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Differences in the Effects of Square Stepping Exercise and Gaze Stability Exercise on Balance in Older Adults at the Elok Edy Health Center

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Abstract. Elderly individuals often face balance disorders, with the World Health Organization (WHO) reporting that approximately 28-35% of the elderly worldwide are at increased risk of falls. According to the Central Statistics Agency (BPS) 2022, 10.48% of the total population and 31-48% of the elderly population experience balance disorders, which affect 6,969 elderly individuals (BPS 2021) in Sleman, Indonesia. These issues can lead to injuries and reduce quality of life. Square Stepping Exercise (SSE) and Gaze Stability Exercise (GSE) have been shown to be effective in improving balance in the elderly. These are non-pharmacological interventions that can help address balance problems through physical activity. However, the comparison of their effects has not been extensively researched. This study aims to determine whether both types of exercises can improve balance in the elderly and to assess the effectiveness of each exercise in enhancing balance among the elderly at the Elok Edy Elderly Posyandu, Rajek Wetan, Melati, Sleman, Yogyakarta. This research used a quantitative approach with a quasi-experimental design, utilizing a pre-test and post-test with two groups. The total number of respondents was 36 elderly individuals who experienced mild to moderate balance disturbances, divided into two groups: the SSE intervention group (n=18) and the GSE intervention group (n=18). This study shows that both types of exercises, Square Stepping Exercise (SSE) and Gaze Stability Exercise (GSE), have a positive impact on improving balance in the elderly. The p-value (Sig) obtained for both tests is p = 0.000, indicating statistical significance.

Keywords: Square Stepping Exercise; Gaze Stability Exercise; Body Balance; Elderly; Berg Balance Scale.

INTRODUCTION

The elderly are an age group over 60 years old who experience the aging process and experience changes and decreases in body functions, Aging in the elderly will cause changes in the musculoskeletal system and can reduce muscle strength (Aprilia et al., 2023). The elderly is a phase of life characterized by increased immunity, decreased immunity to various diseases, environmental changes, reduced mobility, and changes in body function. The physical health of the elderly is influenced by various factors such as energy, activity, work capacity, stress, and medical complications, which make the elderly less optimal in carrying out their daily lives (Height & Health, 2020).

According to the World Health Organization (WHO), the elderly are individuals who are more than 60 years old (Organization, 2022; Sum et al., 2022; Wong, 2023; Xiao et al., 2022; Zhang & Wang, 2025). Middle age is the process from 45-59 years old, the elderly is 60-74 years, the elderly is 75-90 years old, the very old age is more than 90 years old (Sinuraya, 2023). According to the Central Statistics Agency (*BPS*), the percentage of the elderly population in Indonesia was 10.48% in 2022. Based on the data obtained, there are 31% - 48% of the elderly who experience balance problems (Listyarini & Alvita, 2018). The prevalence of fall risk in the population aged 55 years reached 49.4%, age over 65 years and above 67.1% (Ministry of Health of the Republic of Indonesia, 2018). The majority of provinces in Indonesia have an elderly population percentage above 7%. Yogyakarta is the province with the highest

percentage of population with a total of 3.68 million people with a percentage (16.69%). The number of elderly residents in Sleman Regency in 2021 was recorded at 6,969 residents.

The risk of falls in the elderly is still a serious public health issue in various countries including Indonesia, because falls can cause injury, disability, loss of independence, and even death. Based on WHO data (2020), more than 28–35% of the elderly aged 65 years and older experience falls every year, this condition shows that impaired balance function is one of the factors that contribute to the increased risk of falling.

Balance is a very important thing that everyone has, both from an old age and a young age, to stay in a balanced state when doing daily activities (Chen et al., 2022; Leach et al., 2024; Wolf et al., 2022). Balance is divided into 2 types, namely static balance and dynamic balance. Static balance is a person's ability to maintain a fixed position and posture within a small space of movement, while dynamic balance is the ability to maintain the body during movement. Balance disorders in the elderly are often caused by muscle weakness, posture instability or physiological disorders in one of the senses of the human body. Other factors of balance disorders can also be caused by aging; therefore, balance exercises are one of the programs carried out on the elderly with a risk of falling (Sudaryanto et al., 2022).

