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Comparison of the Effectiveness of Elderly Gymnastics with Neuromuscular Tapping on Dynamic Balance and Spinal Flexibility in the Elderly

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ABSTRACT

The elderly experience changes in physiological function and body structure, including decreased muscle mass, and joint stiffness. These changes lead to a decrease in the functional balance of the body. This study aims to analyze the difference in the effect of elderly gymnastics and the combination of elderly gymnastics with neuromuscular taping on dynamic balance and flexibility of the elderly. The design of this study was a quasi-experiment with two groups: group 1 elderly gymnastics, while group 2 elderly gymnastics and neuromuscular taping. The study population was the elderly in Karanglo Indah Elderly Gymnastics Group Malang City aged 60-74 years. Data was measured using Timed Up and Go Test for balance and modified schober test for flexibility. Data were analyzed by nonparametric test. The results showed that the combination of elderly gymnastics and neuromuscular taping provided an improvement in dynamic balance and better spinal flexibility compared to only elderly gymnastics.

Keywords: dynamic balance, elderly gymnastics, neuromuscular taping, spinal flexibility

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BACKGROUND

As life expectancy increases, the rate of degenerative diseases will also increase. The increase in the elderly population, combined with declining mortality and birth rates, is changing the demographic composition. Like other countries in the Asia Pacific region, Indonesia will also face rapid population aging. In 2012, Indonesia ranked third in Asia for the largest number of people over 60, after China (200 million) and India (100 million), with Indonesia (25 million). It is estimated that the number of elderly people in Indonesia will reach 100 million by 2050. A developing country is considered to have an older population structure if the population aged 60 years and above reaches 7% of the total population. In 2010, the proportion of the elderly population in Indonesia reached around 10% (Ekasari et al., 2019).

According to Sibuea & Aloysius (2022) "almost all countries in the world are experiencing population aging characterized by an increasing number of elderly people". The number of elderly people increased about fourfold over the previous fifty years, according to BPS (2020), reaching 9.92 percent of the overall population in that year. This is a result of Indonesia's demographic transition process, which is already at a point where low birth and death rates are increasing life expectancy (Bappenas, 2019) there will be an increase in senior individuals from 2016 to 2020.

The increasing elderly population is causing an epidemiological transition, or change in disease patterns from infectious diseases and dietary disorders to generative diseases such as diabetes, chronic renal failure, and chronic lung disease. Given that the problems faced by older age groups differ significantly from those faced by younger age groups, this growth certainly deserves more attention from all sectors. As the health problems of the elderly are complex and require specialized care, this is becoming increasingly evident in the field of health care. Interventions based on layered strategies that can be implemented can improve elderly well-being, quality of life, improve functional ability, and reduce inactivity (Sunarti et al., 2019).

As we age, logical function decreases due to degenerative processes, so that non-communicable diseases appear in healthy people. The elderly morbidity rate is the proportion of the elderly population who experience health problems that interfere with daily activities during the past month (Sunarti et al., 2019).

The elderly will experience changes in physiological function and body structure. Physical changes that occur include the musculoskeletal system which includes decreased muscle mass, joint stiffness, decreased joint range of motion (ROM), decreased bone mass and density. There is also a decrease in sensory function which includes visual function or vision, vestibular function located in the ear, and somatosensory function which includes touch, taste, perception, and pain. There is also a decrease in cognitive and psychological functions which results in decreased sensory-motor integration functions and excessive anxiety that causes fear of falling. Changes in body functions in the elderly that tend to decline will cause a decrease in the functional balance of the body.

Balance function that decreases with age causes functional activities to be disrupted so that the elderly cannot do their usual activities. This will affect the quality of life of the elderly. Balance can be assessed and measured using various assessment instruments, one of which is the Timed Up and Go Test. In addition to decreased balance, the elderly also experiences decreased flexibility, so flexibility is also necessary to help reduce muscle tension and pain often experienced by the elderly. This can help improve daily comfort and reduce the risk of developing health problems related to muscles and joints.

Age-related neuro-musculoskeletal deterioration is usually accompanied by poor health and mobility problems, which impair physical function and increase the risk of falls

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(Li et al., 2022). According to the WHO (2022), falls are the second largest cause of fatal accidents globally and are responsible for the majority of accidents involving people aged over 60 years.

Various types of exercises can be given to improve balance or reduce the risk of falls in the elderly such as elderly gymnasticss (Aprilia et al., 2022), ergonomic exercises (Wulandari, 2020).

