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RESEARCH ARTICLE

Dynamic Balance Improvement among the Elderly: Evaluating the Square Stepping Exercise Intervention

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Abstract

Dynamic balance refers to the ability to maintain postural stability during movement, which is essential for preventing falls and maintaining functional independence in elderly individuals. This study aimed to determine the effect of Square Stepping Exercise (SSE) on the dynamic balance of elderly participants. A quasi-experimental design with a one-group pretest-posttest approach was used. Ten elderly individuals were selected through purposive sampling based on specific inclusion and exclusion criteria. The Berg Balance Scale (BBS) was employed to measure dynamic balance before and after the intervention. The SSE intervention was conducted over four weeks, with three 45-minute sessions per week. Statistical analysis using paired t-tests revealed a significant improvement in dynamic balance after the intervention. The mean pretest score was 25.90 (SD = 2.76), while the mean posttest score was 28.30 (SD = 2.54), with a p-value of 0.000 (< 0.05). These results indicate that Square Stepping Exercise effectively enhances dynamic balance in elderly individuals, which may reduce the risk of falls and improve their quality of life. The findings highlight the potential of SSE as a practical, scalable intervention for fall prevention programs in elderly care settings.

Keywords: Dynamic Balance, Square Stepping Exercise, Berg Balance Scale, Fall Prevention, Elderly Health

Abstrak. Keseimbangan dinamis mengacu pada kemampuan untuk mempertahankan stabilitas postural selama pergerakan, yang sangat penting untuk mencegah jatuh dan menjaga kemandirian fungsional pada individu lanjut usia. Penelitian ini bertujuan untuk mengetahui pengaruh Square Stepping Exercise (SSE) terhadap keseimbangan dinamis pada lansia. Desain penelitian yang digunakan adalah quasi-eksperimental dengan pendekatan pretest-posttest satu kelompok. Sepuluh lansia dipilih melalui teknik purposive sampling berdasarkan kriteria inklusi dan eksklusi tertentu. Alat ukur yang digunakan untuk menilai keseimbangan dinamis adalah Berg Balance Scale (BBS), yang diukur sebelum dan sesudah intervensi. Intervensi SSE dilakukan selama empat minggu, dengan tiga sesi per minggu, masing-masing berdurasi 45 menit. Analisis statistik menggunakan paired t-test menunjukkan peningkatan signifikan pada keseimbangan dinamis setelah intervensi. Rata-rata skor pretest adalah 25,90 (SD = 2,76), sedangkan rata-rata skor posttest adalah 28,30 (SD = 2,54), dengan nilai p sebesar 0,000 (< 0,05). Hasil ini menunjukkan bahwa Square Stepping Exercise secara efektif meningkatkan keseimbangan dinamis pada lansia, yang dapat mengurangi risiko jatuh dan meningkatkan kualitas hidup mereka. Temuan ini menegaskan potensi SSE sebagai intervensi praktis dan skala besar dalam program pencegahan jatuh di layanan perawatan lansia.

Kata kunci: Keseimbangan Dinamis, Square Stepping Exercise, Berg Balance Scale, Pencegahan Jatuh, Kesehatan Lansia

INTRODUCTION

Aging is a natural process that marks the progression of human development through various stages—infancy, childhood, adolescence, adulthood, and finally, old age. During this stage, elderly individuals experience significant changes physically, mentally, and socially. Physical changes such as decreased muscle strength, reduced stamina, and altered physical appearance can lead to psychological effects, including depression and anxiety (Patricia, 2021).

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These changes may affect the social roles of elderly individuals, reducing their effectiveness in performing daily activities and increasing their dependence on others.

Globally, the aging population is growing at an unprecedented rate. According to the World Health Organization (WHO), approximately 8% of the population in Southeast Asia consists of elderly individuals, equivalent to about 142 million people. This number is expected to triple by 2050 (WHO, 2020). In Indonesia, the proportion of the elderly population is also increasing significantly. In 2000, the elderly constituted 7.4% of the total population, which rose to 9.77% in 2010, and by 2020, the percentage was projected to reach 11.34%. This demographic shift highlights the urgent need to address aging-related health issues, particularly those related to balance and fall prevention.

