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# The Effect Of Balance Exercise On Postural Balance In The Elderly At The Elderly Social Rehabilitation Center Karawang

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**Abstrak**

Latar Belakang: Proses penuaan menyebabkan berbagai perubahan fisiologis pada sistem muskuloskeletal, termasuk penurunan kekuatan otot dan gangguan keseimbangan tubuh, yang dapat meningkatkan risiko jatuh pada lansia. Latihan keseimbangan merupakan aktivitas fisik yang dirancang untuk mencegah gangguan keseimbangan dan meningkatkan stabilitas. Tujuan: Penelitian ini bertujuan untuk mengevaluasi pengaruh latihan keseimbangan terhadap keseimbangan postural pada lansia. Metode: Penelitian ini menggunakan desain kuasi-eksperimen dengan pendekatan pretest-posttest dan kelompok kontrol. Sebanyak 60 responden lansia dibagi menjadi dua kelompok: kelompok intervensi (n = 30) yang diberikan latihan keseimbangan, dan kelompok kontrol (n = 30) yang tidak diberikan intervensi. Keseimbangan postural diukur menggunakan Berg Balance Scale (BBS). Analisis data dilakukan dengan menggunakan Generalized Linear Model (GLM). Hasil: Hasil penelitian menunjukkan adanya peningkatan yang signifikan pada keseimbangan postural lansia di kelompok intervensi dibandingkan dengan kelompok kontrol (nilai p = 0,000). Kesimpulan: Latihan keseimbangan yang dilakukan secara rutin terbukti efektif dalam meningkatkan keseimbangan postural pada lansia, sehingga dapat direkomendasikan sebagai strategi pencegahan risiko jatuh.

**Kata Kunci:** *lansia; latihan keseimbangan; keseimbangan postural; Berg Balance Scale; pencegahan jatuh.*

***Abstract***

*Background: Aging is associated with physiological changes in the musculoskeletal system, including reduced muscle strength and impaired body balance, which increase the risk of falls among the elderly. Balance exercises are physical activities designed to prevent balance disorders and improve stability in older adults. Purposes: This study aimed to evaluate the effect of balance exercises on postural balance among the elderly. Methods: A quasi-experimental study was conducted using a pretest-posttest control group design. Sixty elderly participants were recruited and assigned into two groups: intervention (n = 30) and control (n = 30). The intervention group received balance exercise training, while the control group did not. Postural balance was assessed using the Berg Balance Scale (BBS). Data were analyzed using the Generalized Linear Model (GLM). Results: The findings showed a significant improvement in postural balance in the intervention group compared to the control group (p-value = 0.000).Conclusion: Regular participation in balance exercises significantly improves postural balance in the elderly and can be recommended as a preventive strategy against falls.*

***Keywords*****:** *elderly; balance exercise; postural balance; Berg Balance Scale; fall prevention****.***



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## INTRODUCTION

Muscle flexibility decreases by 20%-30% between the ages of 30 and 70 years. Decreased lower extremity muscle flexibility reduces the range of motion of the lower extremity joints, thereby reducing the elderly's capacity to maintain the body. (Quijoux et al., 2020). Decreased physical activity, hormonal changes, and bone resorption cause progressive bone loss that causes the spine to become softer and compressed, the long bones to become less flexible, and the bones to become weaker overall. The condition of the elderly becomes stiffer, slower, and less coordinated. As a result, the body's balance becomes unstable, increasing the possibility of injury and falls. (Potter & Perry, 2020). The elderly are most likely to have postural balance issues because their muscles deteriorate or undergo morphological changes, resulting in functional alterations in the muscles by reducing muscle strength and contraction. Postural balance disorder can be brought on by several factors, such as illness, accidents, or the aging process. However, among these three factors, aging is the primary cause of postural balance deficits in the elderly. (Malasari et al., 2022). Balance is essential for daily activities, including standing, walking, and changing direction. Postural balance is defined as the body's ability to maintain the body's centre of gravity within the limits of stability determined by the base of support. Margins of stability are places in space where the body can maintain its position without moving from the base of support. Standing balance is defined as the ability to stand unassisted without falling on moving platforms or using the hands. (Priyanto et al., 2019). Balance Exercise training is useful for increasing functional stability limits, improving the motor system, improving postural control, and increasing dynamic stability. Balance training has a significant effect on improving the quality of life of the elderly. (Kiik et al., 2018). This is because balance training can improve physical health, psychological health, social relationships, and the environment. Balance exercises can strengthen the muscles in the lower legs (feet) and improve body balance or the vestibular system. (Albornos-Muñoz et al., 2018). This exercise focuses on balance which can increase physical capacity so that it is useful for reducing the risk of falls in the elderly. (Supendi et al., 2023).

