



DIFFERENCES IN THE EFFECT OF THE COMBINATION OF SQUARE STEPPING AND GAZE STABILIZATION WITH SQUARE STEPPING AND CORE STABILITY ON DYNAMIC BALANCE IN THE ELDERLY

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Abstract

Physiological changes in the elderly occur related to skeletal muscle changes and are related to the balance of the fall risk assessment. Therefore, researchers provide Square Stepping, Gaze stabilization, and Core stability exercise interventions to improve dynamic balance. Square stepping exercise is an exercise to improve lower extremity functional fitness. Gaze Stabilization is an exercise to improve balance by way of cooperation between the vestibular system and the visual system. While Core Stability is a special exercise intended to help improve abdominal and lumbo pelvic muscles in trunk stability. The purpose of the study was to determine the difference in the effect between the combination of Square stepping and Gaze stabilization exercise with Square stepping and Core stability exercise on improving dynamic balance in the elderly. This research is a quantitative study with a quasi experimental type of research. The sample amounted to 30 respondents with a purposive sampling technique. Measurement of dynamic balance using TUGT. The Square Stepping intervention was carried out 3 times a week for 4 weeks, Gaze Stabilisation was carried out 3 times a week for 4 weeks and Core Stability was carried out 2 times a week for 4 weeks. Based on the Mann-Whitney Test using the TUGT measurement instrument, a significance value of 0.034 ($p < 0.05$) was obtained. The results of this study indicate that there is a difference in the effect between giving square stepping and gaze stabilization with square stepping and core stability exercise on improving dynamic balance in the elderly.

Keywords: Dynamic Balance; Elderly; *Square Stepping*; *Gaze Stabilitation*; *Core Stability*; *Time up and go test (TUGT)*

1. Introduction

Elderly (elderly) is a term for people who have aged 60 years or more. Aging is a natural process that cannot be avoided, running continuously and continuously (Astuti *et al.*, 2020). The physiology of aging is characterized by the degeneration of organ systems and tissues determined by various factors such as genetics and the environment. In old age there are physiological changes associated with

periods of immobility such as age-related loss of muscle strength, changes in skeletal muscles and changes related to balance from fall risk assessment (Rosdiana Ika & Lestari Aghnia Cahyani, 2020).

Dynamic balance involves controlling the body as it moves through space (Nasri & Widarti, 2020). Dynamic balance is a condition that can protect the position while moving or the center of gravity (COG) always changes like walking (Alita *et al.*, 2021). Dynamic balance disorders in the elderly are related to decreased proprioceptive, degenerative processes in the vestibular system,

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slowed position reflexes, and weakened muscle strength which is very important in maintaining posture (Ayu *et al.*, 2021). One of the balance disorders experienced by the elderly is caused by weakness in the body's enforcing muscles. This weakness of the body's enforcing muscles arises due to degenerative decline in the elderly, this decline is seen in the field of musculoskeletal studies where there is a massive decrease in muscle mass and is accompanied by a decrease in functional activity (Suparwati *et al.*, 2017). As for maintaining the balance of the elderly, namely by providing a physical exercise.

Square stepping is a training program that requires physical and cognitive efforts, namely attention, memory and executive use, The benefits of Square stepping on balance are to improve agility, coordination, balance, speed, endurance energy, improve dynamic balance and improve lower extremity fitness in the elderly (Putri & Munawwarah, 2018). Gaze stability is a self-adjusting exercise based on the ability of the vestibular system to modify the magnitude of the vestibulo-ocular reflex (VOR) in improving balance, self-confidence and cognitive use (Jehaman *et al.*, 2021). Core stability exercise is an exercise aimed at facilitating core muscles that function to increase the stabilization of the vertebral column to maintain the spine in a neutral position (Hamzah *et al.*, 2021).

Based on the description of these problems, the purpose of this study is to determine the difference in the effect of a combination of square stepping and gaze stabilization with square stepping and core stability exercise on dynamic balance in the elderly.

2. Method

This type of research is quantitative research with a type of quasi experimental research that uses a pretest posttest non-equivalent group design with the aim of knowing the difference in the effect of a combination of square stepping and gaze stabilization with square stepping and core stability exercise on dynamic balance in the elderly. In this study two groups were used which were given a square stepping and gaze stabilization program with square stepping and core stability exercise, the dose was carried out 3 times during the week. The research was

conducted at Posyandu Temuireng in February 2023.

Respondents in this study were elderly people who experienced balance problems at Temuireng Posyandu. The sampling technique in this study used purposive sampling, namely by taking subjects based on inclusion and exclusion criteria. with the number of elderly who met the inclusion criteria of 30 respondents. The independent variables in this study are square stepping, gaze stabilization and core stability. the dependent variable in this study is dynamic balance in the elderly.

