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Closed Kinetic Chain Exercise Affects Reduction in Knee Joint Pain Levels in Elderly with Osteoarthritis

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Abstract

Background: Osteoarthritis of the knee is a chronic joint disease characterized by abnormalities in the cartilage (cartilage) which will result in the bones rubbing against each other, the presence of joint cartilage abrasion, and the formation of osteophytes on the joint surface which causes symptoms in the form of stiffness, pain, and restriction. movement of the knee joint. Closed kinetic chain exercise therapy generally provides benefits in reducing complaints which are thought to be able to improve the patient's functional ability to perform activities optimally.
Objective: This study aims to determine the effect of Closed Kinetic Chain exercise on reducing knee joint pain levels in the elderly with Osteoarthritis at the Tresna Werdha Budi Mulia 3 Social Home, South Jakarta.
Methods: This study used a quasi-experimental design with a one-group pretest-posttest without a control design. The population of this study is the elderly affected by Osteoarthritis. Sampling using total sampling with a sample of 24 people. The research instrument used an NRS sheet.
Results: The results of statistical tests using the paired t-test obtained a p-value = 0.000 (α 0.05), so there is an effect of close kinetic chain exercise on reducing knee joint pain levels in the elderly with Osteoarthritis at Tresna Werdha Budi Mulia Social Institution 3 South Jakarta.
Conclusion: Before the intervention, the average respondent suffered from a moderate knee joint pain scale of 4.9308. After being given the intervention, the average respondent suffered from a mild knee joint pain scale of 3.8475. The average difference in the degrees of knee joint pain before and after being given closed kinetic chain action was 1.08333. There is a significant effect of giving closed kinetic chain action to decrease the scale of knee joint pain with osteoarthritis.

Keywords: elderly, close kinetic chain, joint pain, knee osteoarthritis, pain scale

Introduction

The elderly are part of the process of growth and development, humans do not suddenly become old, but develop from babies, children, and adults and eventually become old. Elderly is a natural process that is determined by God Almighty. In general, signs of the aging process begin to appear at the age of 45 years and will cause problems at the age of around 60 years. Based on SUSENAS in 2020, almost half of Indonesia's elderly experience health complaints, both physical and psychological (48.14 percent). Meanwhile, the percentage of elderly people who are sick is almost a quarter of the elderly in Indonesia (24.35) percent. However, the elderly morbidity rate in 2020 is the lowest point in the last six years. In general, diseases experienced by the elderly are non-communicable diseases that are degenerative or caused by age factors such as heart disease, diabetes mellitus, stroke, rheumatism, and injury.[1]

The higher life expectancy in the elderly causes more problems that arise in the elderly caused by the aging process and degenerative problems that reduce endurance. There are two types of biggest problems in the elderly in the first place, namely hypertension at the age of 55-64 years as much as 45.9% and age 65-74 years as much as 57.6%, for arthritis occupy the second position, namely age 55-64 years as much as 45% and 51.9% aged 65-74 years. Based on RISKESDAS data in 2018, the most diseases in the elderly were non-communicable diseases including hypertension, dental problems, joint disease, oral problems, diabetes mellitus, heart disease and stroke, and infectious diseases such as ARI, diarrhea, and pneumonia.[2]

Aging causes various anatomical, physiological, and biochemical changes in the body. These changes affect various functions and abilities of the body which are characterized by various physical declines and also declines in cognitive abilities in the elderly which often cause various health problems. Joint pain is a degenerative bone disease that is characterized by the loss of articular cartilage (joints). Signs and symptoms such as the following, redness and swelling in the joint area, a warm sensation to the touch, fever, pain when moving, joint tension, swelling, redness, unable to move freely.[3]

One of the health problems that often occur in the elderly due to degenerative processes, namely physiological functions has a decrease in the musculoskeletal system. In the musculoskeletal system, there is usually a decrease in joint synovial fluid, a decrease in muscle mass, thinner cartilage and stiffer ligaments, and a decrease in joint range of motion causing pain which will result in a decrease in joint functional ability. Osteoarthritis is one of the most common musculoskeletal disorders.[3]

Osteoarthritis causes various health problems, namely decreased physiological abilities, psychological changes, limited social interactions, limitations in carrying out spiritual needs, and decreased work productivity. The economic, psychological, and social problems of osteoarthritis are enormous, not only for sufferers but also for families and the environment.[4]