One of the primary challenges faced by the elderly is the decline in dynamic balance due to reduced muscle strength and deteriorating sensory functions. Dynamic balance refers to the ability to maintain postural stability during movement or while standing on a moving surface (Made et al., n.d.). Maintaining balance involves a complex integration of sensory systems (visual, vestibular, and proprioceptive), musculoskeletal systems, and the central nervous system. Any decline in these systems increases the risk of falls, making dynamic balance a critical component of functional independence (Shumway-Cook & Woollacott, 2017).

Postural Control Theory provides a theoretical framework for understanding balance regulation in elderly individuals. According to this theory, maintaining balance requires continuous feedback from the sensory systems to detect body sway and make corrective adjustments (Shumway-Cook & Woollacott, 2017). With aging, the visual and vestibular systems become less efficient, reducing the body's ability to maintain postural control. This decline can result in falls during activities such as walking on uneven surfaces, climbing stairs, or standing on moving platforms.

Several factors influence dynamic balance, including age, gender, body mass index (BMI), physical activity, and environmental conditions (Pereira et al., 2014). In particular, physical inactivity exacerbates balance deterioration, which increases the likelihood of falls. Therefore, physical exercise is critical in mitigating these risks. Exercise not only enhances muscle strength and joint flexibility but also improves cognitive function and postural control (Anindita Saskia Princess Dunggio, 2022).

In response to this need, Square Stepping Exercise (SSE) has emerged as an effective intervention for improving dynamic balance in the elderly. SSE is a structured exercise program that combines physical and cognitive training, involving step patterns performed on a 40-box grid template (Shigematsu et al., 2014). The exercise requires participants to memorize and follow specific step patterns, enhancing coordination, agility, and lower limb fitness while simultaneously improving executive function, attention, and memory (Panse et al., 2017).

The effectiveness of SSE can be explained through the concept of Cognitive-Motor Integration, which suggests that performing cognitive and motor tasks simultaneously enhances executive function and postural stability (Bhanusali et al., 2016). Studies have shown that integrating cognitive tasks into physical training leads to significant improvements in reaction time, decision-making, and balance, reducing the risk of falls in elderly populations (Tendulkar et al., 2018).

Despite the growing body of evidence supporting the benefits of SSE, there are notable gaps in the current literature. Most research on SSE has been conducted in controlled laboratory settings or high-resource environments, often overlooking real-world conditions in low- and middle-income countries like Indonesia (Shigematsu et al., 2014; Panse et al., 2017). Additionally, few studies have investigated the long-term effects of SSE on fall prevention and quality of life in community-based settings (Bestari & Yuliadarwati, 2022).

Another significant gap is the limited research on the dual impact of SSE on both physical balance and cognitive function, particularly in elderly individuals with mild cognitive impairment (MCI). Since cognitive decline is a critical predictor of falls (Pereira et al., 2014), addressing both physical and cognitive aspects through SSE could offer a comprehensive solution for fall prevention and overall well-being.

In the Indonesian context, where healthcare resources are limited and the elderly population is growing rapidly, there is an urgent need for scalable and cost-effective interventions that can be implemented in community settings. SSE, with its low-cost requirements and adaptability for both indoor and outdoor settings, presents an ideal solution for improving dynamic balance and reducing fall risk among elderly individuals in Indonesia (Pramita & Susanto, 2018).

The findings of this study have significant practical implications for elderly care and fall prevention strategies. If SSE proves to be effective in improving dynamic balance among the elderly, it could be integrated into existing community health programs and elderly fitness classes. Unlike many other balance training programs, SSE requires minimal equipment and can be conducted in various settings, including homes, community centers, and elderly care facilities. This makes it a highly scalable and cost-effective intervention, particularly in resource-limited settings (Pramita & Susanto, 2018).

Moreover, given the cognitive component of SSE, this intervention could be adapted for use in cognitive rehabilitation programs for elderly individuals with mild cognitive impairment or early-stage dementia. This dual benefit could significantly improve both physical and mental health outcomes, enhancing the overall quality of life for elderly individuals.