Data obtained from nursing home officers at the Karawang Elderly Social Rehabilitation Center in 2021 there were 20 people who experienced falls an increase of 10% in 2022. Prevention that has been carried out by the orphanage is only limited to environmental modifications, such as installing handrails, keeping floors non-slip, installing anti-slip mats for the elderly, and lighting the room.

Based on the above phenomena, this research aims to identify the influence of balance exercise on postural balance in elderly people in social rehabilitation institutions.

## METHOD

This research was conducted at the Karawang elderly social rehabilitation centre. With a quantitative approach with a quasi-experimental design with a two-group pretest-posttest design. The sample used was 60 divided into two intervention and control groups of 30 respondents each. Inclusion criteria are >60 years old, not currently experiencing physical injuries that result in total bed rest, able to stand, walk, or move well so that they can do sports. Exclusion criteria for elderly who have severe cognitive problems. Balance assessment was conducted before and after the intervention using the Berg balance scale (BBS) with a validity test value of r = 0.67. The balance exercise movements given to the intervention group were Single leg stand, Tandem walking (Heel-to-toe), Chair sitting and standing. The balance exercise with a frequency of 2 times a week or 6 sessions in 3 weeks for 30 minutes accompanied by local health workers. Data collection on the results of the balance assessment was carried out at each meeting with pre-and-post. Bivariate analysis used the T-test because the data was normally distributed. Multivariate data analysis using a Generalized Linear Model (GLM).

## RESULT and DISCUSSION

### 1. Univariate Analysis

Table 1. Frequency Distribution of Respondent Characteristics

| Variable | | Intervention f (%) | Control f(%) |
|---|---|---|---|
| **Age** | Elderly (60-74 years) | 17 (56.%) | 9 (30%) |
| | Old (75-90 years) | 12 (40.0%) | 20 (66.7%) |
| | Very Old (>90 years) | 1 (3.3%) | 1 (3.3%) |
| **Gender** | female | 17 (56.7%) | 21 (70%) |
| | male | 13 (43.3%) | 9 (30.%) |

According to the study findings, the majority of participants in the intervention group were 60–74 years old, also known as elderly age, with a percentage of 56.7%, whereas the majority of participants in the control group were 75–90 years old, also known as old age, with a percentage of 66.7%. Every year, falls affect between 28–35% of elderly 65 years of age and older, and 32–42% of seniors 70 years of age and older (World Health Organization, 2019). Body balance can be impacted by growing older and the musculoskeletal system deteriorating as a result of aging because lower extremity muscular strength declines leading to altered body weight support and an increased risk of falls. When people get older than 70 years old, their trunk extensor flexibility might diminish by up to 50%, which causes the centre of mass (COM) to shift to their heels. (Carcelén-Fraile et al., 2021). The majority of respondents in both the intervention group and the control group were women, with a ratio of 56.7% for the intervention group and 70% for the control group, according to research findings on gender. Older women are more likely to fall than older men because they tend to have balance issues. Ankle flexibility declines by 50% in women and 35% in men over the age of 55% (Carcelén-Fraile et al., 2021). Furthermore, women become older faster than men due to a decline in the hormonal system, which leads to osteoporosis. Almost 80% of osteoporosis cases affect women, and a lack of physical activity leads bones to lose density, making them brittle (De Martinis et al., 2020). Due to a reduction in muscle mass and strength, particularly in the lower limbs, older women's leg strength will decline, affecting their gait and balance.

