

Research Article

The Effect of the Combination of Tera Gymnastics and Square Stepping Exercises on the Level of the Elderly's Dynamic Balance

Nungki Marlian Y^{1*}, Agus Setiawan², and Rama Manggala P¹¹Study Program of Physiotherapist Profession University of Muhammadiyah Malang²Aisyiyah Ponorogo General Hospital**ORCID**Nungki Marlian Y: <https://orcid.org/0000-0002-5830-3915>**Abstract.**

With increasing age, there is a decrease in the degenerative body, such as a decrease in musculoskeletal, neuromuscular, and cardiovascular functions, as well as a reduced ability to perform daily activities. One of the declines in musculoskeletal function is a decrease in muscle function, which causes muscle fibres to shrink, causing a decrease in strength, muscle mass, and bone mass. This causes dynamic balance disorders in the elderly. To improve and maintain dynamic balance, a combination of Tera Gymnastics and Square Stepping exercises are given to the elderly. This study aimed to determine whether there is an effect of the combination of Tera Gymnastics and Square Stepping Exercises on the level of the dynamic balance of the elderly in Sasana Malang. The research design was pre-experimental, namely the One Group Pre-Test and Post-Test Design. The study was focused on 35 elderly people for four weeks. The research instrument used was the Timed Up and Go Test. Shapiro Wilk Test data was normal, Pre-Test was 14.2317, and Post-Test was 11.9480. Paired Sample T Test significance was 0.000, H₀ was rejected and H₁ was accepted. It was discovered that a combination of Tera Gymnastics and Square Stepping exercises for 4 weeks increases the dynamic balance of the elderly in Sasana Malang.

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1. INTRODUCTION

Limitation of physical activity causes a decrease in the dynamic balance of elderly people. Elderly is the age at the end of the life cycle. This stage begins at the age of 60 years and everyone experiences the aging process. The prevalence of the elderly population in Indonesia reaches 23.66 million people or 9.03%. In 2020, the elderly population in East Java reaches 13.48%. According to the Indonesian Ministry of Health in 2012, the average decline in the balance of elderly people in Indonesia was 63.8%-68.7%. According to the Central Statistics Agency, in East Java, the elderly population experienced a balance decline of 10.40%.

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Elderly people with postural balance disorders have the possibility of falling. Muscle weakness is caused by changing muscle morphology and resulting in functional changes, namely flexibility, strength, and speed (1). The body's ability to adapt to its environment is physiological. One of the causes of this decline is the decrease in the number of somatic cells (2).

Decreased motor function in the elderly is a decrease in strength in bone tissue, muscles, and joints that affect flexibility, speed, strength, and balance. The decreased sensory function then affects the sensitivity of the receptor nerves, including excessive skin sensitivity to touch stimuli (hyperesthesia), and tingling (paresthesia), which causes loss of sensitivity when stimulated. Decreased sensory function is experiencing balance and coordination disorders (Sudrajat & Soetardji, 2014). This causes a decrease in the balance of elderly people and the body decreases.

2. METHOD

This research is a quantitative study with a research design of One Group Pre-Test Post-Test Design using a pre-experimental research design. There was one group in this study, namely the experimental group (3). Observations were carried out before the intervention was given (pre-test) and after the intervention (post-test).

3. RESULTS

TABLE 1: Respondents Based on Genders.

Gender	Frequency	Percentage%
Female	29	83%
Male	6	17%
Total	35	100%

According to (4)elderly women experience menopause, which causes a lack of the hormone estrogen. Bone density is greatly influenced by hormones in the body. Body deformities due to decreased bone density cause a lack of balance and then increase the risk of falling, which often occurs in elderly women.

Balance problems are often found in elderly women and are also influenced by hormonal changes, muscle mass, lifestyle, body fat, and psychological factors. Menopause causes a decrease in the female hormone estrogen and affects changes in the musculoskeletal system. Estrogen plays an important role in women's bone integrity. When estrogen levels drop, calcium and nutrient metabolism and absorption become less

effective. The loss of calcium in the bones depends on estrogen, which occurs rapidly during the 5 to 10 years after menopause. Elderly Women have less muscle control than men affecting the lower extremities. Imbalance in upright posture is influenced by aging factors such as decreased reflexes, impaired proprioceptive function, and decreased sense of vibration. Risk factors for musculoskeletal changes include decreased muscle strength, coordination, flexibility, limited range of motion, and an increased risk of falls and fractures (5)

TABLE 2: Respondents Based on BMI.

