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Effect of hamstring stretching for improving body function or activity in patients with knee osteoarthritis

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Abstract

Background: Osteoarthritis (OA) is a long-term disease characterized by abnormalities in the cartilage in the joints which causes the bones to rub together, causing stiffness, pain, decreased flexibility and impaired functional activities.

Purpose: To determine effect of hamstring stretching for improving body function or activity in patients with knee osteoarthritis.

Method: A quantitative quasi-experimental approach. Participants were selected using random sampling and the Issac & Michael formula, resulting in 30 participants who were divided into two groups, namely 15 participants in the intervention group and 15 participants in the control group from Sebelas Maret University Hospital. Pre-test and post-test functional activity assessments using the Western Ontario and McMaster Universities Arthritis Index (WOMAC) instrument in the intervention and control groups. Univariate statistical analysis was conducted, including a shapiro wilk and one way anova test.

Results: Intervention group and control group have a p-value <0.05, meaning that functional activity has an effect on have hamstring stretching exercise on increasing functional activity in knee osteoarthritis patients.

Conclusion: Hamstring strengthening exercise on increasing the ability of functional activities in knee osteoarthritis. This can be considered as evidence that specific exercise interventions on the hamstring muscles provide positive benefits in individuals with knee osteoarthritis.

Keywords: Functional Activities; Hamstring Stretching; Osteoarthritis.

INTRODUCTION

Osteoarthritis (OA) is a long-term chronic disease characterized by cartilage disorders in the joints that cause the bones to rub against each other, causing stiffness, pain, decreased flexibility, and impaired functional activity. Osteoarthritis generally affects the body in the knees, hands, feet, and hips. Person with a diagnosis of this disease will tend to experience weakness and deterioration of the body system that occurs with age such as pain in the joints including the musculoskeletal system experiencing rheumatism, gout, and joint pain (Sudaryanto, Mudigto, & Soemanto, 2018)

Signs and symptoms that are often felt are stiffness and pain in the joints when moved, swelling or inflammation of the joints, sound in each joint (crepitation), changes in gait, and limited functional activity. The consequences are loss of muscle strength, decreased fitness and functional activity. Mobility can increase the risk of weight gain. The less often the joints are used, the weaker and stiffer the joints and bones become (Qiudandra, & Akram, 2022).

Based on data from the World Health Organization (WHO) in 2017, it is estimated that osteoarthritis

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sufferers in the world reached 9.6% in men and 18% in women. In Central Java, the incidence of osteoarthritis is 5.1% of the total population. According to research, the prevalence of knee osteoarthritis in Surakarta, Central Java reached 68.5% and most did not have a history of injury. Most osteoarthritis complaints are experienced at the age of 36 - 65 years (Alfarisi, 2018).

The hamstring muscle is the main muscle responsible for knee flexion, thus the hamstring muscle has an important role in the performance of functional activities. Muscle damage and inefficient mobility occur when the biomechanics of the hamstring muscle shortens. When the hamstring muscle is stretched, there will be an elongation of the hamstring muscle, then when the stretching force is released, the muscle will return to its resting length position and is called elastic (Gunn, Stewart, Morgan, Metts, Magnusson, Iglowski, & Arnot, 2019).

Exercise therapy can effectively relieve pain, prevent muscle atrophy, and improve motor function in the lower extremities. The principle of stretching or stretching in muscles increases blood flow and brings nutrients to the muscles and removes metabolic waste from the muscles. If a muscle has a spasm, there is a shortening of muscle fiber so that when stretching is done by holding a few seconds in the elongated muscle position with the aim of providing adaptation to the muscle spindle to the change in muscle length that we provide. Then stretching can help relax the muscles so that the muscles are more flexible in moving due to increased oxygen supply, and increase the ability to move muscles and joints in all areas of movement (Handini, Fariz, Priskusanti, & Endaryanto, 2022).

RESEARCH METHOD

A quasi-experimental approach, specially focusing on a two-group pretest-posttest. The study took place from 10-24 January, 2024, in Sebelas Maret University Hospital (UNS Hospital). The independent variable was hamstring stretching where hamstring stretching exercise is a hamstring muscle stretching performed on knee osteoarthritis. According to the limit of ability or according to the patient's tolerance threshold. The dependent variable was the improvement of functional activity where the research instrument uses The Western Ontario and McMaster Universities Arthritis Index (WOMAC). Using random sampling and the Isaac & Michael formula, 30 participants were selected, with 15 intervention groups and 15 control groups who met specific inclusion and exclusion criteria.

The inclusion criteria required male and female participants, the age of the participants was 36 - 65 years, the patients were conscious and cooperative, had a medical diagnosis of osteoarthritis, and were willing to be research subjects from beginning to end, while exclusion criteria involved participants who have injuries such as fractures, burns, etc. That are still new in the knee area, taking pain relievers, hypermobility, the presence of hematoma or tissue trauma, bone blocks that limit movement, and acute injuries.