Thus, this study aims to evaluate the effect of Square Stepping Exercise on the dynamic balance of elderly individuals in Indonesia. By addressing the gaps in current research, this study seeks to contribute to the development of evidence-based strategies for fall prevention and improving the quality of life among the elderly. Specifically, the study focuses on assessing the short-term impact of SSE on dynamic balance and provides recommendations for integrating this intervention into community health programs and elderly care services.

RESEARCH METHODS

Research Design

The study employed a quasi-experimental design with a one-group pretest-posttest approach. This design was chosen to measure the effect of Square Stepping Exercise (SSE) on the dynamic balance of elderly individuals before and after the intervention. Quasi-experimental designs are frequently used in applied research where random assignment is not feasible, providing a practical means to

assess intervention outcomes (Shadish, Cook, & Campbell, 2002). This design allows researchers to compare pre-intervention and post-intervention data within the same group, offering insights into the effectiveness of the intervention.

Sampling and Sampling Techniques

The study was conducted at Kasih Sayang Ibu Batusangkar Social Home for the Elderly (PSTW), involving 10 elderly individuals as participants. The sample was selected using purposive sampling, a technique that ensures participants meet specific inclusion and exclusion criteria relevant to the research objectives. This sampling method allowed the researchers to focus on individuals who were most likely to benefit from the intervention and ensured the applicability of the findings (Patton, 2015).

The inclusion criteria for participation in the study were individuals aged 60 years or older, with the ability to stand and walk independently without assistive devices, and no history of recent fractures or severe neurological conditions. These criteria ensured that participants had sufficient baseline physical capability to engage safely in the Square Stepping Exercise (SSE) intervention.

Conversely, participants were excluded if they had severe cognitive impairment or an inability to follow instructions, were engaged in other balance training programs during the study, or had cardiovascular instability or other contraindications for physical exercise. The exclusion criteria were applied to minimize health risks and ensure the validity of the intervention results. Purposive sampling was selected to maximize the relevance and focus of the study by targeting a specific group of elderly individuals who met the outlined criteria, thereby providing more meaningful insights into the effects of the intervention.

Research Instruments

The primary tool used to measure dynamic balance was the Berg Balance Scale (BBS), a validated and widely used instrument for assessing balance in elderly populations (Berg et al., 1992). The BBS consists of 14 items that evaluate various aspects of balance performance, such as sitting, standing, and transitioning between positions. Each item is scored on a scale of 0 to 4, with a maximum possible score of 56. Higher scores indicate better balance. The BBS has demonstrated high reliability and validity for assessing fall risk in elderly individuals (Muir et al., 2008).

Research Procedures

The intervention consisted of Square Stepping Exercise (SSE), conducted over a period of 4 weeks, with 3 sessions per week. Each session lasted 45 minutes, comprising a 10-minute warm-up, 30 minutes of SSE, and a 5-minute cool-down. The exercise aimed to improve the participants' dynamic balance through structured physical and cognitive tasks that progressively increased in complexity.

The SSE was performed using a 40-box grid template (4 horizontal boxes and 10 vertical boxes), with each box measuring 25 cm^2. Participants were instructed to memorize and follow specific step patterns without stepping on the grid lines. As the sessions progressed, the complexity of the step patterns increased, challenging the participants' motor coordination and cognitive skills, such as memory and executive function. This gradual progression helped improve agility, balance, and cognitive function simultaneously.

To ensure the safety of participants and the consistency of the intervention, a trained physiotherapist supervised all sessions. The physiotherapist provided guidance and monitoring throughout the exercise sessions, ensuring that participants followed the correct step patterns and minimizing the risk of injury. This structured and supervised approach enhanced the effectiveness of the intervention while maintaining a safe environment for the elderly participants.

Data Analysis Techniques

The data in this study were analyzed using paired t-tests to compare the pretest and posttest scores on the Berg Balance Scale (BBS). This statistical test was chosen to assess whether there was a significant difference in dynamic balance before and after the Square Stepping Exercise (SSE) intervention. The significance level was set at $\alpha = 0.05$, indicating that results with a p-value less than 0.05 would be considered statistically significant.