Researchers formulate research hypotheses by identifying the effect of dynamic balance on the elderly before and after being given the intervention of Square stepping and Gaze Stabilisation, identifying the effect of dynamic balance on the elderly before and after being given the intervention of Square stepping and Core stability exercise and analyzing the difference in influence between the combination of Square stepping and Gaze stabilization with Square stepping and Core stability exercise on improving dynamic balance in the elderly between before and after the intervention.

3. Result and Discussion

Result

Respondent Characteristics Age

Table 1. Characteristics of Age Respondents

	Categori	(n)	(%)
Age	60-67	24	80
	68-74	6	20
Mean	63,77		
Total		30	100

Based on the data in table 1, it shows that most research respondents are aged 60-67 years with 24 respondents (80%) and the rest are aged 68-74 years with 6 respondents (20%)

Respondent Characteristics Gender

Table 2. Characteristics of Respondents by Gender

	Categori	(n)	(%)
Gender	Male	29	96,7
	Female	1	3,3

Total	30	100
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Based on table 2 shows that respondents with female gender are more than male gender, namely with the number of female gender 29 (96.7%) and the number of male gender is 1 (3.3%).

Balance Measurement Results in the Elderly

TUG balance scale (Time Up And Go Test) which has been tested for validity as described in research according to (Purnomo, 2018), the results of the validity test were obtained. the use of the TUG balance scale shows a validity of $r = 0.716$ so it can be concluded that the research instrument is standardized and does not need to be tested. standardized and does not need to be tested for validity

The results of balance measurements using TUGT before treatment are described in table 3 below:

Table 3. Balance Measurement Results in the Elderly

Categori	(n)	(%)
TUGT		
High fall risk	30	100
Total	30	100

Based on table 3, the results of the TUGT measurement of the experimental group before treatment showed 100% results in the balance of high fall risk.

Influence Test

The effect test in this study uses Wilcoxon because the data obtained is not normally distributed, namely $0.00 < 0.05$. The results of the effect test are shown in table 4 below:

Table 4. Results of the Effect Test of Experimental Group 1 (Square stepping and Gaze stabilitation) and Experimental Group 2 (Square Stepping and Core stability)

Wilcoxon	Group	Z	Sig.(p)
Skor TUGI	Pre-Post	-1.000	0.317
	Eksperimen 1		
	Pre-Post	-2.449	0.014
	Eksperimen 2		

Based on table 4 the Wilcoxon effect test is used to see whether there is an effect of giving

square stepping and gaze stabilization by giving square stepping and core stability. The results of the Wilcoxon test based on the TUGT value in the experimental group before and after treatment showed a significance value of $0.317 > 0.05$, then H_01 was accepted and H_{a1} was rejected so that it could be concluded that there was no effect on experimental group 1.

Based on experimental group 2 with TUGT values before and after treatment shows a significance value of $0.014 < 0.05$, then H_02 is rejected and H_{a2} is accepted so that it can be concluded that there is an influence on experimental group 2. The conclusion from the results of the effect test that experimental group 2 with square stepping and core stability exercise treatment is more significant than experimental group 1 with square stepping and gaze stabilitation treatment.

Test of Differential Influence

This test uses Mann Whitney because the data in this study is not normally distributed. The results of the difference in effect test are shown in table 4.6 below:

Table 5. Results of Differential Test of Influence

Mann Whitney	Group	Z	Sig.(p)
TUGT	Eksperimen 1 Square stepping and Gaze stabilitation	-2.122	0.034
	Eksperimen 2 Square Stepping and Core stability		

Based on table 5, the results of the Mann Whitney effect difference show that the TUGT value after treatment in experimental group 1 and experimental group 2 shows a significance value of $0.034 < 0.05$, then H_{a1} is accepted so that it can be concluded that there is a difference in the effect between giving square stepping and gaze stabilization with square stepping and core stability exercise interventions on improving balance in the elderly.

Discussion

Characteristics by Age

Respondents based on table 1 mention the age of 60-74 with the most respondents aged 60-67 with a frequency of 24 respondents (80%) and the least at the age of 68-74 with a frequency of 6 (20%).

According to the opinion (Lupa *et al.*, 2017), age may be one of the factors that affect the level of body balance in the elderly. The older the age, the more the body's fitness decreases. Increasing one's age affects the decline in balance function which can begin to occur at the age of 60 years in both men and women (Suparwati *et al.*, 2017).

The elderly between 60-74 years old have a high percentage of balance disorders. The occurrence of body balance disorders is usually caused by limb muscle weakness, postural stability and physiological disorders of one of the senses in our body, besides other factors such as aging also affect balance disorders (Wijayani, 2022).

Characteristics of Gender Respondents

Based on table 2 in this study, it was found that female respondents were more dominant 29 (96.7%) than male respondents 1 (3.3%).