According to government regulations, Law No. 13 of 1998 concerning the welfare of the elderly, as the legal basis of the apparatus, the government and the community jointly strive to maintain, maintain, and develop cultural values through efforts to improve social welfare which aims to realize independence and welfare of the elderly.

According to Permenkes No.80/MENKES/SK/III/2013, "physiotherapy is a form of health services shown to individuals and/or groups to develop, maintain, and restore body movement and function throughout the life cycle by using manual handling, movement improvement, equipment (physical, electrotherapeutic, and mechanism) of function and communication training" (Karakoyun et al., 2024).

Therefore, physiotherapy plays an important role and is needed by the community to overcome problems in the elderly, especially those who have balance disorders and have a risk of falling in the elderly. One of the interventions provided to overcome balance problems and prevent the risk of falling in the elderly is by providing an exercise program.

It is necessary to develop and implement physical interventions that can help improve balance in the elderly. One form of intervention that has been shown to be effective is physical exercise specifically designed for the elderly, such as Square Stepping Exercise (SSE) and Gaze Stability Exercise (GSE) (Muslimaini et al., 2023).

Research by Hidayati & Waliyanti (2025) reported that the prevalence of falls in the elderly reached 28–35% globally and increased to 32–42% at the age of over 70, while in Indonesia the risk of falling reached 49.4% at the age of 55 and 67.1% at the age of 65, and the results of the case study showed that the administration of SSE for 4 weeks was able to reduce the risk of falling based on the Berg Balance Scale (BBS) score.

As Allah says in Surah Al-An'am verse 17:

وَاِنْ يَّمْسَسْكَ اللّٰهُ بِضُرٍّ فَلَا كَاشِفَ لَهٗٓ اِلَّا هُوَ ۗوَاِنْ يَّمْسَسْكَ بِخَيْرٍ فَهُوَ عَلٰى كُلِّ شَيْءٍ قَدِيْرٌ ۝١٧

And if Allah strikes upon you, O people, a calamity that is bitter in your life such as

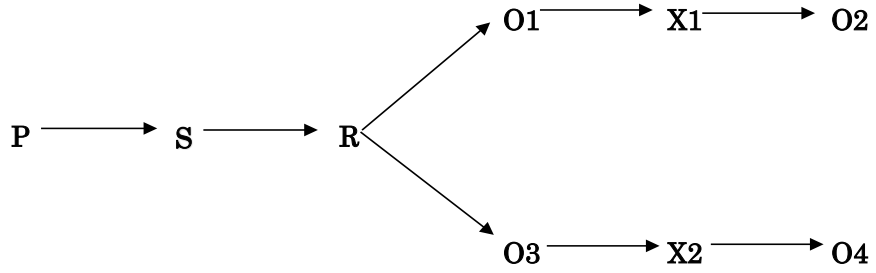
earthquakes, mountain eruptions, diseases, and crises, then there is no one who can remove it but Him, for Allah is Omnipotent over all things. And if He brings you good, such as being healthy, rich, and successful in life, then He is Almighty over all things to realize, reduce, and even eliminate that goodness."

Meaning: humans are still commanded to strive to find a cure, maintain health, and utilize existing knowledge and treatment, while trusting in Allah for the results.

Based on preliminary studies that have been carried out in two places, namely in the Hamlet, Elok Edy Elderly Posyandu, Rajek Wetan, Tirtoadi, Melati, Sleman on November 18, 2025, the elderly population at the Elok Edy Elderly Posyandu reached 56 elderly people in RT 01-03, and 20 people were found who were active in elderly posyandu activities which are routine activities every month, From the results of these observations, it was found that almost all of the elderly experienced balance disorders, both mild to moderate balance disorders. Meanwhile, the preliminary study that has been conducted in Sukunan Village on November 18, 2025 obtained 30 elderly people who are active in elderly posyandu activities.

MATERIALS AND METHODS

This study used a quasi-experimental design. Meanwhile, the research design was with a pre-test post-test of two group design by comparing the treatment groups given Square Stepping Exercise (SSE) and Gaze Stability Exercise (GSE) on balance in the elderly. Before being given treatment, the two sample groups were measured for balance with BBS to determine the level of balance in the elderly.



