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The Impact Lowcost Management Balance Exercise Program Reduce Fall Risk In The Elderly In Surakarta

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ABSTRACT

Introduction: The aging process is a process of aging in the elderly group characterized by, among other things, changes in body balance that will impact the risk of falling. This study aims to determine the effect of the Low-Cost Management Balance Exercise Program as an effort to reduce the risk of falls among the elderly in Surakarta. **Method:** The type of this research is quantitative with a quasi-experimental design. This study uses a Pre-Test Post-Test with Control Group Design research design with subject selection using purposive sampling. Results: data were analyzed using the paired sample t-test. **Results:** The result obtained a p-value of 0.001 ($p < 0.05$), which means that there is a significant difference in balance values before and after the exercise was given in group 1, which is the treatment group. In the control group, a p-value of 0.004 ($p < 0.05$) was obtained, indicating a significant difference in balance values before and after the exercise was given. **Conclusion:** The Low-Cost Management Balance Exercise program is effective in reducing the risk of falls in the elderly.

Keywords: *Training Program, Balance Disorders, Elderly*

INTRODUCTION

The aging of individuals is unavoidable. As individuals age, they are also at risk of experiencing a decline in physical function. The decline in the musculoskeletal system's ability leads to decreased flexibility, muscle and joint strength, reduced cartilage function, and bone density, which will affect the ability to perform daily activities in the elderly. The ability to control body balance functions in the elderly is affected by the degenerative process, making them prone to instability, easily slipping, and tripping, which can increase the risk of falls for seniors (Ivanali[1] et al., 2021). Body balance for the elderly affects their ability to perform daily activities due to changes in gait and weakness in the muscle strength of the extremities, which are related to the decrease in muscle tone and strength (Kreativitas et al., 2023).

In Indonesia, the incidence of falls among the elderly is reported to be 17%. The prevalence of fall injuries among residents aged over 55 years in Indonesia reaches 49.4%, while among the elderly over 65 years, the number of fall injuries is higher at 67.1%. The incidence of falls among the elderly in the community increases each year, from 25% at the age of 70 to 35% after the age of 75 (Fitri, 2022).

The condition of balance deterioration is also more commonly found in those aged 60 and above. Based on the level of balance deterioration experienced by the elderly, most are at a moderate level. As the age group increases, the deterioration of body balance will become more severe (Tnp2K & The SMERU Research Institute, 2020). Aging affects the muscle mass of the entire lower extremities, and the femoral muscle mass, which is the main part related to body balance in the elderly. Elderly individuals

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with decreased body balance will experience a quantitative loss of muscle mass, leading to changes in the characteristics of individual muscle fibers, which will affect the loss of muscle strength (Rodrigues et al., 2023). Based on this condition, it then underlies the research team in conducting a study to determine the effect of the Low-Cost Management Balance Exercise Program on Reducing Fall Risk in the Elderly. This research aims to determine the effect of the Low-Cost Management Balance Exercise on reducing fall risk in the elderly.

METHODS

The type of this research is quantitative with a Quasi-Experimental research design aimed at determining the effect of the Low-Cost Management Balance Exercise program on reducing the risk of falls in the elderly. This study uses a Pre-Test Post-Test with Control Group Design, where the researcher employs two groups, namely the experimental group and the control group. The effect of the Low-Cost Management Balance Exercise program intervention was assessed by comparing the Pre-Test and Post-Test scores in the experimental group and the Balance strategy exercise by comparing the Pre-Test and Post-Test scores in the control group. Sampling using purposive sampling The inclusion criteria established for respondent selection are: 1) Elderly individuals aged 60-70 years at the Elderly Posyandu in Surakarta City; 2) Experiencing a risk of falling. Exclusion criteria include: 1) Elderly individuals with a history of musculoskeletal injuries/trauma such as fractures, muscle injuries, or ligament injuries due to sports in the lower extremities, and 3) Elderly individuals who use walking aids. The sampling technique used purposive sampling, in accordance with the inclusion and exclusion criteria. Respondents who met the criteria were then divided into 2 groups (treatment and control), and an initial measurement (pretest) was conducted to determine the level of physical functional activity ability. Respondents in Group 1 were given treatment in the form of a Low-Cost Management Balance Exercise program, consisting of 3 training sessions per week for 6 weeks (Pierle et al., 2022). Respondents in Group 2 were given the treatment of balance strategy exercise three times a week for six weeks. (Mohammadian et al. 2019). At the end of the intervention, a posttest was conducted on both groups to determine the effect of the Low-Cost Management Balance Exercise program and balance strategy exercise on reducing the risk of falls in the elderly. The research instruments used include: 1) Time Up and Go Test (TUGT) to assess the dynamic balance condition of the elderly; 2) Stopwatch to measure the duration of the exercise. 3) chair, 4) dumbbells 2 kg for women and 3.5 kg for men, midline, 5) Standard Operating Procedure (SOP) for the low-cost senior fitness multicomponent exercise program. 4) Standard Operating Procedure (SOP) for TUGT.