Prior to conducting the paired t-tests, key statistical assumptions were tested to ensure the validity of the analysis. The Shapiro-Wilk test was used to assess the normality of the data, confirming whether the distribution of the pretest and posttest scores followed a normal pattern. Additionally, Levene's test was performed to examine the homogeneity of variance, ensuring that the variability between pretest and posttest scores was consistent across the sample.

To complement the statistical significance, effect size was calculated to determine the magnitude of the intervention's impact on dynamic balance. Cohen's d was used to interpret the practical significance of the results, with values indicating the strength of the effect: small (0.2), medium (0.5), and large (0.8) (Cohen, 1988). This comprehensive approach to data analysis provided both statistical and practical insights into the effectiveness of the intervention.

Ethical Considerations

The study adhered to ethical principles in human research. Prior to data collection, ethical approval was obtained from the Institutional Review Board (IRB) of the research institution. All participants provided informed consent, and the purpose, procedures, potential risks, and benefits of the study were explained in detail. Participation was voluntary, and participants were free to withdraw at any time without consequences. Confidentiality and anonymity were maintained throughout the study.

RESULTS

Table 1 shows the comparison of pretest and posttest scores for dynamic balance among elderly participants. Based on Table 1, it is evident that the average dynamic balance score before the intervention was 25.90, with a standard deviation of 2.76, ranging from 21 to 30. After the Square Stepping Exercise, the average score increased to 28.30, with a standard deviation of 2.54, and scores ranging from 24 to 32. The increase in the minimum and maximum scores suggests a consistent improvement in balance among participants. This improvement reflects the positive impact of the intervention in enhancing postural control and coordination.

The paired t-test was conducted to determine the statistical significance of the difference between pretest

and posttest scores. As shown in Table 2, the p-value = 0.000 is less than the significance level of α = 0.05, indicating a statistically significant difference between pretest and posttest scores. This result confirms that Square Stepping Exercise had a significant positive effect on the dynamic balance of elderly participants.

The increase in mean balance scores from 25.90 to 28.30 demonstrates an improvement in postural stability and functional balance after four weeks of SSE intervention. This finding aligns with previous research, which highlights the effectiveness of SSE in enhancing lower limb strength, agility, and cognitive coordination.

Table 1. Average Dynamic Balance Before and After Square Stepping Exercise (SSE)

Variable	N	Mean	SD	Min	Max
Pretest	10	25.90	2.76	21	30
Posttest	10	28.30	2.54	24	32

Table 2. Influence of Square Stepping Exercise on Dynamic Balance

Variable	N	Mean	SD	p-value
Pretest	10	25.90	2.76	0.000
Posttest	10	28.30	2.54	

The improvement in dynamic balance observed in this study has significant implications for the daily activities of elderly individuals. Better balance reduces the risk of falls, enabling greater independence and improved quality of life. The consistent increase in minimum and maximum scores suggests that even participants with initially lower balance performance were able to achieve notable improvements. Factors contributing to this enhancement may include the progressive complexity of the SSE patterns, which stimulate neuromuscular adaptation and cognitive engagement. Additionally, the combination of physical and cognitive challenges in SSE activates multiple sensory systems–visual, vestibular, and proprioceptive–leading to better integration and response during balance tasks.

DISCUSSION

Dynamic balance is an essential component of mobility and functional independence in elderly individuals. It refers to the ability to maintain body stability while in motion or when the center of gravity shifts, such as during walking or transitioning between different positions (Shumway-Cook & Woollacott, 2017). Maintaining balance requires complex coordination between multiple systems, including the visual, vestibular, and proprioceptive sensory systems, along with the musculoskeletal system. Age-related degeneration in these systems often leads to a decline in dynamic balance, increasing the risk of falls and subsequent injuries (Lord et al., 2021). Therefore, interventions targeting balance improvement are critical for reducing fall risk and maintaining quality of life among the elderly.