Balance in women is lower than men, because women experience menopause which will experience a decrease in estrogen levels which causes bone density to decrease so that bones become brittle which affects changes in the musculoskeletal system resulting in the balance of the female body decreasing rapidly (Yuliadarwati *et al.*, 2019).

Gender differences affect the physical activity of the elderly, the amount of muscle mass and fat distribution in men is less than in women because in men the hormone testosterone works more so that it affects protein synthesis which is useful for muscle mass, muscle mass affects muscle strength to maintain and improve dynamic balance. Whereas in women there is a decrease in the hormone estrogen at menopause which results in a decrease in the musculoskeletal

system. 5 to 10 years after menopause there is a decrease (Yuliadarwati *et al.*, 2020).

Elderly women have a higher risk of falling than elderly men. Male elderly respondents and female elderly respondents have significant differences in body balance levels. Generally, women tend to experience faster musculoskeletal decline due to hormonal factors during menopause. Men experience 10-15% skeletal decline, while in women the skeletal decline is 25-30% (Lupa *et al.*, 2017).

Results of Balance Measurement in the Elderly

Based on table 3, it is known that the TUGT value in the experimental group shows the results of the balance value <14 with a percentage of 100%.

Decreased body function in physical capacity related to balance includes decreased muscle strength, changes in posture, decreased proprioceptive, decreased visual. The decrease in physical capacity will greatly affect the balance of the elderly and this will increase the risk of falls in the elderly (Segita *et al.*, 2021).

Decreased lower extremity muscle strength can result in slowness of movement, short steps, feet cannot tread firmly and are more easily unsteady. Decreased muscle strength also causes decreased mobility in the elderly. Because muscle strength is a major component of the ability to step, walk and balance. So that the elderly often experience falls (Listyarini & Alvita, 2018).

Dynamic balance is controlled by lower extremity muscle strength (ankle and knee joints), proprioception, and support from large joint movements such as the hip joint which functions to prevent falls and improve dynamic balance. Dynamic balance is more dependent on lower extremity muscle strength because it is important to control the risk of falls that occur when the body moves (Sari *et al.*, 2022).

Effect Test on Experiment Group 1 (Square stepping and Gaze stabilization) and Experiment 2 (Square Stepping and Core stability)

Based on the test according to table 4, mentioning in experimental group 1 shows before and after being given the intervention square

stepping and gaze stability shows the TUGT $p=0.317$ value, then it can be concluded that the overall $p>0.05$ value means that square stepping and gaze stability have no significant effect on improving balance in the elderly.

According to (Setyadhi & Irfan, 2020) square stepping exercise movements that are carried out have a better effect on the elderly because the movement combines the vestibular, visual and musculoskeletal systems so that there is good synergy to realize dynamic balance. According to (Sulfitra, 2022) Square stepping is less effective in improving the balance of the elderly because the elderly experience obstacles in conveying commands to the cortical center so that they cannot be conveyed to the vestibular and direction control that cannot result in increased balance and mobility in activities.

In the elderly, decreased cognitive function can decrease the ability to maintain balance due to changes in the sensory, motor and central nervous system. The degeneration process in the vestibular system will result in balance disorders in the elderly (Pramadita *et al.*, 2019).

According to (Sudarsono & Syakib, 2022) gaze stability training has a direct effect on vestibular sensory, through the vestibulo ocular reflex which has an important role in maintaining balance from the input provided by head movements, especially when looking at objects then the input is forwarded to the brain stem precisely in the vestibular nucleus.

The conclusion of the intervention carried out in experimental group 1 square stepping requires a combination of the vestibular, visual and musculoskeletal systems so that there is good synergy to realize dynamic balance but square stepping experiences obstacles in conveying commands to the cortical center so that it is not conveyed to the vestibular so that it does not result in an increase in balance while gaze stability exercises with visual and vestibular systems during head movements effectively improve balance (Jehaman *et al.*, 2021). However, gaze stabilization can increase the vestibulo-ocular reflex, which helps stabilize the eyes during head movements, but this does not mean an improvement in balance.

Based on experimental group 2 in table 4.5, before and after the intervention of square stepping and core stability exercise shows the TUGT $p=0.014$ value. It can be concluded that the overall p value <0.05 , which means that square stepping and core stability exercise have an effect on balance in the elderly.

The conclusion from the results of the study between experimental group 1 in the form of square stepping coupled with gaze stability is not able to improve balance in the elderly and experimental group 2 is an intervention in the form of square stepping coupled with core stability exercise can help improve balance in the elderly.