RESULTS

The results of the pretest and posttest measurements are then processed and analyzed using specific statistical tests to determine the effect of the intervention. Hypothesis testing used the Mann-Whitney test with a significance level of $p<0.05$. The research was conducted at the Senja Bahagia Elderly Posyandu in Surakarta from March 5 to July 31, 2024. With a total of elderly individuals, 42 met the inclusion and exclusion criteria. Through purposive sampling, the research was conducted on elderly individuals aged 65-70 years who had Balance Disorders as measured by the Berg Balance Scale. There were no dropouts in this study (table 1).

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Table 1. Pre-Test and Post-Test scores in the control group

Variable	Average Before Training	Average After training	Defferent Value	%	p Value
Balance					
B1	38,36±1,35	43,98±1,74	4,62	10,50 %	0,001
B2	38,21±1,29	39,21±2,59	1,00	2,55 %	0,004

DISCUSSION

The low-cost management balance exercise program consists of warm-up, light-intensity dynamic stretching and dual-task activities, activities for cardiorespiratory fitness, resistance exercise, static and dynamic balance training, and cool-down. Through these exercise components, the aim is to maximize the function of postural control. Postural control is a complex task, and many factors contribute to good control. Postural control depends In the peripheral sensory system, the visual and vestibular systems have a significant influence on the body posture control system. The quality of performance of these systems depends on the integration of visual, vestibular, proprioceptive, and tactile inputs, which play a role in modulating muscle tone and strength regulation, and ultimately, maintaining balance (Nieto-Guisado et al., 2022).

The low-cost management balance exercise program can improve body balance through several exercise components. The warm-up, which consists of head movement, neck movement, trunk movement, ankle movement, and back extension, can optimize muscle contraction when entering the core workout. The warm-up mechanism increases the temperature of the working muscle groups, stimulating the accelerated absorption of muscle glycogen during contraction due to the movement commands from the warm-up performed. With rapid glycogen absorption, this facilitates quicker adenosine triphosphate (ATP) turnover, especially through increased phosphocreatine (PCr) usage, resulting in more maximal muscle contraction during the core workout (Mukhopadhyay, 2022). Balance training and dual-task activities can enhance phonemic fluency and semantic memory function. Through walking and balance tasks related to cognitive strategies, it is possible to create challenges that can improve the plasticity of the frontal nerves, which are responsible for working memory performance, mental flexibility, attention deviation, visual processing speed, and exploration. Regular physical exercise can increase blood flow to the brain, help in the formation of new brain cells, and prevent the disconnection of brain cell connections. Physical activity can facilitate neurotransmitter metabolism, produce nutritional factors that stimulate the neurogenesis process, enhance molecular activity stimulation, and maintain brain plasticity. When brain function is maximized, the functions related to movement planning and coordination will also be maximized, as the brain will design movements while processing the precise movements of the joints, following the movements, and then comparing the plan with the performance to move the limbs. The command for conscious movement originates from the associative areas of the cortex. The thalamus modulates the received information and transmits it to the basal ganglia, cerebellar pathways, and then to the premotor and motor cortex. The result of sensory input through the senses as well as from tendons, joints, skin, and muscles is in the form of movement changes, thereby forming the body's ability to maintain body projection on the ground while in motion, such as walking, and transferring or moving from one position to another, which is dynamic balance. (Yanti et al. 2023).

Light-intensity dynamic stretching that is performed will affect the sensory organs of the muscle-tendon unit, namely the muscle spindle and the Golgi tendon organ, which act as mechanoreceptors that convey information to the central nervous system and respond to the muscle when it is stretched. The muscle spindle is one of the sensory organs that is sensitive to stretching

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and functions to receive and convey changes in muscle length and the rate of change in elongation. (Nascimento et al., 2023).

