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Differences in the Effectiveness of *Dynamic Stretching Exercise* and *Static Stretching Exercise* on Lumbar Flexibility for Elderly

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ABSTRACT

Introduction: Muscle flexibility begins to decline around 20% - 30% at the age of 30-70 years old. Decreased flexibility of the lumbar muscles will result in various problems. The condition will continue to worsen if stretching is not done. The study is to investigate the difference in effectiveness difference of dynamic stretching exercise and static stretching exercise on lumbal flexibilities in the elderly. **Methods:** The study was experimental with pre and post-test two-group design. The data were taken by using a random sampling technique. The samples were 32 people aged 60 – 79 years old. **Results:** The result of data analysis using a Paired Sample t-test in groups I and II showed p=0.000 (p<0.05) meaning that there was no significant difference in improving lumbal flexibilities in the elderly. **Conclusion:** Static and dynamic stretching both enhance flexibility, but static stretching is more effective for flexibility improvement, while dynamic stretching better enhances muscle power and performance quality.

***Keywords**: Dynamic Stretching Exercise, Static Stretching Exercise, Lumbal Flexibilities*

INTRODUCTION

The global phenomenon of the *Aging Population* is currently increasing, in 2020 around 10% of Indonesia's population will be elderly. The demographic transition in Indonesia has caused an increase in the number of elderly from shifting death rates and low birth rates (Bappenas, 2019). According to Susenas data for March 2022, 10.48% of Indonesia's population is elderly, and eight provinces include the *Aging Population*, namely West Sumatra, Lampung, Central Java, DI Yogyakarta, East Java, Bali, North Sulawesi, and South Sulawesi. Yogyakarta is a province with an elderly proportion of 16.69% (BPS Statistical Analysis, 2022).

According to WHO (2013), elderly people can be classified based on their age, namely: 1) Middle age (*Middle age)*, age group 45-54 years. 2) Elderly (*Elderly*), age group 55-65 years. 3) Young elderly (*Young Old*), age group 66-74 years. 4) Older people (*Old*), age group 75-90 years.

Based on 2018 Basic Health Research (Riskesdas) data, 20% of individuals aged 65 years and over are classified as having insufficient physical activity. A decrease in physical activity will cause a reduction in *Range of Motion* (ROM) and muscle strength resulting in a decrease in flexibility (Ministry of Health of the Republic of Indonesia, 2018). Muscle flexibility begins to decrease by 20% - 30% at the age of 30-70 years, a decrease in flexibility in the extensor trunk will cause a shift in the *Center of Mass* (COM) (Putri et al., 2020).

From the results of research on elderly women in the PSTW Nursing Home and the West Jakarta Nursing Home Foundation, it was found that prevalence data of 145 (60-80 years) of 53.3-46.7% experienced a decrease in lumbar flexibility below average (Inswiarsi., Laksono et al., 2013).

The prevalence of elderly people in Indonesia who experience decreased flexibility in their parts trunk has a fairly high percentage based on ages 55-64 years at 45%, ages 65-74 years at 51.9%, and ages 75 years and over with a percentage of 54.8%, the prevalence based on gender is higher in elderly women (13.4%) than elderly men (10.3%) (Utami, 2013).

Decreased flexibility will cause the muscles used in daily activities to experience fatigue which will cause stiffness or spasms in the

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muscles if they are not stretched. Excessive muscle spasms will cause muscle contraction and relaxation to become unstable and limited and decrease flexibility. A person who lacks physical activity can cause tension in some muscles that are rarely stretched so that there is little myosin in actin, this makes the muscles more difficult to move or stretch beyond normal movements. The more often the body moves, the body will get used to working according to its function, and can increase flexibility (Ratna Ningrum, 2018).

The demographic conditions where the research is conducted are very influential. The low level of knowledge of the community in the area regarding the importance of physical activity or exercise can affect lumbar flexibility, such as a lack of knowledge among the elderly or families in the area as well as a lack of desire to seek treatment at health facilities such as hospitals or community health centres in the area. Most of these elderly people no longer work, only stay at home, and in this area, posyandu activities for the elderly are still not carried out routinely.

