

## DIFFERENCES EFFECT OF TANDEM GAIT EXERCISE AND SQUARE STEPPING EXERCISE ON REDUCING RISK OF FALLING IN THE ELDERLY

**Yuliana Ratmawati<sup>1</sup>, Yoni Rustiana Kusumawati<sup>2</sup>**

<sup>1,2</sup> Politeknik Kesehatan Kemenkes Surakarta

E-mail<sup>1</sup>: [yonirustiana@gmail.com](mailto:yonirustiana@gmail.com)

### Abstract

**Background:** The increase in the elderly population from year to year will have an impact on increasing health problems for the elderly. Changes in the body functions of the elderly related to aging can affect physical and psychological health which in the future will affect the social and economy. One of the problems is the increased risk of falling caused by physiological changes in the body due to the aging process. For this reason, intervention is needed to deal with this problem. Tandem gait exercise and square stepping exercise can be used as an alternative as a form of preventive and rehabilitative action. The goal to be achieved in this study is to determine the difference in the effect of tandem gait exercise and square stepping exercise on the risk of falling in the elderly, **Methods:** Two Group Pre test – Post test Design. Measuring instrument : TUG test, **Results:** independent t test by comparing the post test of the tandem gait exercise group and the square stepping exercise group obtained a value of  $p = 0.075$  ( $p > 0.05$ ) meaning that there is no difference between tandem gait exercise and square stepping exercise on the risk of falling in the elderly. **Conclusion:** there is no significant difference between tandem gait exercise and square stepping exercise on the risk of falling in the elderly.

**Keyword :** *Tandem Gait Exercise, Square Stepping Exercise, Risk of falling, elderly*

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### Introduction

Fall is an incident where a person accidentally lies on the ground or floor or lower surface due to loss of balance in daily activities, and it is the main cause of death in the elderly. The aging process accompanied by mental changes causes the elderly to have a risk of falling more than 10 times that of young adults and middle-aged people. Falls are often experienced by the elderly. Many factors cause the elderly to fall, both intrinsic factors such as gait disturbances and extrinsic factors such as the drugs consumed and the environment (4). Reduced muscle strength and poor balance are also risk factors that make the elderly vulnerable to falling. Balance is a complex motor skill and describes the dynamics of body postures. Loss of balance is related to aging, and age also affects muscle mass and function. To reduce the risk of falling, balance can be improved with special exercises (4). According to statistics on the incidence of falls in the elderly, 15.3% occur at the age of 65 years or more, 20% occur at the age of more than 70 years, and 35% occur at the age of more than 75 years. When the elderly experience a fall, it can cause severe injuries such as hip fractures, brain injuries

due to trauma, and limited movement so that the elderly cannot be independent. 10% to 20% of falls in the elderly are related to balance and gait disturbances. Which then causes decreased walking ability (5). The risk of falling increases as the ability to maintain balance decreases. Lack of physical activity is a risk factor for balance disorders in the elderly. Physical activity consists of transportation activities such as walking and cycling, work activities, and physical exercise. Tandem gait exercise can control balance in the elderly by maintaining control of body posture while walking straight ahead and behind the legs in a line of walking 3-6 m with eyes open can train cognition and coordination of the abdominal, trunk, lumbar, pelvic and ankle muscles in the elderly (6). Another source said that in square stepping exercises there is visual feedback when doing stepping exercises on a square mat and coordination feedback when practicing together on the same mat. In addition, it was also found that cognitive stimulation in the form of step patterns and muscle coordination involved in this exercise makes it more useful for training balance and reducing the fear of falling (7). Therefore, the authors are interested in researching and studying more deeply by taking the title differences in the effect of tandem gait exercise and square stepping exercise on the risk of falling in the elderly. Thus, it is expected that tandem gait exercise or square stepping exercise can be used as a technique in reducing the risk of falling in elderly.

### **Method and Materials**

This research is a treatment of two groups pre and post test design (quasi experimental). Group 1 giving tandem gait exercise and group 2 square stepping exercise method 3 times a week for 4 weeks. The inclusion criteria were: (1) elderly aged 60-80 years, (2) willing to participate in the study voluntarily (without coercion), (3) self-ambulation without assistance, (4) having a TUG speed test value of 15-29 seconds, (5) able to follow simple commands. Exclusion criteria: (1) have a history of stroke or Parkinson's disease which interferes with gait patterns, (2) have intellectual impairments in the form of memory or cognitive impairments which make it difficult or not easy for research subjects to understand. Subjects were declared dropped out (DO) if: (1) they did not fulfill the number of training sessions according to the program (did not come 3 times during practice), (2) research subjects were unable to carry out instructions properly, (3) were not present in the post test.

Elderly is someone who is known from a male or female identity card aged 60 years and over which is characterized by a decrease in the body's organ systems, cell functions, and tissues in the body. A fall is an incident where a person accidentally lies down on the ground or floor or lower surface due to loss of balance. The risk of falling is a condition where there is an increased susceptibility to falls which can have an impact on physical and health damage. The risk of falling in this study will be measured using the Time Up and Go test (TUG). Tandem gait exercise is a way of walking 3-6 meters straight with your eyes open. The procedure for doing a tandem gait exercise with one foot is in front of the other foot, the foot in front touches the toes behind it in a straight line 3-6

meters long. The subject must walk in a straight line for 3-6 meters with eyes open and maintain a position so that the feet do not go out of a straight line. The dose of exercise is done 3 times a week for 4 weeks. Square stepping exercise is an exercise consisting of several patterns of steps on a 25 cm<sup>2</sup> checkered mat, performed for 30 minutes with a frequency of 3 times per week for 4 weeks. The square stepping exercise consists of 2 types of exercises, namely, the basic pattern and the elementary pattern, which are performed 10 times in each pattern. Then proceed with cooling for 5 minutes.