Description:
Q: Sample
PS: Purposive Sampel
R: Randomization
O1: Balance measurement results before treatment (pre-test)
X1: Treatment in group 1 with GSE
O2: Balance measurement results after treatment (post-test)
O3: Balance measurement results before treatment (pre-test)
O4: Balance measurement results after treatment (post-test)
X2: Treatment in group 2 with SSE

Data Collection Tools and Techniques

This study will collect quantitative data to measure the effect of Square Stepping Exercise (SSE) and Gaze Stability Exercise (GSE) on the physical balance of the elderly. Quantitative data will be obtained from a physical balance test, namely the Berg Balance Scale (BBS) for static and dynamic balance. In addition, qualitative data will also be collected to obtain an

overview of participants' perceptions and experiences regarding the exercises carried out, through semi-structured interviews.

Data Collection Instruments

1. Berg Balance Scale (BBS): Used to measure static and dynamic balance in the elderly. BBS tests an individual's ability to perform a variety of balance tasks such as standing, sitting, and one-legged standing. A higher score indicates a better balance.
2. Validity: This instrument has high validity with a validity coefficient of 0.97 (Joa, 2024).
3. Reliability: It has a Cronbach alpha of 0.98, which signifies excellent consistency in balance measurements.
4. Semi-Structured Interviews: In addition to qualitative data, semi-structured interviews will be conducted to explore participants' experiences and perceptions of SSE and GSE exercises. This interview will provide information about the participants' difficulties or comfort in doing the exercises and their perception of the effect of the exercise on their balance.

Data Management and Analysis Methods

Data that has been collected in the data collection stage must be processed first. The goal is to simplify all the data collected. Present it in a neat arrangement and then analyze it. In data management, there are three activities carried out, namely editing, coding and tabulation.

Data Processing Methods

In this study, data management is carried out starting from preparation, tabulation to the data analysis stage in accordance with the research approach.

Editing (data editing)

The results of interviews or questionnaires obtained or collected through questionnaires are then edited first. Then put it into the observation table.

Coding

After the questionnaire is edited or edited, then coding is carried out, which is converting data in the form of sentences or letters into numerical or numerical data.

Coding for gender
Male : 1
Women : 2
Coding for BBS (Berg Balance Scale) scores
Risk of a mild fall (41-56) : 3
Moderate fall risk (21- 40) : 2
High risk of falling (0-20) : 1
Tabulation
Creating data tables according to the research objectives or desired by the researcher.

Data Analysis

Data obtained from the measurement results using the berg balance scale (BBS) will show changes in functional activity capabilities before and after doing Square Stepping Exercise (SSE) and Gaze Stability Exercise (GSE) with Square Stepping Exercise (SSE) and Gaze Stability Exercise (GSE) movement exercises using the help of SPSS statistical data

processing software. In this study, the data collected from the respondents were included in the ordinal scale data. In analyzing the data obtained, the researcher used several statistical tests, including:

Test Analysis Requirements

1. Descriptive Test

Discrete statistics are used to describe the physical characteristics of the sample which include age, sex, BBS measurement results whose data are taken before and after treatment.

2. Normality Test

To determine the right form of statistical test. The researcher conducted normality testing in treatment group 1 and treatment group II using the *saphiro wilk* test because the number of samples was less than 50 people. With a $p>0.05$ value which means normal.

3. Uji Hypothesis

To test hypotheses 1 and 2, if the data are normally disposed of using the Paired Sample t-test. If it is not normal, then use the Wilcoxon signed rank test.

To test hypothesis 3, the method is to test the normality of the data (data before groups 1 and 2 and data after groups 1 and 2). The homogeneity test included data before and after groups 1 and 2. If the results of one of them are not homogeneous, then the data used for the test hypothesis 3 is the data before and the difference data after, but if the two are homogeneous, then to test the 3rd hypothesis with the post data of groups 1 and 2. Hypothesis test 3 for the difference test of 2 groups. If the data is abnormal, it is tested with Mann-whitney, if the data is normal, it can be tested with an independent sample t-test.