METHODS

The study is a quasi-experimental study with a pre test post test two group design. There are 2 sample groups that will be studied to see which treatment or intervention is better or more effective. Group 1 is given elderly gymnastics, while group 2 is given a combination of elderly gymnastics and neuro muscular taping. This study analyzes the difference in the effect of elderly gymnastics with a combination of elderly gymnastics and neuromuscular tapping on dynamic balance and spinal flexibility in the elderly. Balance measured by Timed up and Go Test, spinal flexibility measured by modified schober test.

Treatment group 1 was given elderly gymnastics 2 times a week for 6 weeks. Treatment group 2 was given elderly gymnastics 2 times a week for 6 weeks accompanied by neuromuscular taping in the form of adhesive tape or special plaster that is elastic to the skin. The plaster is attached to the back area. The size of the plaster used is a plaster with a length of 20 to 30 cm and a width of 5 cm.

This research was conducted in January-February 2024 at the Karanglo Indah Elderly Gymnastics group in Malang City. The population in this study consisted of elderly people who were members of the Karanglo Indah Elderly Gymnastics Group in Malang City. Samples were taken from population, with an age range of 60-89 years, who were not injured, and were randomly selected. In this study, random sampling technique was used as a sampling method, which is included in probability sampling with an error rate of 5%. The sample size was determined following the Krejcie-Morgan table, with a minimum of 40 elderly as the sample.

RESULTS

Characteristics of Respondents

Table 1. Frequency Distribution by Gender at the Karanglo Indah Elderly Gymnastics Group, Malang City

Gender	Frequency (n)	Percentage (%)
Elderly gymnastics group		
a. Male	1	3.3
b. Female	29	96.7
Total	30	100.0
Elderly gymnastics + NMT group		
a. Male	5	16.7
b. Female	25	83.3
Total	30	100.0

The table above shows that gender for both groups is more female than male. For the treatment group with gymnastics, men were 3.3% and women were 96.7%. For the treatment group with gymnastics and neuromuscular taping, men were 16.7% and women were 83.3%.

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Table 2. Frequency Distribution by Gender at the Karanglo Indah Elderly Gymnastics Group, Malang City

Age	Frequency (n)	Percentage (%)
Elderly gymnastics group		
a. 60-74 years	26	86.7
b. 75-90 years	4	13.3
Total	30	100.0
Elderly gymnastics + NMT group		
a. 60-74 years	26	86.7
b. 75-90 years	4	13.3
Total	30	100,0

The table above shows that the age group for both groups is more aged 60-74 years with a percentage of 86.7 than aged 75-90 years with a percentage of 13.3 in both treatment groups.

Special Data

Table 3. Dynamic Balance Criteria of the Treatment Group with Gymnastics

Dynamic Balance Criteria	Pre test		Post test	
	Frequency (n)	Percentage (%)	Frequency (n)	Percentage (%)
Elderly gymnastics group	28	93.3	30	100.0
a. Low fall risk	2	6.7	0	0.0
b. High fall risk				
Total	30	100.0	30	100.0

The table above shows that for the treatment group with gymnastics, most of the pre-test dynamic balance criteria (93.3%) are in the low fall risk category, while the post-test dynamic balance criteria are all in the low fall risk category.

Table 4. Dynamic Balance Criteria of the Treatment Group with Gymnastics + NMT

Dynamic Balance Criteria	Pre test		Post test	
	Frequency (n)	Percentage (%)	Frequency (n)	Percentage (%)
Elderly gymnastics+NMT group	27	90.0	29	96.7
a. Low fall risk	3	10.0	1	3.3
b. High fall risk				
Total	30	100.0	30	100.0

The table above shows that for the treatment group with gymnastics and neuromuscular taping, the pre-test dynamic balance criteria were mostly (90.0%) in the low fall risk category, while the post-test dynamic balance criteria were mostly (96.7%) in the low fall risk category.

Table 5. Spine Flexibility Criteria of the Treatment Group with Gymnastics

Spine Flexibility Criteria	Pre test		Post test	
	Frequency (n)	Percentage (%)	Frequency (n)	Percentage (%)

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Elderly group	gymnastics	15	50.0	17	56.7
a.	Good flexibility	15	50.0	13	43.3
b.	Less flexibility				
Total		30	100.0	30	100.0

The table above shows that the pre-test spinal flexibility criteria are 50% in the good flexibility category and 50% in the less flexibility category, while the post-test spinal flexibility criteria are 56.7% in the good flexibility category and 43.3% in the less flexibility category.