The pre-test was conducted by have a functional activity measurement instrument using The Western Ontario and McMaster University (WOMAC) developed by Bellamy to our intervention group and control group. This questionnaire has 24 items regarding pain intensity, stiffness and physical function. The scoring score is 0-4 with categories, 0 (no), 1 (low grade), 2 (intermediate), 3 (high grade), 4 (extremely). Intervention group group have a hamstring stretching and control group have a therapy as usual.

This hamstring stretching exercise is performed on osteoarthritis patients by positioning the patient's body sitting upright and putting both legs straight forward. Then the researcher helps provide a tool such as a towel or theraband that is wrapped around the soles of the patient's feet, then the respondent pulls the towel or theraband by raising the tip of the foot independently to the limit of the respondent's ability. After that, lower the tip of the foot slowly and then repeat the movement again. This exercise is performed for 6-10 seconds/set, 5 seconds pause, 8 sets of 3 repetitions, each of which is performed 3 times/week for a period of 3 weeks.

The post-test was conducted after 3 weeks with functional activity assessment using measurement instrument the Western Ontario and McMaster Universities Arthritis Index (WOMAC) our intervention group and control group to evaluation and education.

The data was analyzed following a step-by-step process, beginning with a normality test using the Shapiro-Wilk test. With p-values greater than 0.05, the data was determined to follow a normal distribution. The analysis proceeded with a univariate test to determine the frequency distribution of respondents' characteristics, followed by bivariate analysis using one way anova test. All analyses were conducted using SPSS 24. This research has obtained permission and recommendations from the Research Ethics Commission Faculty of Medicine Universitas Sebelas Maret with number. 102/UN27.06.11/KEP/EC/2024 on April 26, 2024.

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RESEARCH RESULTS**Table 1. Characteristic of the Participants (n=30)**

Variables	Group	
	Intervention (n=15)	Control (n=15)
Age (n/%) (Mean±SD)(Range)(Year)	(54.33±8.506)(36-65)	(53.60±16.243)(36-65)
36-40	1/6.7	0/0
41-45	1/6.7	2/13.3
46-50	3/20.0	2/13.3
51-55	2/13.3	1/6.7
56-60	3/20.0	1/6.7
61-65	5/33.3	9/60.0
Gender (n/%)		
Male	4/26.6	4/26.6
Female	11/73.4	11/73.4
Employment (n/%)		
Employed	8/53.3	5/33.4
Unemployed	7/46.7	10/66.6

Table 1. Shows the characteristics of participants with a mean age and standard deviation of (54.33±8.506) in the age range of 36-65 years in the intervention group and (53.60±16.243) in the age range of 36-65 years in the control group. The majority of both groups consisted of female, 11 (73.4%) in the intervention group and 11 (73.4%) in the control group. Most participants in the intervention group were employed 8 (53.3%). The majority of participants in the control group were not employed 10 (66.6%).

Table 2. Effect Functional Activity

Variable	Intervention Group		Control Group	
	(Mean±SD)	p-value	(Mean±SD)	p-value
Functional Activity				
Pre-test	25.72±2.049	0.000	34.03±2.891	0.004
Post-test	19.31±1.184		29.42±2.045	

Table 2. Shows intervention group, functional activity decreased from an average of 25.72 in the pre-test to 19.31 in the post-test. Control group, functional activity decreased from an average of 34.03 in the pre-test to 29.42 in the post-test. The results of hypothesis testing show a significance value of sig<0.05, meaning that functional activity has an effect on have hamstring stretching exercise on increasing functional activity in knee osteoarthritis patients.

DISCUSSION

Characteristics that participants from both groups with the most calculations were aged 61 - 65 years. With increasing age, the elderly will experience a

degeneration process and a decrease in performing daily functional activities (Swastini, Ismunandar, Wintoko, Hadibrata, & Djausal, 2022). The aging process is a journey or process characterized by the function of the body's work system decreasing, susceptible to various complaints or diseases, and death (Afrida, Aryani, Annisa, Idyawati, & Saftarina, 2022). In the aging period there is an association with musculoskeletal complaints. Where this aging occurs with a decrease in collagen production and synthesis of proteoglycans, causing reduced joint elasticity and bones and joints are easily damaged when there is pressure (Hadi, Yani, & Wardhani, 2023).

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One theory that describes the aging process is "The Functional Consequences Theory". This theory explains that the addition of age, actions, risk factors will have an impact on the continuity of daily activities and the quality of life of the elderly (Hikmah, & Pradana, 2022). Osteoarthritis disease is part of a non-communicable disease in the form of joint disease with a high prevalence that occurs in the elderly due to metabolic disorders and followed by musculoskeletal changes, along with other supporting factors (Rahayu, Irawan, Santoso, Susilowati, Atmojo, & Kristanto, 2021). This disease will progress with increasing age and is supported by the presence of slow cell death that will change the matrix structure and function of chondrocytes (Egwu, Ayanniyi, Adegoke, Olagbegi, Ogwumike, & Odole, 2018).