4. Significance

All hypothesis tests will use a significance level of $p<0.05$ to test whether the differences found in the analysis are statistically significant. If the p-value is less than 0.05, then it can be concluded that there is a significant influence of SSE and GSE exercises on the balance of the elderly.

RESULTS AND DISCUSSION

Research Results

Data Analysis Test Results

The normality test is used to determine the distribution of data on a data group or variable, whether the distribution of data is normally distributed or not. The results of the study were obtained from the data normality test using *the Shapiro test and* the following results were obtained as in the table:

a. Normality Test

Table 1. Data Normality Test Results Using *Shapiro wilk*

Valueρ

Variable	Before Treatment	After Treatment	Remarks
BBS Value intervention group 1 (SSE)	0.310	0,513	Normal
Intervention group 2 BBS score (GSE)	0,898	0,125	Normal

Source: (Data Primer, 2026)

Based on table 1, the results of the normality test on the intervention group of 1 *Square Stepping Exercise (SSE)* before treatment obtained a value of ρ = 0.310 and after treatment ρ = 0.513. Therefore, the value of ρ before and after treatment in the intervention group 1 *Square Stepping Exercise (SSE)* was more than 0.05 (ρ = >0.05) the data was normally distributed so that it was included in the parametric statistics and the statistical test to be used for the hypothesis was the *paired sample t-test.* Meanwhile, in the intervention group 2 *Gaze Stability Exercise (GSE),* a value of ρ = 0.898 was obtained before treatment, and after treatment a value of ρ = 0.123. Therefore, the values of ρ before and after treatment in the 2 *Gaze Stability Exercise (GSE)* intervention group were more than 0.05 (ρ = >0.05) of the data was normally distributed.

b. Homogeneity Test

Data homogeneity tests were conducted to see the homogeneity of the data or to confirm whether the population variants were the same or not and were carried out to test whether the variance between intervention groups of different ages was homogeneous or not. Although intervention group 1 (SSE) and intervention group 2 (GSE) consisted of respondents with different age ranges, the homogeneity test still showed that *the variance* between groups remained consistent. The interpretation of balance values in the elderly between the group before *the Square Stepping Exercise (SSE)* and *Gaze Stability Exercise (GSE)* exercises and the group after *the Square Stepping Exercise (SSE)* and *Gaze Stability Exercise (GSE) exercises* was then tested for homogeneity using *the levene's test* as follows:

Table 2. Homogeneity Test of Intervention Group 1 *Square Stepping Exercise (SSE)*

Variable	Sig.	Remarks
***Pre-test* Balance**	0,739	Homogeneous
***Post test* Balance**	0,838	Homogeneous

Source: *Primary research data processed using SPSS (2026)*

The results of the homogeneity test using *levene's test*, from the equilibrium value of group 1 before the intervention obtained a value *of p=0.739* with a value *of p>0.05 and* after the intervention the value *of p=0.838*, it can be concluded that in both groups it is homogeneous.

Table 3. Group 2 *Gaze Stability Exercise (GSE) Homogeneity Test*

Variable	Sig.	Remarks
Pre Balancin	0,932	Homogeneous
Post Balance	0,962	Homogeneous

Source: *Primary research data processed using SPSS (2026)*

The results of the homogeneity test using *levene's test*, from the balance value of group 2 before the intervention obtained a value *of p=0.932 with* a value *of p>0.05 and* after the intervention the value *of p=0.962*, it can be concluded that in both groups it is homogeneous.

c. Uji Hypothesis

To find out the effect of *Square Stepping Exercise (SSE)* and *Gaze Stability Exercise (GSE)* on balance improvement in the elderly, as well as to see the difference in the effect of the interventions given, namely *Square Stepping Exercise (SSE)* and *Gaze Stability Exercise (GSE)* using *the Paired Sample t-test* due to normal data distribution both before and after the intervention was given.