According to (Setyadhi & Irfan, 2020) square stepping exercise can improve the cognitive of the elderly, because the elderly are required to understand the pattern and in taking steps must be according to the pattern that has been made. The sensory system that will be stimulated in this exercise is the proprioceptive system located in the joints, and also the visual sensory system of these two systems which will help improve balance in the elderly.

Research conducted by (Utama *et al.*, 2020) that core stability exercises will affect dynamic stability by tensing and allowing weight control. Repetitive core training movements can increase the proprioceptive sensitivity of core muscles which is the main sensory mechanism of motor control, this proprioceptive increase can increase work mobility (Fatimah *et al.*, 2022).

Based on the intervention carried out in the experimental group 2 square stepping requires a combination of vestibular, visual and musculoskeletal systems so that there is good synergy to realize dynamic balance while core stability activates and increases core muscle tone so that it can integrate to work to maintain posture to stay balanced (Adenikheir, 2019).

Test of Differential Influence between experimental group 1 square stepping and gaze stability and experimental group 2 square stepping and core stability.

Based on the effect difference test in table 5, it states that the provision of square stepping and gaze stability in experimental group 1 and the

intervention of square stepping and core stability exercise in experimental group 2, after conducting an effect difference test, the results of the TUGT value after treatment of experimental group 1 and experimental group 2 have a significance value of $0.034 < 0.05$, which means that there is a difference in influence between the provision of square stepping and gaze stability with square stepping and core stability interventions.

Treatment with square stepping and core stability is better than square stepping and gaze stabilization because square stepping combines the vestibular, visual and musculoskeletal systems so that there is good synergy to realize dynamic balance. Then square stepping exercise can improve the cognitive of the elderly, because the elderly are required to understand the pattern and in doing the steps must be according to the pattern that has been made, while core stability training activates and increases core muscle tone so that it can integrate to work to maintain posture to stay balanced.

Improving dynamic balance using square stepping and core stability with 3 times for 4 weeks gradually and has the effect of increasing dynamic balance in the elderly at Temuireng Posyandu. Giving Square Stepping Exercise is able to improve motor function by activating the improvement of motor function in the brain. So that it affects vestibular and directional control so that balance and mobility will increase. because during the Square Stepping Exercise by stepping in various directions the leg drive muscles will actively contract the muscles so as to improve balance (Dunggio, 2022).

With the addition of core stability interventions in accordance with the theory put forward by Nyman Core Stability is the ability to control the position and motion from the trunk to the pelvic which is used to perform optimal movement in the presence of weight transfer and stepping during the walking process. Activation of core muscles is used to produce spine rotation.

Increased core stability activation patterns also result in increased levels of activation in the extremities or limbs thus developing the capability to support or move the extremities. This shows that only with optimal posture

stability (core stability muscle activation), mobility in the extremities can be carried out efficiently. core stability exercises play a role in increasing the strength of the muscles, especially the muscles of the lumbar area so that good core stability will stabilize the vertebral segment which causes dynamic limb movements to be more efficient (Apriani *et al.*, 2018).

Thus the intervention of experimental group 2 is more significant than experimental group 1 square stepping requires a combination of vestibular, visual and musculoskeletal systems so that there is good synergy to realize dynamic balance but square stepping has obstacles in conveying commands to the cortisol center so that it is not conveyed to the vestibular so that it does not result in improved balance while gaze stability exercises with visual and vestibular systems during head movements effectively improve balance (Jehaman *et al.*, 2021). However, gaze stabilization may increase vestibule-ocular reflexes, which help stabilize the eyes during head movements, but this does not translate into improved balance.

4. Conclusion and Suggestion

Based on the results of research conducted on 30 elderly people with dynamic balance disorders at the Temuireng Posyandu, it can be concluded that the most subjects aged 60-67 years are female with the highest TUGT value at a value of > 14 . The results of the Mann Whitney test using the TUGT measurement instrument have a significance value of 0.034 then ($p < 0.05$) meaning that there is a difference in the effect between giving square stepping and gaze stabilization with square stepping and core stability exercise on improving dynamic balance in the elderly.

Based on the research that has been done, there are several suggestion, for educational institutions, it is hoped that the results of this study can be used as material or learning material among students so that they can provide treatment, especially for the elderly regarding dynamic balance disorders, for the elderly. For the elderly, it is hoped that it can provide information on how to improve dynamic balance with square stepping, gaze stabilization and core stability exercise and continue the exercises that

have been taught, For physiotherapy this research can be used as a source of information for physiotherapy related to dynamic balance cases with square stepping, gaze stabilization and core stability exercise interventions on dynamic balance disorders in the elderly, For further researchers, it is hoped that the results of this study can be refined with more respondents, controlling physical activity, paying more attention to the environment that is conducive to being used as a place when providing interventions, and when screening respondents it is hoped that researchers can assess the cognitive quality of research subjects with the aim of getting good coordination subjects.

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