Zijlstra et al., 2022) (Cadore & Izquierdo, 2024)

Research with similar results was also reported in experimental studies showing that balance exercises performed in a structured manner were able to significantly improve lower extremity muscle strength as well as physical function in the elderly. The findings are reinforced by recent intervention research that concluded that balance-based exercises and postural control are effective in improving muscle strength and functional stability in the elderly, thereby contributing to increased independence of daily activities. (Granacher et al., 2021) (Freire & Seixas, 2024)

CONCLUSION

Based on the results of research that has been conducted on the effect of balance exercises in the form of *tandem exercises* on the risk of falls in the elderly in Mongolato Village, Telaga District, it can be concluded that before being given intervention, most of the elderly were in the category of low fall risk. After the *tandem exercise was carried out*, there was an increase in the number of elderly people who were in the low fall risk category, which showed an improvement in the balance and mobility ability of the elderly.

SUGGESTION

The results of this study are expected to be a reference for future researchers to expand their insights and knowledge related to the application of *tandem exercise* balance as one of the non-pharmacological methods in preventing the risk of falls in the elderly. For the Mongolato Village Government, the results of this research can be used as a consideration in evaluating and planning elderly health programs, especially those related to fall risk prevention efforts. For families, this research is expected to be a guideline in providing more optimal support, attention, and monitoring for the elderly, especially in daily activities that have the potential to pose a risk of falling. In addition, for the field of nursing, the results of this study can be used as a reference in improving the quality of nursing education and learning processes, especially in community nursing, related to the application of *tandem exercises* to increase mobility and prevent the risk of falling in the elderly.

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