Uji Hypothesis 1

Table 4. Results of Hypothesis 1 test using *Paired Sample t-test* (Primary data, 2026)

Treatment Groups	N	*Red*	*ρ*
***Pre-Test* intervention group (SSE)**	18	30.94	.000
***post-test* intervention group (SSE)**		45.39	

Source: *Primary research data, Paired Sample t-test analysis using SPSS (2026).*

Based on table 4 of the hypothesis test results, probability value data (ρ) was obtained, if the probability value above is less than 0.05 (ρ = <0.05) then Ha is accepted and H0 is rejected. In the table of intervention group 1 *Square Stepping Exercise (SSE),* ρ = 0.000 was obtained which means less than 0.05 so that (ρ< 0.05) so that Ha was accepted and H0 was rejected. Before participating in *the Square Stepping Exercise* (SSE), the average balance score of the respondents was 30.94, after the intervention, the average balance score increased to 45.39. This difference of 14.45 *points* shows a significant improvement in physical balance in the elderly. It can be concluded that there is an effect of *Square Stepping Exercise (SSE)* on improving balance in the elderly.

Table 5. Results of Hypothesis 2 test using *Paired Sample t-test* (Primary data, 2026)

Treatment Groups	N	*Red*	*ρ*
***Pre-Test* intervention group (GSE)**	18	27.61	.000
***Post-test* intervention group (GSE)**		41.61	

Source: *Primary research data, Paired Sample t-test analysis using SPSS (2026).*

Meanwhile, in the 2 *Gaze Stability Exercise (GSE) intervention group table,* the average pre-balance *test* score was 27.61, while the average post-test score after the intervention was 41.61. A difference of 14.00 *points* between *the pre-test* and *the post test* can be concluded that *the Gaze Stability Exercise* (GSE) intervention has a significant influence on balance improvement, as evidenced by the similarity of the value p = 0.000 which means less than 0.05 so that (ρ< 0.05) so that Ha is accepted and H0 is rejected.

Uji hypothesis 3

Table 6. Independent *sample t-test.*

Variable		Red	Sig
***Pre-test* Balance**	Group 1	30,94	0,000

	Group 2	27,61	
***Post-test* Balance**	Group 1	45,39	0,000
	Group 2	41,61	

Source: *Primary research data, Independent Sample t-test analysis using SPSS (2026).*

From table 6 above, the results of the independent sample t-test show that the p-value (Sig) for the pre-test in group 1 and group 2 is p = 0.000, both of which have a p< value of 0.05. With the score between the SSE intervention group and the average pre-test score of 30.94, while the post-test reached 45.39, with a difference of 14.45 points. In the GSE group with an average pre-test score of 27.61, and post-test 41.61, with a difference of 14.00 points.

This shows that there is a significant difference between the two groups, both in the pre-test and post-test. This shows that the treatment or intervention applied during this study had a significant impact on changes in the balance scores of the two groups. Therefore, the hypothesis that there is a significant difference between the two groups is acceptable.

Research Discussion

There is an effect of Square Stepping Exercise (SSE) on balance improvement in the elderly.

To test this hypothesis, a paired sample t-test was used. Intervention treatment group 1 which amounted to 18 samples with the administration of Square Stepping Exercise (SSE) on balance in the elderly which was measured using BBS and obtained a score in intervention group 1 at the beginning of measurement before being given Square Stepping Exercise (SSE), a BBS score was obtained with an average score in the pre-test of intervention group 1 Square Stepping Exercise (SSE) 30.94 and SD 5,795, Then at the end of the measurement after being given both treatments, a BBS score was obtained in the intervention group 1 Square Stepping Exercise (SSE) with a mean of 45.39 and SD 5.772. Then the test was carried out with a paired sample t-test in the treatment group I with a value of ρ=0.000 where if the value of ρ <0.05 means that Ho is rejected and Ha is accepted, which means that there is an effect of Square Stepping Exercise (SSE) on balance and the risk of falling in the elderly.

The basic theory used in this study is a theory that explains the importance of physical exercise in improving balance in the elderly. Based on the theory, physical activities involving coordination, balance, and agility, such as those found in Square Stepping Exercise (SSE), can improve motor function and reduce the risk of falling in the elderly (Surya et al., 2024). SSE involves repetitive movements and changes of direction, which improve postural stability and balance through proprioceptive and vestibular exercises. This improvement in balance in the elderly can be explained through the theory of neuroplasticity, where physical exercise can stimulate the formation of new neural connections that play a role in regulating balance (Bestari & Yuliadarwati, 2022).