Most of the population works as vegetable farmers, but most of the elderly over 60 years old only stay at home, so there is minimal activity and physical activity that can be done. Apart from that, many elderly people in the area complain of stiffness, back pain and difficulty performing prayer movements such as bowing. The results of measurements of the level of lumbar flexibility carried out by researchers in the community in this area are classified as very poor, not only among the elderly but also among the pre-elderly it is still classified as lacking.

The lumbar joint is susceptible to structural changes that can reduce tissue elasticity and, if left for a long time, can reduce flexibility. This results in elderly people complaining of being unable to move their backs, having difficulty bending over, and having lower back pain when doing activities. The elderly's limitations in activities can affect their quality of life. In addition, it can increase the risk of back injury (Miftahul, 2020).

Reduced collagen, nutritional deficiencies, reduced activity, and the effects of arthritis or a combination of other diseases can also cause changes in flexibility in the elderly. Collagen changes in the annulus and nucleus pulposus decreased, especially in elderly people which causes the disc volume to decrease so that it becomes inflexible (Arfadilah, 2022).

Static Stretching Exercise is an effort to relax physically and mentally so that you don't become tense or stressed and exercises to maintain and develop flexibility or suppleness (Ningsih, 2018).

Dynamic stretching is a stretching technique that involves a movement that uses beats resulting from a controlled movement to move certain body parts to the limit of the range of motion of a joint (Nitaya Putri Nur Hidayati, 2019).

METHODS

This research is *Experimental* with a *Pre* and *test group Design* which aims to determine whether there is an influence on the effectiveness of *Dynamic Stretching Exercise* and *Static Stretching Exercise* on lumbar flexibility in the elderly.

Ethical Clearance in this research No. 2917/KEP-UNISA was issued on 31 May 2023. This research was conducted from 1 June 2023 to 6 July 2023.

Inclusion criteria are as follows: 1) Elderly people who are willing to be research samples. 2) Elderly aged 60 – 79 years. 3) Can fulfill *Dynamic Stretching Exercise* and *Static Stretching Exercise* instructions. 4) Able to carry out activities independently. 5) Have a BMI of 17.0 – 25.0. 6)Has decreased lumbar flexibility with a score of 7-9 (very little) for male samples, and for women 11-14 (very little)

Exclusion criteria: 1) Elderly people who have spinal disorders, osteoarthritis, osteoporosis. 2) History of fracture injury during the last 6 months. 3) Have complaints of pain with VAS >5. 4) Taking pain relievers or anti-inflammatory drugs. 5) Elderly people who use assistive devices

In this study, 2 treatment groups were used, treatment 1 was given a *Dynamic Stretching Exercise* and Group 2 was given a *Static Stretching Exercise*. The sampling method used a *Random Sampling* technique with a sample of 32 people aged 60-79 years who were active in the elderly posyandu in Dukuh Hamlet, Donokerto, Turi, Sleman Yogyakarta. In this study, the *Sit and Reach Box Scale* measuring instrument was

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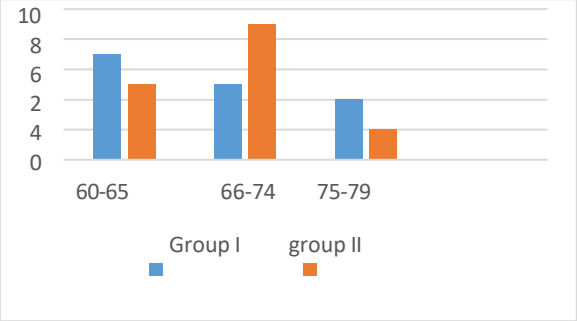
used. Measurements were carried out in the first week before treatment and after treatment in the fourth week. The research was conducted for 4 weeks with 3 meetings in 1 week.

The method for collecting samples before further research was carried out was that the researcher attended the elderly posyandu held by cadres, on this occasion the researcher asked for approval and explained the mechanisms related to the research that would be carried out in the following week.