Class	Frequency	Percentage
Less Body Weight <18,5	3	9%
Normal Body Weight 18,5-22,9	15	43%
Excessive Body Weight 23,0 - 24,9	10	29%
Obesity >=25	7	20%
Total	35	100%

The frequency of falls in elderly people is influenced by unstable postures. Postural instability associated with the aging process is related to changes in body posture, uneven distribution of fat, and loss of bone density also causes changes in gait that result in imbalance. An ideal BMI is needed because it can facilitate daily activities and reduce the risk of disease (6). Any changes in BMI that occur will affect muscle tone because the balance of the human body is influential. Loss of strength and weight gain increase imbalances and problems with walking, as well as cardiovascular disease. Biomechanical disturbances and loss of the body's balance system are caused by low muscle mass. When the BMI is below normal, the body does not have enough calories and tends to be unbalanced, and is at risk of developing health problems such as brittle bones (6).

Balance disorders are generally caused by physiological disorders (visual, vestibular, tactile, proprioceptive, and metabolic) (6). Obesity causes an uneven distribution of body weight, which affects posture. Elderly people who experience decreased physiological functions, such as changes in posture, and metabolic disorders such as obesity cause their bodies to lose balance and increase the risk of falling.

Table the effect of tera gymnastics and square stepping exercise combination on dynamic balance levels in the elderly using paired t-test

The results showed that the decrease in the level of dynamic balance experienced by the elderly people was one of the factors that interfered with their activities. Giving a combination of tera exercise and Square Stepping Exercise can increase the strength

TABLE 3: Results of the Effect of Combination of Interventions.

	Mean	N	Df	t count	T table
Tera exercise & Pre-Square Stepping Exercise	14.2317	35	34	31.605	2.032
Post-test	11.9480	35			

and flexibility of the lower extremities during physical movement. In addition, it improves motor function by activating increased motor function centered on cortical centers and maintaining balance by influencing control and direction.

4. DISCUSSION

Tera gymnastics is one of the effective sports for elderly people because there are breathing exercises combined with movement (7). Tera gymnastics was adopted from the movements in Tai Chi gymnastics originating from China. The tera exercises dose is 3 times a week for 4 weeks and each exercise lasts 30 to 60 minutes (8). Motor and sensory stimuli are found in tera exercises. The exercise stimulus given is muscle contraction which can increase muscle strength and improve dynamic balance. Sensory stimuli are muscle and joint stimuli that enhance proprioceptive function. Improved musculoskeletal and proprioceptive functions improve postural control and improve dynamic balance (9).

The Square Stepping Exercise (SSE) is an exercise using a 25-inch square pattern of 40 squares in a regular pattern. This exercise requires the elderly to take steps forward, backward, right, and left. In the Square Stepping Exercise, the elderly need to understand the pattern and act according to the specified pattern. Studies show that SSE can reduce the risk of falling and is appropriate for improving balance (10). The SSE dose is 3 times a week, for 15-30 minutes (8). In Pramita and Susanto's research (2018), it has been proven that regular exercise 3 times a week for 4 weeks, effectively improves the dynamic balance of elderly people. SSE exercise significantly improves balance and reduces the risk of falls in the elderly. SSE exercises can improve motor function by activating increased motor function of the cortical centers. Improvements in the cortical centers affect vestibular regulation and direction, thereby improving dynamic balance and mobility in elderly people (10).

Square Stepping Exercise is an exercise that involves various sensory systems (multi-sensory factors). The sensory stimulated in this movement are the proprioceptive system and the visual sensory system. Improvement of proprioceptive function and the visual

sensory system can improve the balance of elderly people. This is because the proprioceptive information received through the spinal cord is transmitted to the brain. In the brain, it is transmitted to the cerebellum and some of it to the cerebral cortex. This mechanism increases awareness of certain positions and improves balance (10).