Intrafusal muscle fibers are part of the muscle spindle that connect to extrafusal muscle fibers at the intrafusal ends. When the muscle is stretched, the intrafusal part of the muscle fibers is stimulated at the ends, while the middle part is not stimulated. In the middle part, if stimulated, it will cause a longitudinal contraction effect on the muscle. Intrafusal muscle fibers are innervated by gamma motor neurons. There are two types of muscle fibers, namely type Ia fibers (primary stretch receptors) that are sensitive to rapid movements and stimulate the stretching of tonic muscle fibers, and type II fibers (secondary stretch receptors) that only stimulate tonic muscle fibers. The Golgi tendon organ is a sensory organ that functions to monitor changes in tension within the muscle-tendon unit. The Golgi tendon organ is composed of collagen and provides sensory information through Ib nerve fibers. This Golgi tendon organ is sensitive to changes in tension within the muscle-tendon unit during both passive stretching and active contraction during normal movement. The coordination of changes in the elongation of muscle fibers will trigger an increase in muscle length, followed by an enhanced range of motion as the muscle fibers elongate, aligning the collagen fibers during the elongation of the muscle fibers, thereby forming maximal muscle stretching. The hamstring muscles have a basic functional movement for knee flexion, serve as muscle accessories for hip extension, and facilitate external and internal movements of hip rotation. The hamstrings are also tonic muscles, functioning as postural stabilizer muscles. The more stable the flexibility of the postural stabilizer muscles, the better the postural balance will be (Behm et al., 2021).

Activities for cardiorespiratory fitness exercise create a high level of efficiency in the circulatory and respiratory systems in delivering oxygen to the working muscles. The more oxygen we can inhale and utilize, the longer our ability to exercise before fatigue sets in. Through exercise, the increase in heart rate frequency through regular training will lead to the enlargement of heart muscles, resulting in an increase in heart size. The volume of blood pumped per heartbeat increases, allowing more blood to be circulated throughout the body. The respiratory system does not change the size of the lungs but improves respiratory efficiency by enhancing the condition of the respiratory muscles, reducing residual air volume, and decreasing the respiratory rate to move the same volume of air. Additionally, it increases the number and size of alveoli, thereby accelerating the supply of oxygen to body cells. This results in an increase in the maximum oxygen uptake (VO2Max) required by muscles during contraction to maintain postural balance (Amanati et al., 2024).

Resistance exercise Strength training will increase the activity of motor unit recruitment, which will enhance muscle strength and thereby improve balance. This exercise also activates the Golgi tendon organ and muscle spindle, leading to improved coordination of extrafusal and intrafusal fibers with the afferent nerves in the muscle spindle, thereby forming good proprioception. Good proprioceptive conditions will provide information about the body's position relative to the surrounding environment (external) and the position between body segments (internal), which is received by the cerebellum and will be used by the body to maintain balance (Gunawan et al., 2022).

Cool down can last for 3–10 minutes and includes stretching or gentle movement variations that you performed during the workout. The purpose of cooling down after exercise is to allow the heart rate and breathing to return to normal and to enhance relaxation. Better psychophysiological recovery after exercise can reduce or prevent performance decline or even enhance performance during the next training session (Kang et al., 2022).

According to a study by Lopez in 2023 titled "Functional mobility and physical fitness are improved through a multicomponent training program in institutionalized older adults," with a dosage of 12 weeks, totaling 32 sessions at a frequency of 2 sessions per week. Each session

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lasts about 45 minutes, and there is at least 48 hours between sessions. The multicomponent exercise training program, based on lower limb resistance exercises and an aerobic exercise protocol, has been demonstrated to be safe and effective for the management of several relevant health indicators such as gait speed, functional mobility, functional capacity, and balance in institutionalized older adults (López-López et al., 2024).

CONCLUSION

This research provides an overview that the implementation of the low-cost management balance exercise program can be proven to have a greater effect on improving balance compared to performing the balance strategy exercise in the Control Group. Thus, the purpose of having a Control Group in this study can be conveyed that to improve balance in the elderly, it is better to provide the low-cost management balance exercise program so that the results obtained are more optimal.