Table 6. Spine Flexibility Criteria of the Treatment Group with Gymnastics + NMT

Spine Flexibility Criteria		Pre test		Post test	
		Frequency (n)	Percentage (%)	Frequency (n)	Percentage (%)
Elderly group	gymnastics+NMT	15	50.0	28	93.3
a.	Good flexibility	15	50.0	2	6.7
b.	Less flexibility				
Total		30	100.0	30	100.0

The table above shows that the pre-test spinal flexibility criteria are 50% in the good flexibility category and 50% in the less flexibility category, while the post-test spinal flexibility criteria are 93.3% in the good flexibility category and 6.7% in the less flexibility category.

Table 7. Dynamic Balance Score in The Elderly Gymnastics Group

Balance Score	Frequency (n)	Mean	SD	p-value
Pre test	15	12.52	13.885	0.000*
Post test	15	9.51	1.706	

Description: *wilcoxon

Based on the table above, it can be explained that the provision of elderly gymnastics obtained a pretest value of dynamic balance of 15.52 and a post test of 9.51 (faster is better). This shows a significant improvement in dynamic balance. The Wilcoxon test results obtained a p value = 0.000 <0.05. This means that the provision of elderly gymnastics has a significant effect on dynamic balance.

Table 8. Dynamic Balance Score in The Elderly Gymnastics + NMT Group

Balance Score	Frequency (n)	Mean	SD	p-value
Pre test	15	13.44	14.784	0.000*
Post test	15	8.93	1.866	

Description: *wilcoxon

Based on the table above, it can be explained that the provision of elderly gymnastics and neuromuscular taping obtained a pretest value of dynamic balance of 13.44 and a post test of 8.93 (faster is better). This shows a significant improvement in dynamic balance. Wilcoxon test results obtained p value = 0.000 <0.05. This means that the provision of elderly gymnastics and neuromuscular taping has a significant effect on dynamic balance.

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Table 9. Spine Flexibility Score in The Elderly Gymnastics Group

Spine Flexibilitty Score	Frequency (n)	Mean	SD	p-value
Pre test	15	21.08	1.666	0.000*
Post test	15	21.50	1.634	

Description: *wilcoxon

Based on the table above, it can be explained that the provision of elderly gymnastics obtained a pretest flexibility value of 21.08 and a post test of 21.50 (greater is better). This shows a significant improvement in flexibility. The Wilcoxon test results obtained a p value = 0.000 <0.05. This means that the provision of elderly gymnastics has a significant effect on flexibility.

Table 10. Spine Flexibility Score in The Elderly Gymnastics + NMT Group

Spine Flexibilitty Score	Frequency (n)	Mean	SD	p-value
Pre test	15	20.21	3.813	0.000*
Post test	15	22.61	1.179	

Description: *wilcoxon

Based on the table above, it can be explained that the provision of elderly gymnastics and neuromuscular taping obtained a pretest flexibility value of 20.21 and a post test of 22.61 (greater is better). This shows a significant improvement in flexibility. The Wilcoxon test results obtained a p value = 0.000 <0.05. This means that the provision of elderly gymnastics has a significant effect on flexibility.

Table 11. Difference in Dynamic Balance Scores Between the Two Treatment Groups

Dynamic Balance Score Change	Frequency (n)	Mean	SD	p-value
Elderly gymnastics group	15	0.44	0.511	0,000*
Elderly gymnastics+NMT group	15	1.80	1.076	

Description: *Man whitney

Based on the table above, it can be explained that the elderly gymnastics treatment group showed a pretest and post test difference value of dynamic balance of 0.44, while the elderly gymnastics and neuromuscular taping treatment group showed a pretest and post test difference value of dynamic balance of 1.80. This shows the difference in the difference in the elderly gymnastics treatment group and neuromuscular taping, and provides better results than the elderly gymnastics treatment group.

The results of the Man Whitney test obtained a value of p = 0.000 <0.05. This means that there is a difference in the effect of elderly gymnastics with a combination of elderly gymnastics and neuromuscular tapping on dynamic balance in the elderly in Malang City.

Table 12. Difference in Spine Flexibility Score Between the Two Treatment Groups

Spine Flexibility Score Change	Frequency (n)	Mean	SD	p-value
Elderly gymnastics group	15	0.38	0.611	0,000*
Elderly gymnastics+NMT group	15	1.81	0.969	

Description: *Man whitney

Based on the table above, it can be explained that the elderly gymnastics treatment group showed a pretest and post test difference value of spinal flexibility of 0.38, while the elderly gymnastics and neuromuscular taping treatment group showed a pretest and post test difference value of spinal flexibility of 1.81. This shows a greater difference in the difference

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in the elderly gymnastics treatment group and neuromuscular taping, and provides better results than the elderly gymnastics treatment group.