Several previous studies conducted between 2020 and 2025 showed similar results, namely improved balance in the elderly after balance training interventions. For example, a study by (Bestari & Yuliadarwati, 2022) who also used Square Stepping Exercise in the elderly, found that the intervention can significantly improve balance with a noticeable reduction in the risk of falling. The study states that SSE is effective in improving body coordination in the elderly, similar to the findings obtained in this study.

Square Stepping Exercise (SSE) has been shown to be effective in improving balance in

the elderly. Research by (Özel et al., 2025) shows that SSE exercises can improve dynamic balance and reduce muscle tension in the elderly with balance disorders. This exercise has also been shown to be beneficial in improving the ability to walk, physical endurance, and mobility of the elderly. SSE not only improves physical balance, but also contributes to the improvement of cognitive function of the elderly. A study by (Bestari & Yuliadarwati, 2022) found that SSE can increase reaction time and reduce the incidence of falls in elderly people living in the community. These exercises can be adapted to the level of difficulty for various groups of the elderly, making them easier to adapt in rehabilitation programs at home or health facilities.

The theoretical implications of these findings strengthen the theory of the importance of balance-based physical exercise in maintaining motor function in the elderly. The balance improvement that occurred in intervention group 1 suggests that SSE can improve nerve function involved in posture regulation. This research also contributes to the development of neuroplasticity theory and rehabilitation of the elderly, especially related to the role of balance training in improving motor skills and preventing functional decline due to aging.

Overall, the results of this study show that Square Stepping Exercise has a significant positive influence on improving balance in the elderly. These findings support the use of SSE as an effective intervention to reduce the risk of falls in the elderly. The practical implications of this study are useful in designing exercise programs for the elderly, while the theoretical implications may strengthen and develop theories about the effect of physical exercise on balance. This research contributes to the development of more effective rehabilitation methods for the elderly, by involving balance exercises such as SSE.

d. Gaze Stability Exercise (GSE) on balance improvement in the elderly

Paired sample t-test results. In the intervention treatment group 2 which amounted to 18 samples with the administration of 2 Gaze Stability Exercise (GSE) intervention on balance in the elderly measured using BBS, the results of the Paired Sample t-test in the GSE intervention group showed a value of $p = 0.000$, which is smaller than the commonly used significance level ($\alpha = 0.05$). This shows that there is a significant difference between pre-test and post-test scores in the group. The mean for the pre-test was 27.61, while the post-test showed a significant improvement with a mean of 41.61. These results indicate that the treatment provided by the GSE intervention had a positive impact on the improvement measured in the pre-test and post-test.

The underlying theory of GSE relates to the importance of visual stability in supporting body balance. Stable vision allows the body to adjust its position more effectively, and it is very important for the elderly to maintain balance and prevent falls (Souza et al., 2024). GSE aims to improve vision ability by improving the eye's ability to follow moving objects, as well as improving the involvement of the vestibular system.

Research conducted by (Yanti et al., 2023) on the impact of GSE intervention programs on similar populations also showed a significant improvement in body balance measurement scores. The findings of this study are in line with the research being analyzed, where improvements in post-tests may be associated with the success of the intervention in improving self-efficacy. However, there are differences in the types of interventions applied. While this study used a GSE-based intervention program, previous studies used a more general physical training approach with no particular emphasis on confidence-building.

Some previous studies focusing on the effects of GSE on the elderly have shown mixed

results. (Zhao et al., 2022) found that GSE is effective in improving the balance of the elderly who have vestibular disorders.

From a theoretical perspective, the results of this study reinforce the view that external factors such as vestibular disorders, age, and overall health status play a very large role in the effectiveness of visual stability-based balance exercises such as GSE. Therefore, these findings suggest developing a more comprehensive theory regarding the relationship between physical exercise, visual stability, and vestibular health in the elderly.

The study also reinforces the understanding that to achieve better balance in the elderly, physical exercise should be personalized according to the condition of each individual. The development of more tailored interventions based on specific physical conditions may be more effective in improving balance in the elderly.