### Bivariate Analysis

Table 2. Differences in Postural Balance Values in Elderly Pre and Post-Balance Exercise Intervention

| Variable Balance value | Mean | Std Deviasi | N | Std Error Mean | df | Sig(2-tailed) |
|---|---|---|---|---|---|---|
| intervention group | -8,700 | 5,932 | 30 | 1,083 | 29 | 0,000 |
| control group | 0,333 | 7,489 | 30 | 1,367 | 29 | 0,809 |

Table 2 indicates that there was a significant difference in the postural balance value between the pre and post-intervention in the intervention group, as the p-value was 0.000 (less than 0.05). In contrast, there was no significant difference in the balance value between the pre-test and post-test in the control group, as the p-value was obtained at 0.809, which is greater than 0.05. According to the study's findings, the intervention group's high balance scores increased by 20 points, from 6.7% to 26.7%, while the control group's low balance scores increased by 13.3 points, from 36.7% to 50%. Elderly people's decreased balance results from a degenerative process that lowers their physiological function, which is

characterized by abnormalities in their motor system, sensory-motor integration, and sensory input and processing. These abnormalities reduce the body's stability and balance. (Murtiyani & Suidah, 2019). When muscle strength, flexibility, and the proper reaction time are at their peak, balance control can be optimally attained. (Jiménez-García et al., 2021). The decrease in muscle size and strength in the elderly due to degeneration can be reduced with regular exercise. Research shows that exercise can increase muscle strength. (Distefano & Goodpaster, 2018). In older people, the elements that maintain this equilibrium diminish with age. Therefore, balancing exercises that improve postural balance.

**Multivariate Analysis**

GLM-RM (General Linear Model Repeated Measure) is an assessment to get an idea of differences in values for variables that are measured repeatedly and differences between groups. Results of analysis of the Balance Exercise intervention at the Karawang elderly social rehabilitation centre.

Table 3. Mauchlys's Test Of Sphericity

| Variable | Within Subjects Effects | Mauchlys' S Test Of Sphericity | df | Sig |
|---|---|---|---|---|
| Postural balance | Measurement/time | 0,029 | 20 | 0,000 |

Based on the data presented in Table 3, the significant value is 0.000 which is less than 0.05. This indicates that Ho, which represents the sphericity assumption, is rejected. However, the Repeated Measures test can still be conducted by using the Greenhouse-Geisser value which is obtained from the test of sphericity.

According to Table 4. the Greenhouse-Geisser (sig) value is less than 0.05, specifically 0.000. As a result, the null hypothesis (Ho) is rejected, and the alternative hypothesis (Ha) is accepted. This means that there is a significant improvement in postural balance over time. Therefore, it can be concluded that the balance exercise intervention is effective in enhancing postural balance in the elderly.

Table 4. Test of Within- Subjects effect

| Variable | Within Subjects Effects | Df | Mean Square | f | Sig |
|---|---|---|---|---|---|
| Postural Balance | *Greenhouse-Geisser* | 2,654 | 474,119 | 19,942 | 0,000 |

Table 5. Test of Within-Subjects Contrasts

| Source | Enhancement | Type III Sum of Squares | df | Mean Square | F | Sig. | Partial Eta Squared |
|---|---|---|---|---|---|---|---|
| Balance | BBS 1 vs. BBS 2 | 81.667 | 1 | 81.667 | 2.809 | .099 | .046 |
| | BBS 2 vs. BBS 3 | 147.267 | 1 | 147.267 | 4.618 | .036 | .074 |
| | BBS 3 vs. BBS 4 | 487.350 | 1 | 487.350 | 13.767 | .000 | .192 |
| | BBS 4 vs. BBS 5 | 595.350 | 1 | 595.350 | 17.902 | .000 | .236 |
| | BBS 5 vs BBS 6 | 1033.350 | 1 | 1033.350 | 20.528 | .000 | .261 |
| | BBS 6 vs BBS 7 | 1804.017 | 1 | 1804.017 | 31.245 | .000 | .350 |
| balance * | BBS 1 vs. BBS 2 | .267 | 1 | .267 | .009 | .924 | .000 |
| Group | BBS 2 vs. BBS 3 | 19.267 | 1 | 19.267 | .604 | .440 | .010 |
| | BBS 3 vs. BBS 4 | 150.417 | 1 | 150.417 | 4.249 | .044 | .068 |
| | BBS 4 vs. BBS 5 | 686.817 | 1 | 686.817 | 20.653 | .000 | .263 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | BBS 5 vs BBS 6 | 968.017 | 1 | 968.017 | 19.230 | .000 | .249 |
| | BBS 6 vs BBS 7 | 1848.150 | 1 | 1848.150 | 32.009 | .000 | .356 |
| Error | BBS 1 vs. BBS 2 | 1686.067 | 58 | 29.070 | | | |
| | BBS 2 vs. BBS 3 | 1849.467 | 58 | 31.887 | | | |
| | BBS 3 vs. BBS 4 | 2053.233 | 58 | 35.401 | | | |
| | BBS 4 vs. BBS 5 | 1928.833 | 58 | 33.256 | | | |
| | BBS 5 vs BBS 6 | 2919.633 | 58 | 50.339 | | | |
| | BBS 6 vs BBS 7 | 3348.833 | 58 | 57.739 | | | |