The data processing method carried out by researchers was using SPSS 25.0, and then analyzing the data. In this study, the normality test used was the *Shapiro-Wilk* test, the homogeneity test used *Levene's test*, hypotheses I and II used the *Paired samples t-test*, testing hypothesis III used the *Independent Sample t-test.*

RESULTS

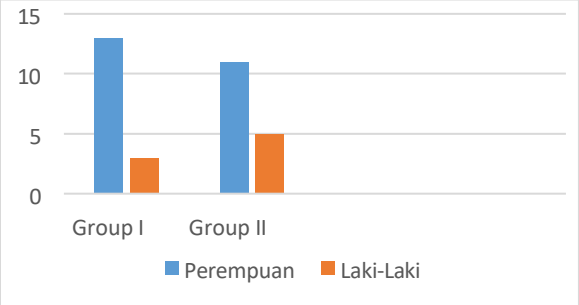
Figure 1. Sample Characteristics Based on Age.



Source: Primary Data 2023.

In figure 1, the age of most respondents in group I was 60-65 years, with 7 people with the highest percentage of 21.9%. In group II, the majority of respondents were young elderly (66-74) years old, 9 people with a percentage of 28.1%.

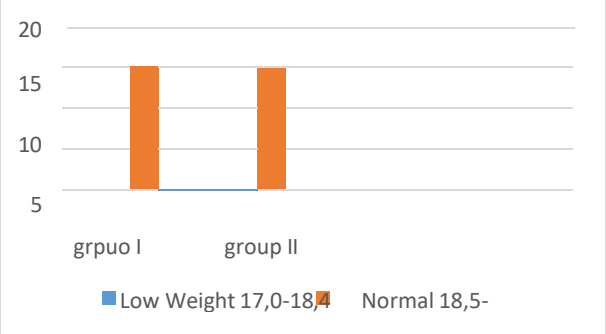
Figure 2. Sample Characteristics Based on Gender



Source: Primary Data 2023.

Based on figure 2, the gender of respondents in group I was at most 13 female with a percentage of 81.25%. In group II, the majority were female, namely 11 people with a percentage of 68.75%, and as many as 5 people were male with a percentage of 31.25%.

Figure 3. Sample Characteristics Based on BMI



Source: Primary Data 2023.

Based on figure 3 Body Mass Index (BMI), 16 respondents in group I had a normal BMI, which ranged from 18.5 to 25.0 with a percentage of 100 %. In group II, 15 people had a normal BMI, ranging from 18.5 to 25.0 with a percentage of 93.8%.

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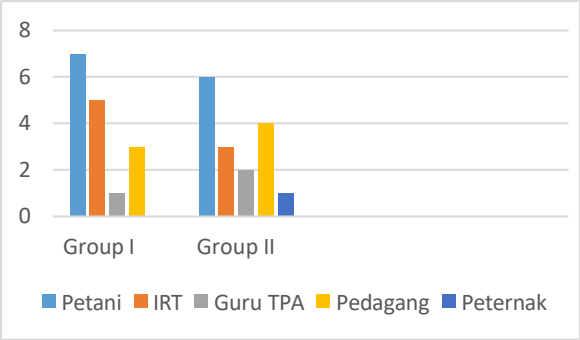
Figure 4. Sample Characteristics Based on Occupation



Source: Primary Data 2023.

Based on figure 4, the jobs in this group are 7 people with a percentage of 43.8%. In group II, 6 people mostly work as farmers with a frequency of 37.5%.

Table 1. Sample Distribution Based on Lumbar Flexibility Measurement Group I

Sample	Group I (Pre) value	Group I (Post) value	Difference
Ny. SP	11.8	13.5	1.7
Ny. SD	11	14	2.5
Ny. PW	10	13	3
Ny. A	12.5	15.3	2.8
Ny. J	14	16.5	2.5
Ny. ET	12.3	15	2.7
Tn. W	9.8	12.2	2.4
Ny. Y	13.5	16.3	2.8
Tn. M	8.6	11	1.4
Ny. E	13.5	15.5	1
Ny. SM	11.3	13.4	2.1
Tn. TM	8.5	10	1.5
Ny. M	11.7	13.5	1.8
Ny. SH	13.3	16	2.7
Ny. SW	12.5	14.5	2
Ny. ST	13.2	15	1.8
Total	16	16	
Mean ± SD	11.719 ± 1.7364	14.044 ± 1.8583	