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REFERENCES

Amanati, S., Jaleha, B., & Triyanita, M. (2024). Effect Aerobic Exercise On Cardiorespiratory Fitness In Athlete. *Jurnal Keperawatan Dan Fisioterapi (Jkf)*, *6*(2), 240–246.

Behm, D. G., Kay, A. D., Trajano, G. S., Alizadeh, S., & Blazevich, A. J. (2021). Effects of stretching on injury risk reduction and balance. *Journal of Clinical Exercise Physiology*, *10*(3), 106–116.

Fitri, N. M. (2022). Pengaruh Latihan Keseimbangan Terhadap Penurunan Resiko Jatuh Pada Lansia Di Desa Bebesen Kecamatan Bebesen Kabupaten Aceh Tengah. *Darussalam Indonesian Journal of Nursing and Midwifery*, *4*(2), 58–65.

Gunawan, D. O., Indriastuti, L., & Isma, R. (2022). Efek Penambahan Latihan Penguatan dengan Resistance Band terhadap Keseimbangan Fungsional Lansia yang Mendapat Latihan Keseimbangan: The Additional Effect of Strengthening Exercise with Resistance Band on Functional Balance in Elderly. *Medica Hospitalia: Journal of Clinical Medicine*, *9*(3), 273–279.

Ivanali[1], K., Amir, T. L., Munawwarah[1], M., & Pertiwi, A. D. (2021). *Hubungan antara aktivitas fisik pada lanjut usia dengan tingkat keseimbangan*.

Kang, H., Zsoldos, R. R., Skinner, J. E., Gaughan, J. B., Mellor, V. A., & Sole-Guitart, A. (2022). The use of percutaneous thermal sensing microchips to measure body temperature in horses during and after exercise using three different cool-down methods. *Animals*, *12*(10), 1267.

Kreativitas, J., Kepada, P., Pkm, M., Bagi, K., & Usia, L. (2023). *Tahu Tahu*. 4995–5004.

López-López, S., Abuín-Porras, V., Berlanga, L. A., Martos-Duarte, M., Perea-Unceta, L., Romero-Morales, C., & Pareja-Galeano, H. (2024). Functional mobility and physical fitness are improved through a multicomponent training program in institutionalized older adults. *GeroScience*, *46*(1), 1201–1209.

Mukhopadhyay, K. (2022). Modern scientific innovations in warming up and cool-down in sports. *J Adv Sport Phys Edu*, *5*(7), 166–175.

Nascimento, M. de M., Maduro, P. A., Rios, P. M. B., Nascimento, L. dos S., Silva, C. N., Kliegel, M., & Ihle, A. (2023). The Effects of 12-Week Dual-Task Physical–Cognitive Training on Gait, Balance, Lower Extremity Muscle Strength, and Cognition in Older Adult Women: A Randomized Study. *International Journal of Environmental Research and Public Health*, *20*(8), 5498.

Nieto-Guisado, A., Solana-Tramunt, M., Marco-Ahulló, A., Sevilla-Sánchez, M., Cabrejas, C., Campos-Rius, J., & Morales, J. (2022). The mediating role of vision in the

ISSN 2722 – 9610
E –ISSN 2722 - 9629

relationship between proprioception and postural control in older adults, as compared to teenagers and younger and middle-aged adults. *Healthcare*, *10*(1), 103.

Pierle, C., McDaniel, A. T., Schroeder, L. H., Heijnen, M. J. H., & Tseh, W. (2022). Efficacy of a 6-Week Suspension Training Exercise Program on Fitness Components in Older Adults. *International Journal of Exercise Science*, *15*(3), 1168.

Rodrigues, F., Jacinto, M., Figueiredo, N., Monteiro, A. M., & Forte, P. (2023). Effects of a 24-Week Low-Cost Multicomponent Exercise Program on Health-Related Functional Fitness in the Community-Dwelling Aged and Older Adults. *Medicina (Lithuania)*, *59*(2). https://doi.org/10.3390/medicina59020371

Tnp2K, & The SMERU Research Institute. (2020). Situasi lansia di indonesia dan akses terhadap rogram perlindungan sosial: analisis data sekunder. In *Tim Nasional Percepatan Penanggulangan Kemiskinan*. http://tnp2k.go.id/download/87694Laporan Studi Lansia - Analisis Data Sekunder.pdf

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