According to the data in Table 5, in the balance value column, each balance value was compared with the 1st balance value (pretest). The results showed that there was a significant difference in the elderly's postural balance from the second measurement after the intervention, with a p-value of 0.036. Additionally, when comparing the Group with the control group, all performance comparisons had a p-value of <0.05. This means that the difference in balance scores before and after the intervention is not the same between the two groups. A group effect was observed starting from the 3rd vs 4th measurement with a p-value of 0.044.

The intervention group demonstrated postural balance before and after treatment (p-value = 0.000 < 0.05). In this study, balance exercise 6 times in 3 weeks can improve postural balance. Previous research showed that after receiving balance training, elderly people's muscle strength ratings improved significantly, despite remaining in the insufficient muscle strength category. (Malasari et al., 2022). Balance exercises strengthen the muscles in the lower limbs which increases body stability. (Listyarini & Alvita, 2018). Thus helping the client's balance, building muscle, and reducing the possibility of falling. (Saraswati et al., 2022). Balance training in the elderly can enhance body balance through reaction time to increase body posture when producing movements or muscle contractions. (Dunsky, 2019).

The Multivariate test analysis revealed significant variations in balance scores between the two groups before and after the intervention (p-value=0.000). As a result, the assumption of sphericity is not met, but it can be maintained in the Repeated Measure test with the sig value in the sphericity test, which can be performed by referring to the Greenhouse-Geisser value. The Greenhouse-Geisser sig value (0.000 < 0.05) indicates a significant increase in the balance value over time. Based on table 5, where each balance value is compared to the first balance value (pretest) in the balance value column. A p-value of 0.05 was found in all balance comparisons, indicating that variations in the postural balance of the elderly were evident from the second measurement following the intervention, with a p-value of 0.036, in contrast to the Balance*Group column. In every performance comparison between the group and the control group, the p-value was less than 0.05. This indicates that the control group did not have the same difference in balance scores before and after the intervention. A group effect with a p-value of 0.044 is present beginning with the third vs the fourth measurement. The intervention group that received balance exercise treatment experienced an increase in postural balance because when this series of movements was performed, there was a process in the brain known as central compensation, in which the brain attempted to adapt to changes in signals caused by this series of movements. Post-activation potentiation (PAP) is a neuromuscular process that results during dynamic stretching and is a factor in enhanced muscle strength (Blazevich & Babault, 2019). Muscle contractions resulting from a series of activities affect the mechanical performance of subsequent muscle contractions. It appears that there is a notable difference between the intervention and control groups in terms of postural balance improvement among older adults. The intervention group showed a significant improvement in postural balance starting from the second measurement after implementing the balance exercise intervention, with the highest postural balance score being recorded during the sixth measurement. On the other hand, the control group showed a slight increase in postural balance but was not statistically significant. Furthermore, the control group's postural balance decreased

during the fifth measurement without implementing the Balance Exercise intervention.

## CONCLUSION

Providing balance exercises six times in three weeks can improve postural balance and lower the risk of falls among the elderly.

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