Source: Primary Data 2023

Table 2. Sample Distribution Based on Lumbar Flexibility Measurement Group II

Sample	Group II (Pre) value	Group II (Post) value	Difference
Ny. SN	14.0	17	2.7
Tn. SJ	10.8	14.7	3.9
Ny. SY	12.5	15.5	3
Ny. ST	11.8	14.8	3
Ny. T	13.5	16	2.5
Ny. SS	11.3	16	4.7
Tn. SG	8.7	12.8	4.1
Tn. B	8.8	12	3.2
Ny. A	12.3	16	3.7
Ny. MJ	13.2	17.7	4.5
Ny. MT	13.3	17.0	3.7
Tn. S	8.6	13	4.4
Tn. N	7.3	10	2.7
Ny. D	12	14.7	2.7
Ny. SH	11	14	3
Ny. P	12.4	16	3.6
Total	16	16	
Mean ± SD	11.344 ± 2.0123	14.825 ± 2.0512	

Source: Primary Data 2023

Based on tables 1 and 2, measuring *pre-post* lumbar flexibility, there was an increase in lumbar flexibility in the elderly.

Table 3. Data Normality Test

Data Group	*Shapiro Wilk Test* *p-Value*	Distribution Description
Pre-test group I	0,191	Normal
Post-test group I	0,420	Normal
Pre-test group II	0,149	Normal
Post-test group II	0,313	Normal

Based on Table 4.7, the results of the data normality test using the *Shapiro Wilk Test*, the *p-value* was obtained > 0.05, which means the data is normally distributed.

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Table 4. Homogeneity Test

Data Group	*Lavene's Teest* *p-Value*	Distribution Description
Pre-test groups I and II	0,556	Homogeneous
Post-test groups I and II	0,798	Homogeneous

The homogeneity test results with *Lavene's Test* in Table 4 obtained a *p-value*>0.05, which means the data obtained is homogeneous.

Table 5. Hypothesis Test I

Sample	Lumbar Flexibility Group I		
	N	Mean ± SD	*P*
Goup I	16	2,3250 ± 0,4879	0,000

The results of the *Paired Sample t-test* calculation obtained a value of $p = 0{,}000$ meaning $p<0.05$ so Ha was accepted and Ho was rejected. It can be concluded that there is an influence of *Dynamic Stretching Exercises* on lumbar flexibility in the elderly before and after the intervention.

Table 6. Hypothesis Test II

Sample	Lumbar Flexibility Group II		
	N	Mean ± SD	*P*
Goup II	16	3,4812 ± 0,6940	0,000

The results of the *Paired Sample t-test* calculation obtained a value of $p= 0{,}000$, meaning $p<0{,}05$ so Ha was accepted and Ho was rejected. It can be concluded that there is a significant effect of giving *Static Stretching Exercises* on lumbar flexibility in the elderly before and after the intervention.

Table 7. Hypothesis Test III

Information	Group I	Group II	
	Mean ± SD	Mean ± SD	*P*
Post Intervention	14,044 ± 1,8583	14,825 ± 2,03512	0,268

Based on the results of the *independent sample T-test*, the *p-value* was > 0.05, which means that Ho was accepted and Ha was rejected, which means that there was no significant difference in effectiveness in the value of lumbar flexibility after being given the intervention between group I (*Dynamic Stretching Exercise*) and group II (*Static Stretching Exercise*).

DISCUSSION

Based on sample characteristics such as age, gender, and BMI, work is associated with a decrease in lumbar flexibility in the elderly.

According to data held by researchers, elderly people aged 60-79 years experience they have decreased muscle flexibility due to lack of *stretching* or exercise. This is also stated in research (Waluyo et al., 2013) showing that flexibility will decrease by around 20 - 30% between the ages of 30 - 70 years and above. According to (Novikasari, 2013) in the elderly, there will be changes in collagen and elastin (connective tissue). Once collagen reaches its maximum function, the strength of elastin and collagen will decrease due to qualitative and quantitative changes caused by ageing. These collagen changes are the cause of loss of flexibility in the elderly.

According to research (Ribeiro et al., 2016) functional capacity and mobility decrease gradually due to loss of muscle mass and muscle strength resulting in decreased flexibility which is likely to result in functional problems, especially in the elderly or people who do not move much.

Flexibility is also influenced by gender, especially in women because they have more fat than muscle. Men have the muscle-forming hormone testosterone compared to women, so women have higher flexibility than men.