Overall, the results of this study show that there was a significant difference between pre-test and post-test in the GSE intervention group, indicating the success of the treatment in improving balance. These results support the theory of self-efficacy and contribute to the development of a more holistic approach to health, which combines psychological and physical aspects in intervention programs. GSE aims to improve vision stability that can support body balance, these results suggest that other factors, such as health conditions and vestibular disorders, may have more influence on the balance of the elderly.

e. Hypothesis 3: There is a difference in the effect of Square Stepping exercise and Gaze Stability Exercise on balance in the elderly.

Based on the normality test and homogeneity test, the data obtained is distributed normally and homogeneously. Furthermore, the Independent Sample t-test was used to test the differences between the two intervention groups. The results of the analysis showed that the mean in the pre-test for group 1 was 30.94, while group 2 was 27.61, with a significance value of Sig = 0.000 which was smaller than 0.05. This indicates a significant difference between the two groups at the time of the initial pre-test measurements.

In the post-test, group 1 had a mean = 45.39, and group 2 had a mean = 41.61, with a significance value (Sig) that was also 0.000. This suggests that after treatment, both groups showed significant differences, with group 1 showing a higher score compared to group 2. Overall, the p-value of >0.05 on both tests showed that the differences found between the two groups were statistically significant.

These findings support the theory that structured physical exercise can improve balance in the elderly. Square Stepping Exercise (SSE) is focused on strengthening leg muscles and postural stability, which can improve motor coordination. Meanwhile, the Gaze Stability Exercise (GSE) focuses more on strengthening the visual-vestibular system, which is also important in maintaining body balance. Both of these exercises refer to the theory of neuroplasticity, which states that proper stimulation can improve the abilities of the nervous system, especially in old age.

This study shows results that are in line with several previous studies. For example (Mueangson et al., 2025) in their study found that the combination of SSE and GSE was more effective in improving the balance of the elderly compared to single exercise. Theoretically, these findings strengthen and develop an understanding of how physical exercise can affect the body's balance. This reinforces the theory of neuroplasticity and physiological adaptation to

structured exercise stimulation, research by (Özel et al., 2025), which shows that exercises that combine the two exercises are more optimal.

From a practical point of view, the findings of this study provide important implications in the field of physiotherapy, especially for interventions in the elderly who are at risk of falling. Square Stepping Exercise (SSE) can be applied as the main program in an effort to improve the physical balance of the elderly. Meanwhile, the Gaze Stability Exercise (GSE) can be used as a complement to train the visual-vestibular system in improving overall balance.

Based on the results of the Independent Sample t-test, it can be concluded that there is a significant difference between group 1 and group 2 in the pre-test and post-test for the balance variable. These results support theories about the importance of balance-based physical exercise in maintaining motor function in the elderly.

CONCLUSIONS

The results of this study demonstrate that both Square Stepping Exercise (SSE) and Gaze Stability Exercise (GSE) have significant effects on improving balance among elderly individuals. Statistical analysis using paired sample t-tests showed significant improvements in Berg Balance Scale (BBS) scores in both intervention groups, indicating that these exercise programs are effective non-pharmacological interventions for enhancing postural stability and reducing fall risk in older adults. Furthermore, the independent sample t-test revealed a significant difference between the two interventions, where the SSE group showed slightly greater improvement compared to the GSE group. These findings suggest that balance-oriented physical exercise, particularly Square Stepping Exercise, can play an important role in maintaining functional mobility and preventing falls among the elderly population.

For future research, several improvements are recommended to strengthen the evidence regarding balance training interventions for the elderly. Future studies should consider using a larger sample size and a randomized controlled trial design to increase the generalizability and internal validity of the findings. In addition, longer intervention periods and follow-up assessments are suggested to evaluate the long-term effects of SSE and GSE on balance and fall prevention. Researchers may also explore the combined application of Square Stepping Exercise and Gaze Stability Exercise, as well as investigate additional factors such as cognitive function, vestibular health, and quality of life outcomes. These future investigations will contribute to the development of more comprehensive and effective rehabilitation programs aimed at improving physical function and independence among older adults.

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