Man Whitney test results obtained p value = 0.000 <0.05. This means that there is a difference in the effect of elderly gymnastics with a combination of elderly gymnastics and neuromuscular tapping on spinal flexibility in the elderly in Malang City.

DISCUSSION

Differences in the effect of elderly gymnastics with elderly gymnastics and neuromuscular tapping on dynamic balance in the elderly

Elderly gymnastics is a type of physical exercise specifically designed for the elderly to improve balance, muscle strength and flexibility. This exercise can help the elderly to remain active and independent in carrying out daily activities. Some of the reasons why elderly gymnasticss can improve balance in the elderly include: increasing muscle strength, improving coordination, and increasing flexibility. By doing these exercises regularly, the elderly can improve their ability to maintain body balance.

Balance is a state where the body maintains itself properly while standing. This is in line with what Bafirman & Wahyuri (2019) stated that balance is the ability to maintain the right attitude and position of the body when standing (static balance). Balance is the body's ability to maintain the body's center of mass against the body's axis to resist the earth's gravity which is influenced by sensory processes or the nervous, motor or musculoskeletal systems (Yasmasitha & Sidarta, 2020). Balance is also influenced by muscle strength, and muscle endurance. These factors can be improved by elderly gymnasticss or elderly gymnasticss that aim to increase muscle strength, and muscle endurance in the elderly.

This research is in line with research conducted by Andria et al (2020) which states that there is an increase in balance in the elderly after being given elderly gymnastics twice a week for four consecutive weeks. Literature review research conducted by Efendi et al (2023) which analyzed 8 scientific articles concluded that elderly gymnastics has a significant effect on improving body balance in the elderly. Elderly gymnastics is recommended as a routine activity that can be carried out independently to improve body balance in the elderly.

This research is in line with research conducted by Suharto & Syakib (2021) which provides tapping on the trunk extensor muscles with a dose installed for 3 days and 2 x a week, which is combined with bobath exercises will improve the balance of cerebral palsy patients. Research conducted by stated that neuromuscular taping on the tibialis anterior, tibialis posterior, and peroneus longus muscles and the transverse arch of the foot is effective in improving balance in patients with diabetic polyneuropathy aged 40-60 years.

The results of the Man Whitney test obtained a p value = 0.000 <0.05. This means that there are differences in the effect of elderly gymnastics with a combination of elderly gymnastics and neuromuscular tapping on dynamic balance in the elderly, where the combination of elderly gymnastics and neuromuscular tapping provides better results than elderly gymnastics.

The addition of neuromuscular tapping is a technique that involves light pressure on certain muscles to stimulate a neuromuscular response. When this technique is applied to the elderly's back, it can improve their balance in several ways, including: neuromuscular tapping can help improve sensory awareness in the elderly. By stimulating the muscles in the back, this technique can help improve their sensory perception of body position and movement, which can help them feel more stable and balanced, neuromuscular tapping can increase muscle activity and neuromuscular response.

By stimulating the muscles in the back, this technique can help improve muscle strength and response, which can help the elderly to better maintain their body balance, neuromuscular tapping can also help relieve muscle tension and stiffness in the back. By

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reducing muscle tension and stiffness, this technique can help improve flexibility and range of motion, which can also contribute to improving balance in the elderly. Thus, neuromuscular tapping applied to the back can improve balance in the elderly through increasing sensory awareness, muscle activity, neuromuscular responses, and relieving muscle tension and stiffness.

Differences in the effect of elderly gymnastics with elderly gymnastics and neuromuscular tapping on spinal flexibility in the elderly

Elderly gymnastics can improve spinal flexibility in the elderly because regular and purposeful physical exercise can provide a number of benefits to the body, including the spine. Elderly gymnasticss often involve muscle stretching exercises, including the muscles around the spine. This stretching helps reduce muscle stiffness and increase flexibility, which in turn can help improve spinal flexibility.

This research is in line with research conducted by Bintang et al (2020) which states that elderly gymnastics can improve balance in the elderly. This is because flexibility is strongly influenced by whether or not an active lifestyle. When physical activity is still carried out, muscles and connective tissue remain elastic. But on the contrary, if activity decreases, then muscles and connective tissue will lose their elasticity. The effect caused by inactivity also has an impact on the clotting of body fat, which in turn limits kinking. Moderate exercise such as senior exercises greatly affects the comfort level through the efficient movements of senior exercises.