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According to (Waluyo et al., 2013) women have greater amounts of the elastin hormone in myofascial, while men do not have this hormone. Apart from that, men have a lower level of flexibility because muscles play a large role in carrying out physical activities.

According to (Mistry et al., 2014) women tend to be more flexible than men of the same age due to anatomical variations in joint structure. Apart from that, it can be caused by men working harder, resulting in bigger joints and muscle building, because some of the elderly still work as farmers. In the elderly in this area, the value of lumbar flexibility in elderly women is higher but is still in the less flexible category compared to elderly men.

Fat tissue is also found around the joints and muscles and can also inhibit the freedom of movement of the joints due to contact between body surfaces, thereby reducing flexibility. BMI can affect lumbar flexibility, according to (Rejeki et al., 2018) flexibility is related to body weight, and body fat, the accumulation of body fat in the abdomen and muscle fibres, affects the measurement of muscle flexibility. Elderly people with an *overweight* BMI tend to have a limited range of motion compared to a normal BMI. This can also be caused by a buildup of adipose tissue in the abdominal area in some elderly people which can affect the results of measuring flexibility with the *Sit And Reach Box Scale*. However, an abnormal BMI is not the main indicator of decreased flexibility in the lumbar spine, someone with a normal BMI can also experience decreased muscle flexibility. According to (Mujtahidin et al., 2015) this can be caused by several factors, namely physical activity factors, work and age factors, the older a person is, the more a person's flexibility decreases.

Work factors and daily activities also influence lumbar flexibility. Poor working attitudes can cause problems, one of which is stress or *strain* on muscles, tendons and ligaments which, if carried out continuously, causes complaints of pain in the lower back and decreased flexibility (Kurniawan et al., 2019).

Muscle tension in the lumbar area for a long time will cause decreased lumbar flexibility. The factor of working in a monotonous position will also cause pain and muscle stiffness resulting in decreased flexibility which causes a reduction in the level of life productivity (Ayu Vitalistyawati et al., 2018). Some elderly people who work have higher flexibility scores but are still in the lower category compared to elderly people who do not work or are at home.

Providing *Static Stretching* and *Dynamic Stretching Exercises* influences the level of lumbar flexibility in the elderly. From the results of these measurements, the *Static Stretching Exercise* is superior to the *Dynamic Stretching Exercise*. The differences in these measurement results can be influenced by the daily activities carried out—elderly people who are still actively working or doing physical activities that involve the lumbar region. In group II, the average *post*-intervention measurement results were higher than in group I, this was because *static stretching* made the muscles stretch maximally within a predetermined time.

When giving *Dynamic Stretching*, will produce maximum muscle lengthening without any resistance. The presence of isotonic contractions will stretch the *stretch receptors* of the *muscle spindles* and Golgi tendons which will stretch the muscles to the maximum so that the Golgi tendons will inhibit muscle tension. When the muscles are stretched to the maximum they are easy to lengthen and increase muscle flexibility (Shaharuddin & Mondam, 2017).

According to (Medeiros et al., 2016) static stretching exercises are effective in increasing muscle flexibility, based on the mechanism of increasing the number of sarcomeres and muscle viscoelasticity because maximally stretching muscles for a certain time can increase muscle length and reduce muscle tension. The movements in *static stretching* are done slowly until a *stretch* occurs which is accompanied by discomfort in the muscles, then maintained for several seconds, the aim is to make the muscles more elastic and move more widely to provide optimal flexibility increase (Behm, 2018).

The measurement results obtained by both interventions can increase lumbar flexibility in the elderly, with regular exercise in both interventions, *Static Stretching* gets higher results

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compared to *Dynamic Stretching*, but both interventions have the same effect on increasing flexibility.

CONCLUSION

According to research (Shaharuddin & Mondam, 2017), static and dynamic stretching exercises can both increase muscle flexibility. However, based on research, static stretching exercises are better at increasing muscle flexibility and dynamic stretching exercises focus more on improving the quality of performance.

Providing *Static Stretching* and *Dynamic Stretching* can both help increase flexibility. However, *static stretching* is considered more suitable for increasing flexibility. Meanwhile, *Dynamic Stretching* is more suitable for increasing muscle power than for increasing flexibility and range of motion in joints (Shaharuddin & Mondam, 2015).

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