The pathophysiology of osteoarthritis disease will increase with signs of joint stiffness, decreased synovial production, and persistent crepitation over time and age. Degeneration will also be severe accompanied by an increase in the frequency of pain in osteoarthritis (Raposo, Ramos, & Lucia Cruz, 2021). The frequency of the majority subjects of this study was more than 50 years old. Increasing age will have an impact on decreasing strength and muscle mass. This is known as sarcopenia, which is a syndrome characterized by increasing age, decreasing muscle mass, decreasing muscle strength. Muscle mass decreases by 1-2% per year while muscle strength is around 1.5% per year and will further decrease at the age of more than 60 years, namely up to 3% per year (Budhiarta, Aryana, Purnami, Putrawan, Astika, & Kuswardhani, 2019).

Classification on characteristics based on gender. The data presented above shows that on average the most participants are female. This means that the occurrence of osteoarthritis in this study women dominate compared to men. This is due to the role of estrogen owned by women with a role as a bone builder. If estrogen decreases, bone density will decrease. Meanwhile, men will experience andropause which will experience a decrease in skeletal function, but in men the rate of hormone decline is less significant than in women (Lis, & Rohaeni, 2022).

Menopause occurs due to decreased production of the hormone estrogen characterized by a stopped menstrual cycle. Many changes occur when women experience menopause, namely physical

appearance, psychological, sexual desire, and fertility. The reduced estrogen hormonal factor in women has an effect on increasing osteoarthritis complaints, especially during the elderly when the menopausal phase occurs. Meanwhile, men experience andropause where testosterone levels decrease so that it will affect the physical and even psychological and quality of life of men (White, & Master, 2016). The symptoms felt by men when experiencing physical conditions and sexual performance decrease as a result will have an impact on daily survival. However, hormonal factors in men are not very significant in increasing osteoarthritis complaints. Not only about hormones, but there are differences in the anatomical structure of the lower extremities between women and men. The pelvic anatomy in women is wide so that it makes a large hip adduction and knee abduction which makes the lower limb structure more valgus (Wijianto, Andzani, & Dewangga, 2021).

Job type factors can affect the occurrence of osteoarthritis. Work with heavy physical movements and continuous use of joints can be a risk factor for osteoarthritis complaints. Heavy loads that exceed the weight that our joints usually bear, if forced and continuously will cause inflammation in the joints and result in joint cartilage damage. Furthermore, if you experience joint inflammation, you will feel pain which results in disruption of physical activity to interfere with work (Dhaifullah, Meregawa, Aryana, & Subawa 2023). One of the complaints of osteoarthritis is pain, the more the pain level increases, the person will limit the movement of the painful part. Work that involves a lot of loading on the joints, especially when squatting and kneeling for a duration of time every day, will cause severity and worsen osteoarthritis complaints themselves. Changes in work position can be seen from the working conditions. Therefore, repetitive and excessive use of joints while working will cause stress on the knee joint structure. The average characteristics of the work of participants in the treatment and control groups were not working or as housewives as many as 20 people (66.7%) (Juliana, Masmuri, Sari, Saputra, & Khatifah, 2023).

The effect of have hamstring stretching exercise on increasing functional activity in knee osteoarthritis is indicated by the Sig results in the treatment group of 0.000, which data is proven to have an effect with a p-value <0.05. As for the control group of 0.004, which

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data is proven to have an effect with a p-value <0.05. With a hamstring muscle strengthening exercise program performed for 3 weeks can significantly increase hamstring muscle strength and increase knee joint stability and can reduce pain and increase daily functional activity in osteoarthritis (Fau, Suhita, Kusumawati, & Nurwijayanti, 2022).

The thigh muscles are the main flexors of the knee and also influence rotation of the tibia femur. The hamstrings are an important factor in controlling movement and play a role in a variety of activities ranging from running and jumping forward, bending while sitting or standing, and postural control. The mechanism of action of hamstring stretching exercise to improve functional activity in knee osteoarthritis patients from the beginning of the meeting in week one to week three. Hamstring Muscle Group Stretch is good at increasing functional activity because this method applies the principle that after a muscle contracts maximally, the muscle will immediately be in a maximally relaxed position (Fahmi, Elyana, & Warsono, 2023).

Muscle strength is defined as the power of muscles to perform and produce force. Strong muscles can stabilize joints and are able to minimize impact or shock absorbers by spreading strength due to the wide area around the quadriceps muscle (Lonica, Oktaria, Makmur, & Soedjatmiko, 2015). The benefits of providing strengthening exercise in addition to reducing pain, increasing functional activity, and restoring range of motion so that it affects the continuity of daily activities. These exercises can help osteoarthritis sufferers reduce pain and increase functional activity and reduce the potential for disability that causes deformity in the knee joint (Yuliani, 2023).

CONCLUSION

The conclusion of the study showed the effect of have hamstring strengthening exercise on improving functional activity ability in osteoarthritis of the knee. This can be considered as evidence that specific exercise interventions on the hamstring muscles provide positive benefits to individuals with osteoarthritis of the knee.

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