The results of the Man Whitney test obtained a p value = 0.000 <0.05. This means that there are differences in the effect of elderly gymnastics with a combination of elderly gymnastics and neuromuscular tapping on spinal flexibility in the elderly, where the combination of elderly gymnastics and neuromuscular tapping provides better results than elderly gymnastics.

The addition of neuromuscular tapping applied to the elderly's back can increase the flexibility of their spine by stimulating the muscles around the spine, thus helping to reduce muscle tension and stiffness around the spine and increase blood flow to the area. With increased blood flow, nutrients and oxygen will be more easily delivered to the spine, which can help improve spinal flexibility and health.

CONCLUSION

The combination of elderly gymnastics and neuromuscular tapping provides better dynamic balance and spinal flexibility compared to elderly gymnastics alone. Both elderly gymnasticss or a combination of elderly gymnasticss on dynamic balance and spinal flexibility in the elderly and neuromuscular tapping.

REFERENCES

Andria, R. D., Riyadi, A., & Pardosi, S. (2020). Peningkatan Keseimbangan Tubuh Lansia Melalui Senam di Sebuah Balai Pelayanan dan Penyantunan Lansia. Jurnal Keperawatan Raflesia, 2(2), 61–70.

Aprilia, E., Novitasari, D., & Sukmaningtyas, W. (2022). Pengaruh Senam Lansia terhadap Keseimbangan Tubuh pada Lansia. Seminar Nasional Penelitian Dan Pengabdian Kepada Masyarakat, 9–13.

Bafirman, B., & Wahyuri, A. S. (2019). Pembentukan kondisi fisik.

Bappenas. (2019). Transisi Demografi dan Epidemiologi: Permintaan Pelayanan Kesehatan di Indonesia. Direktorat Kesehatan Dan Gizi Masyarakat, Jakarta.

Bintang, S. S. B. S., Tinambunan, N. W., Berampu, S., Zannah, M., & Jehaman, I. (2020). Pengaruh Pemberian Senam Lansia Terhadap Peningkatan Kebugaran Dan

DOI: https://doi.org/10.30994/sjik.v13i2.1131
ISSN: 2252-3847 (print); 2614-350X (online) Vol.13 No.2 November 2024 Page. 170-178

Fleksibilitas Serta Kecepatan Pada Lansia Di Desa Sionom Hudon Selatan Tahun 2020. Jurnal Keperawatan Dan Fisioterapi (JKF), 3(1), 21–26.

Efendi, E., Handayani, E., Juariah, E., & Lismayanti, L. (2023). Pengaruh Senam Lansia Terhadap Keseimbangan Tubuh Pada Lansia: Literatur Review. Journal of Nursing Practice and Science, 2(1), 155–162.

Ekasari, M. F., Riasmini, N. M., & Hartini, T. (2019). Meningkatkan kualitas hidup lansia konsep dan berbagai intervensi. Wineka Media.

Li, H., Qiu, X., Yang, Z., Zhang, Z., Wang, G., Kim, Y., & Kim, S. (2022). Effects of Cha-Cha Dance Training on the Balance Ability of the Healthy Elderly. International Journal of Environmental Research and Public Health, 19(20), 13535.

Sibuea, K., & Aloysius, S. (2022). Variabel-Variabel yang Memengaruhi Lansia Bekerja Penuh Waktu di Indonesia Tahun 2020. Seminar Nasional Official Statistics, 2022(1), 957–966.

Suharto, S., & Syakib, A. (2021). Intervensi Kinesio Taping Dan Bobath Exercises Terhadap Peningkatan Keseimbangan Berdiri Dan Penurunan Spastisitas Tungkai Pasien Cerebral Palsy Di Sekolah Luar Biasa Dan Yayasan Pendidikan Anak Cacat Makassar. Buletin Penelitian Sistem Kesehatan, 24(4), 245–251.

Sunarti, S., Ratnawati, R., Nugrahenny, D., Mattalitti, G. N. M., Ramadhan, R., Budianto, R., Pratiwi, I. C., & Prakosa, A. G. (2019). Prinsip dasar kesehatan lanjut usia (Geriatri). Universitas Brawijaya Press.

WHO. (2022). World Health Organization Falls (Vol. 19, Issue 20). MDPI.

Wulandari, N. M. (2020). Kontribusi Senam Ergonomis Terhadap Risiko Jatuh Pada Lansia. Sekolah Tinggi Ilmu Kesehatan Wira Medika Bali.

Yasmasitha, Z., & Sidarta, N. (2020). Hubungan pes planus dan keseimbangan statis pada anak sekolah dasar. Jurnal Biomedika Dan Kesehatan, 3(2), 84–89.