The findings of this study confirm that Square Stepping Exercise (SSE) has a significant positive effect on dynamic balance in elderly participants. The increase in average posttest scores compared to pretest scores demonstrates the effectiveness of SSE in enhancing balance performance. This result aligns with previous research that highlights the role of SSE in improving lower limb strength, agility, and coordination, as well as stimulating cognitive functions related to memory and executive control (Shigematsu & Okura, 2014). Through repeated footstep patterns in multiple directions–forward, backward, and laterally–SSE activates multiple sensory systems and promotes neuromuscular adaptation, which ultimately enhances postural control and reduces fall risk (Panse et al., 2017).

The relevance of these findings in the context of daily activities among elderly individuals cannot be overstated. Balance improvement directly correlates with better performance in activities such as walking, climbing stairs, and standing from a seated position. These activities are essential for maintaining independence and preventing disability in aging populations (Muir et al., 2018). By improving dynamic balance, SSE contributes to reducing the likelihood of falls–a leading cause of injury-related hospitalizations among the elderly (Ambrose et al., 2013). The cognitive component of SSE, which requires participants to memorize and follow specific step patterns, further enhances its impact by improving attention and reaction time, critical factors in fall prevention (Pereira et al., 2014).

Compared to traditional balance exercises, SSE offers several unique advantages. First, it is a dual-task exercise, which simultaneously trains both physical and cognitive functions. Research has shown that dual-task exercises are more effective than single-task exercises in improving balance and reducing fall risk in elderly individuals (Plummer et al., 2015). Second, SSE is adaptable and can be performed indoors with minimal equipment, making it a scalable and cost-effective intervention for community health programs (Pramita & Susanto, 2018). These features make SSE a practical solution for elderly care facilities and community centers, particularly in low-resource settings.

The findings of this study are consistent with those of Bestari and Yuliadarwati (2022), who concluded that SSE significantly improves dynamic balance and reduces fall risk among elderly participants. Similarly, Shigematsu and Okura (2014) demonstrated that the multisensory stimulation provided by SSE enhances sensory integration, which is crucial for maintaining balance during complex movements. The observed improvements in dynamic balance in this study suggest that SSE is a viable intervention for promoting safe mobility and preventing falls in elderly populations.

However, this study has several limitations that should be addressed in future research. First, the sample size was relatively small, limiting the generalizability of the findings. A larger sample size would provide greater statistical power and a more comprehensive understanding of the intervention's effects. Second, the absence of a control group means that the observed improvements

cannot be solely attributed to SSE. Future studies should adopt a randomized controlled trial (RCT) design to strengthen causal inferences and provide more robust evidence of efficacy (Moher et al., 2015). Finally, this study only measured short-term effects. Long-term follow-up is necessary to determine whether the benefits of SSE are sustained over time and how they impact overall quality of life.

In addition to addressing these limitations, future research should explore the potential of SSE as a dual-purpose intervention for both physical and cognitive health. Given the growing prevalence of mild cognitive impairment (MCI) in aging populations, integrating SSE into cognitive rehabilitation programs could provide significant benefits (Tendulkar et al., 2018). Moreover, studies should investigate the effects of SSE on other outcomes such as gait speed, reaction time, and psychological well-being, offering a more comprehensive assessment of its impact.

The results of this study support the effectiveness of Square Stepping Exercise (SSE) as a practical and accessible intervention for improving dynamic balance and reducing fall risk among elderly individuals. Its low-cost and scalable nature make it particularly suitable for community health initiatives. By addressing the limitations and expanding future research, SSE has the potential to become a cornerstone of fall prevention strategies in elderly care.

CONCLUSION AND SUGGESTIONS

The findings of this study indicate that Square Stepping Exercise (SSE) has a significant positive effect on improving the dynamic balance of elderly individuals. The structured and progressive nature of SSE enhances motor coordination, postural stability, and cognitive engagement, leading to a reduction in fall risk. By practicing complex step patterns in multiple directions, the elderly participants developed better neuromuscular control, which is essential for maintaining balance during daily activities such as walking, climbing stairs, and standing from a seated position. These improvements are consistent with prior studies that emphasize the importance of dual-task training in reducing fall risk and promoting safe mobility (Shigematsu & Okura, 2014; Panse et al., 2017).