A combination exercise of tera and SSE to improve the dynamic balance of elderly people with a dose of 3 times a week for 4 weeks can improve the ability of the musculoskeletal system, this exercise is also able to improve visual abilities. In the combination of tera gymnastics and SSE exercise, dynamic balance increases because tera gymnastics is an exercise to control the shift in the center of mass of the body when standing and to increase the strength and flexibility of the lower extremities during the execution of physical movements. The rhythm of movement adopted from tai chi gymnastics which has a repetitive and slow rhythm of movement facilitates sensory-motor integration, the continuous transfer of load from one foot to another facilitates control of balance, motor coordination, and lower extremity strength, and tera gymnastic have coordinated and flowing limb movements to increase the Joint Scope of Motion (LGS) and joint flexibility (10).

The results of this study are in accordance with the results of research from Pramita and Susanto (2018). With a dose of 3 times a week for 4 weeks, the average value of dynamic balance in the people before the intervention was given was 12.03 seconds, after exercise the average value was 8.67 seconds. The average increase in dynamic balance before and after exercise was 27.92%. According to (11) the average value before the intervention is 14.70 and the average after the intervention is 13.04, which can be concluded that the combination of tera gymnastics and Square Stepping Exercise improves the dynamic balance of elderly people.

5. CONCLUSION

The combination of tera gymnastics and Square Stepping Exercises has an influence on the level of dynamic balance in elderly people.

References

- [1] Murtiyani N, Suidah H. Pengaruh Pemberian Intervensi 12 Balance Exercise Terhadap Keseimbangan Postural Pada Lansia. *J Keperawatan*. 2019;12(1):42–52.
- [2] Dewi A, Aswira D, Legsyanto E. Pengaruh Senam Tai Chi Terhadap Keseimbangan Tubuh Lansia Di Yayasan Taman Bodhi Asri Kabupaten Deli Serdang. *Health Sci J*

- Siti Hajar. 2016;1(1):1–8.
- [3] Mulyadi M. Riset Desain Dalam Metodologi Penelitian. *J Studi Komun Dan Media*. 2012;16(1):71–80.
- [4] Susilo W, Limyati Y, Gunawan D. The Risk of Falling in Elderly Increased with Age Growth and Unaffected by Gender. *J Med Healthc*. 2017;1(6):568–74.
- [5] Lupa AM, Hariyanto T, Ardiyani VM. Perbedaan Tingkat Keseimbangan Tubuh Antara Lansia Laki-Laki Dan Perempuan. *Nurs News J Ilm Keperawatan*. 2017;2(1):454–61.
- [6] Karunia NL, Wibawa A, Adiputra LM. Hubungan Indeks Massa Tubuh (IMT) Dengan Keseimbangan Statis Pada Mahasiswa Fakultas Kedokteran Universitas Udayana. *Maj Ilm Fisioter Indones*. 2015;2(1):29–33.
- [7] Khasanah U, Nurjanah S. Pengaruh Senam Tera Terhadap Penurunan Tekanan Darah Pada Lansia Dengan Hipertensi. *Indones J Nurs Sci Pract*. 2020;3(1):23–34.
- [8] Ashim A. Perbedaan Efektivitas Square-Stepping Exercise Dan Four-Stepping Exercise Terhadap Peningkatan Keseimbangan Lanjut Usia. *J Univ Esa Unggul*; 2017. pp. 1–8.
- [9] Swandari A, Purwanto B, Sulistiawati. Pengaruh Senam Tai Chi Terhadap Peningkatan Keseimbangan Dinamis Pada Lanjut Usia. *J Keperawatan Muhammadiyah*. 2016;1(1):7–12.
- [10] Pramita I, Susanto AD. Pengaruh Pemberian Square Stepping Exercise Untuk Meningkatkan Keseimbangan Dinamis Pada Lansia. *Sport Fit J*. 2018;6(3):1–7.
- [11] Lestari AB, Ersila W, Rejeki H. Pengaruh Kombinasi Square Stepping Exercise Dan Senam Otak Terhadap peningkatan Keseimbangan Dinamis Lansia Di Desa Sidosari Kecamatan Kesesi Kabupaten Pekalongan. *Naskah Publ Program Studi Sarj Fisioter*; 2020.