**Result**

1. Research criteria

Research subject data based on gender in group I consisted of 7 people (47%) male and 8 people (53%) (female), while in group II consisted of 5 people (33%) male and 10 people (67%) were female. Data of research subjects based on age in group I between the ages of 55-65 years were 10 people (67%), between the ages of 66-80 there were 5 people (33%) while group II was between aged 55-65 years as many as 10 people (67%), between the ages of 66-80 years as many as 5 people (33%).

The research subject data was based on the pre and post TUG test scores of 30 research subjects consisting of 15 in group I with an average pre and post TUG score of 17.53. In the 15 subjects of group II with an average pre TUG value of 19.93 while the post TUG average value was 15.33.

2. Normality test

**Tabel 1.** Normality test  
**Shapiro Wilk Test**

	<i>p</i>	<i>Explanation</i>
Pre test group 1	0,122	Normal
Post test group 2	0,067	Normal
Pre test group 1	0,200	Normal
Post test group 2	0,479	Normal

Source: Primary data, 2022

3. Different result pre and post test group 1 and group 2

**Tabel 2..** Paired sample t – test

<i>Result</i>	<i>p</i>	<i>Explanation</i>
Pre – post group 1	0,000	Hypothesis accepted
Pre – Post group 2	0,000	Hypothesis accepted

Source: Primary data, 2022

4. Different result post test group 1 and group 2

**Tabel 3.** Independent sample t test

<i>Result</i>	<i>p</i>	<i>Explanation</i>
Post – post group 1 and group 2	0,075	Hypothesis is rejected

Source: Primary data, 2022

**Discussion**

The results of the research data on the distribution of subject data based on gender and age show that the number of female subjects in both groups is more than the number of male subjects with an age range of 55-80 years, in addition to the distribution of TUG test scores or balance values which will affect the risk of falling the average value of 21.47 and 19.93. This is in accordance with Pathath's 2017 statement, which states that with increasing age in the elderly it can cause a decrease in proprioception, the musculoskeletal system, the neurological system, and sensory systems such as visual, vestibular, and proprioceptive which can affect balance in the elderly (2). The elderly also experience a decrease in organ systems and a decrease in physiological function (2,3). Based on the results of this study, in group I there was an effect of giving tandem gait exercise to reducing the risk of falling in the elderly. The effect of tandem gait exercise in reducing the risk of falling is supported by research conducted by Novianti et al (2018) which concluded that tandem walking exercises are better at improving elderly balance than Balance Strategy exercises. The movement of tandem walking exercises can control balance in the elderly by maintaining control of body posture when walking straight in front and behind in a walking line 3-6 m with eyes open can train cognition and coordination of abdominal, trunk, lumbar, pelvic and ankle muscles in the elderly (6). Tandem gait exercise in the elderly by training visually and proprioceptively. Tandem gait exercise in the elderly by training visually, namely looking ahead and focusing the eyes so that they stay in line. Tandem gait exercise in the elderly by training proprioceptively which plays a role is vestibular and somatosensory, namely by maintaining the body position so that it remains upright while walking in tandem lines. (17) So that in measurements using the TUG test the results show that the walking is faster or the less time it takes to walk, the better balance the elderly have. In the elderly there is a decrease in balance due to a decrease in muscle fibers which results in the risk of falling. The muscle strength of the lower limbs in the elderly must be strong in order to be able to carry out daily activities without balance disturbances. The more muscles that contract against gravity and external loads, the better your posture and balance will be. Muscle strength is affected by the number of nerve fibers that activate the muscles, so there are also many muscle fibers that contract. If the muscles have many nerve fibers that contract, the muscle strength will be better (16). Proprioceptive exercises in tandem gait exercise will provide information on musculoskeletal reflexes and motion perception which helps in establishing joint dynamic stability in the

elderly (17) The results of the study in group II found that there was an effect of giving square stepping exercise to reducing the risk of falling in the elderly. The stepping exercise movements in the square stepping exercises are exercises developed from walking patterns in general, so the movements are almost the same as walking movements. The movement of walking in the elderly requires good balance so that it does not fall easily. Balance involves the integration of sensory input and the planning and execution of movements in an activity (5). Square stepping exercises involve sensorimotor stimulation and tasks that require visual, cognitive and motor integration during the exercise process so that an increase in elderly balance can be achieved. The visual integration is in the form of step patterns on the base of the box, cognitive integration in the form of motion planning to follow the pattern and motor integration in the form of synergistic and agonist muscle activation of the lower limbs when carrying out the stepping motion. Square stepping exercises stimulate the activation of agonist and antagonist muscles in the lower extremities thereby increasing lower extremity fitness. In addition, Square stepping exercises are also useful for preventing falls due to increased functional abilities, lower extremity fitness and the health status of the elderly (7). This is in accordance with research conducted by Fisseha, 2017 which also states that square stepping exercises are significantly better than subjects who only walk or are subjects without any exercise for preventing falls, preventing fear of falling and improving the health status of the elderly (13). The hypothesis in this study is that there are differences in the effect of tandem gait exercise and square stepping exercise on reducing the risk of falling. This was not proven by the independent sample t test by comparing the post test in groups I and II which obtained a value of  $p = 0.075$  ( $p > 0.05$ ), thus it can be interpreted that there is no significant difference from the presence of tandem gait exercise.

### Conclusions

The results of this study can be concluded that there is no difference in the effect of tandem gait exercise and square stepping exercise on the risk of falling in the elderly as indicated by an increase in balance.

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