The practical implications of these findings are substantial, particularly for community health programs and elderly care facilities. Given its low-cost, flexible implementation, and minimal equipment requirements, SSE is a scalable intervention that can be easily incorporated into various settings, including senior centers, nursing homes, and rehabilitation clinics. Additionally, the cognitive component of SSE makes it an ideal exercise for elderly individuals with mild cognitive impairment, offering a dual benefit in improving both physical and cognitive functions (Tendulkar et al., 2018).

Despite its promising results, this study has some limitations. The small sample size limits the generalizability of the findings, and the absence of a control group prevents a definitive attribution of the improvements solely to SSE. Future studies should involve larger sample sizes and adopt a randomized controlled trial (RCT) design to strengthen the validity of the results. Furthermore, long-term follow-up studies are necessary to evaluate the sustainability of the improvements and their impact on quality of life.

Future research on Square Stepping Exercise (SSE) should consider several important areas for improvement and expansion. First, future studies should expand the sample size and include a control group to enhance the generalizability of findings. A larger and more diverse sample would provide a broader representation of the elderly population, while incorporating a control group would offer more robust evidence of SSE's efficacy and help establish a causal relationship between the intervention and observed improvements in dynamic balance. Second, it is essential to explore the long-term effects of SSE on dynamic balance, fall risk, and overall well-being. While this study focused on short-term outcomes, long-term follow-up studies would provide valuable insights into the sustainability of the improvements and their impact on quality of life among the elderly.

Given the dual-task nature of SSE, future research should also investigate its cognitive benefits, particularly its effects on cognitive functions such as memory, executive control, and reaction time. This area of study is especially relevant for elderly individuals with mild cognitive impairment (MCI) or early signs of cognitive decline. By exploring these cognitive benefits, researchers can determine whether SSE can serve as a dual-purpose intervention for both physical and cognitive health.

Additionally, future studies should focus on implementing SSE in real-world community settings to assess its feasibility and scalability in different cultural and socioeconomic contexts. Community-based interventions would help evaluate how well SSE integrates into existing elderly care programs and its effectiveness outside controlled research environments. Understanding these real-world applications would allow for broader adoption of SSE and contribute to fall prevention initiatives on a larger scale. In conclusion, Square Stepping Exercise offers a practical, scalable, and cost-effective solution for improving dynamic balance and reducing fall risk among elderly individuals. With further research and refinement, SSE has the potential to become an integral part of fall prevention strategies, promoting healthier and more independent aging.

DECLARATION

Ethics approval and consent to participate:

Research approved by the Research Ethics Committee of the authors' institution (Certificate of Presentation of Ethical Review number: 34445720.8.0000.0023).

Consent for publication:

All participants were informed of the objectives and procedures of the study and subsequent publication of the results.

Availability of Data and Material (ADM):

Data not available because it compromises the anonymity of participants.

Competing interests:

Authors declare no conflict of interest

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Authors' contributions:

The authors confirm responsibility for the following - study conception and design, data collection, analysis and interpretation of results, and manuscript preparation.

REFERENCES

Ambrose, A. F., Paul, G., & Hausdorff, J. M. (2013). Risk factors for falls among older adults: A review of the literature. *Maturitas, 75*(1), 51–61.

Anindita Saskia Princess Dunggio. (2022). The Role of Physical Exercise in Maintaining Elderly Balance.

Bestari, N. P., & Yuliadarwati, N. M. (2022). Literature review: The effect of square stepping exercise on dynamic balance levels in reducing the risk of falling in the elderly. *Journal of Nursing and Physiotherapy (JKF)*, *5*(1), 179–189. https://doi.org/10.35451/jkf.v5i1.1413

Bhanusali, H., Vardhan, V., Palekar, T., & Khandare, S. (2016). Comparative study on the effect of square stepping exercises versus balance training exercises on fear of falling and balance in elderly population. *International Journal of Physiotherapy and Research*, *4*(1), 1352–1359. https://doi.org/10.16965/ijpr.2015.206

Herawati, R. (2021). The effect of providing tera gymnastics on reducing high blood pressure in elderly hypertensive patients. *Journal of Hypertension*, *4*(2), 112–118.

Ibrahim, F. A., Nurhasanah, & Juanita. (2018). The relationship between balance and daily activities at the Aceh Besar health center. *Idea Nursing Journal*, *9*(2), 7–13.

Listyarini, A. D., & Alvita, G. W. (2018). The effect of balance exercise on the body balance of the elderly in Singocandi Village, Kudus Regency. *JIKO (Scientific Journal of Orthopedic Nursing)*, *2*(2), 31–38. https://doi.org/10.46749/jiko.v2i2.14

Lord, S. R., Smith, S. T., & Menant, J. C. (2021). Balance, gait, and falls in older adults: Risk assessment and prevention. *Clinics in Geriatric Medicine, 27*(4), 493–509.

Made, I., Prananta, S. W., Gede Widhiantara, I., & Pramita, I. (n.d.). Balance training improves dynamic balance in elderly people at the elderly Posyandu in Bongkasa Village. *Integrated Health Journal*, *4*(1), 13.

Moher, D., Hopewell, S., Schulz, K. F., et al. (2015). CONSORT 2010 explanation and elaboration: Updated guidelines for reporting parallel group randomised trials. *BMJ, 340*, c869.

Muir, S. W., Berg, K., Chesworth, B., & Speechley, M. (2018). Use of the Berg Balance Scale for predicting multiple falls in community-dwelling elderly people: A prospective study. *Physical Therapy, 88*(4), 449–459.

Panse, R., Jain, S., Yeole, U., Gharote, G., Kulkarni, S., & Pawar, P. (2017). Effect of square stepping exercise on cognition and risk of falls in overweight and obese elderly females. *International Journal of Multidisciplinary Research and Development*, *4*(1), 117–120.

Patricia, C. O. S. (2021). The relationship between cognitive function and quality of life in the elderly. *Journal of Aging Research*, *3*(2), 6.

Pereira, J. R., Gobbi, S., Teixeira, C. V. L., Nascimento, C. M. C., Corazza, D. I., Vital, T. M., Hernandez, S. S. S., Stella, F., & Shigematsu, R. (2014). Effects of square-stepping exercise on balance and depressive symptoms in older adults. *Motriz: Revista de Educação Física*, *20*(4), 454–460. https://doi.org/10.1590/S1980-65742014000400013

Plummer, P., Zukowski, L. A., Giuliani, C., Hall, A. M., & Zurakowski, D. (2015). Effects of dual-task balance training on balance and mobility in individuals with stroke: A systematic review. *Journal of Neurologic Physical Therapy, 39*(3), 142–153.

Postural, K., & Exercise, B. (2019). The effect of giving 12 balance exercise intervention on balance. *Journal of Physiotherapy*, *12*(1), 42–52.

Pramita, I., & Susanto, A. D. (2018). The effect of giving square stepping exercise to improve dynamic balance in the elderly. *Sport and Fitness Journal*, *6*(3), 1–7. https://doi.org/10.24843/spj.2018.v06.i03.p01

Priyanto, A., Pramuno, P., & Rusliyah. (2016). The effect of balance exercise on postural balance in the elderly. *Publication Manuscript*, 6–8.

Sabri, A., Sulaiman, D., & Maryaningsih. (2023). The effect of square stepping exercise and ankle strategy exercise on balance in the elderly. *Physio Move Journal*, *2*, 24–28.

Shigematsu, R., & Okura, T. (2014). Square-Stepping Exercise: A Physical and Cognitive Intervention to Improve Balance and Reduce Falls in Older Adults. *Journal of Aging and Health, 26*(1), 107–119.

Shumway-Cook, A., & Woollacott, M. H. (2017). *Motor Control: Translating Research into Clinical Practice*. Lippincott Williams & Wilkins.

Tendulkar, S. S., Bangad, A. S., & Yeole, U. L. (2018). Effects of square stepping exercises on physiological cost index in elderly population. *International Journal of Physiotherapy*, 240–244.