The impact of pain on osteoarthritis is a decrease in the quality of life expectancies such as severe fatigue, decreased range of motion, and pain in movement. Stiffness gets worse in the morning when you wake up, with severe pain at the beginning of the movement but the stiffness does not last long, which is less than a quarter of an hour. Stiffness in the morning causes reduced ability to move in extension movements, and limited physical mobility, and the systemic effects caused are organ failure and death. Osteoarthritis has a major negative effect on the activity as well as on mental and physical health. Even in 2020, osteoarthritis is estimated to be the fourth leading cause of disability in the world. It is also estimated that 1 to 2 million elderly people in Indonesia suffer from disabilities due to osteoarthritis.[5]

Osteoarthritis (OA) is a degenerative disease of the joints that involves cartilage, joint

lining, ligaments, and bones, causing pain and stiffness in the joints. OA can occur in many factors, including increasing age, obesity, female gender, trauma, joint infections, genetic, metabolic, traumatic factors, a history of joint inflammation, and metabolic disorders11. Appearance or clinical manifestations are characterized by joint pain, motion pain, limitation of motion, and others. Clinical symptoms of OA are non-specific and vary between individuals at various locations of the joints affected, and are influenced by many things, apart from joint damage.[6]

The prevalence of OA in the world is included in the high category, ranging from 2.3% to 11.3%, besides that, OA is a musculoskeletal disease that often occurs, which is number 12 among all existing diseases. It can be seen that the prevalence of OA in the elderly aged >60 years is estimated at 10-15% with an incidence rate of 18.0% in women and 9.6% in men, from this figure it can be seen that the prevalence of OA in women is higher compared to men15. For western society, OA is an increasingly common and frequent problem.[7]

Based on data from RISKESDAS 2018, the prevalence of joint disease in Indonesia is around 7.3% and osteoarthritis (OA) is a common joint disease. Although often associated with increasing age, otherwise known as degenerative diseases, the joint disease has occurred in people in the age range of 15-24 years (prevalence rate is around 1.3%), and the prevalence rate continues to increase in the age range of 24-35 years (3.1). %) and the age range of 35-44 years (6.3%). The prevalence of OA by age in Indonesia is quite high, namely 5% at the age of 40 years, 30% at the age of 40-60 years, and 65% in the elderly (elderly) more than 61 years.[8]

Efforts made to reduce knee joint pain in the elderly can be given in the form of pharmacological and non-pharmacological therapy. Pharmacological therapy is usually given symptomatic drugs NSAIDs (aspirin, ibuprofen), analgesics such as tramadol, intraarticular glucocorticoid injections, and muscle relaxants. Giving pharmacological therapy to patients with osteoarthritis has a high risk of producing adverse effects on the health of the elderly with various decreases in body functions, so non-pharmacological therapy such as providing physical exercise activities is the best alternative to overcome pain in the elderly. For non-pharmacological therapy, namely warm or cold compresses can reduce pain and can also be given physical exercise in the form of flexibility exercises, exercises for joint space, and stretching exercises. The basic principles of physical exercise In patients with osteoarthritis increase and maintain range of motion (ROM), strengthen muscle movement, improve locomotor function, reduce swelling, reduce pain, and reduce inflammation.[9]

One of the physical exercises that can be done easily is stretching exercises, namely Close kinetic chain therapy performed in a standing position, this exercise strengthens the agonist and antagonist muscles simultaneously and is an exercise that focuses on the lower limbs. This exercise is very useful for training the muscles, especially to improve the ability of the lower leg muscles. In principle, the Closed Kinetic Chain exercise is an exercise that strengthens muscles simultaneously and is a more physiological exercise for the lower limbs. The closed kinetic chain movement technique is flexion-extension movements such as squats and wall sits.[10]

The results of research from Meylisa Putri Ayunanda 2014 entitled the difference in the effect of the open kinetic chain and close kinetic chain on increasing the functional ability of the knee joint in elderly women. In a different test, it was found that the administration of Close kinetic chain exercises was more influential than the open kinetic chain in increasing the functional ability of the knee joints in elderly women. Because the close kinetic chain is considered to be able to improve the functional ability of the knee joint and provide training with a wider range of motion in the joint, while the open kinetic chain exercise only emphasizes static contractions without any real load on the body movement.[11]

Based on the above background, the researcher is interested in conducting a study entitled "The Effect of Closed Kinetic Chain Exercise on Reducing Knee Joint Pain Levels in the Elderly with Osteoarthritis at Tresna Werdha Budi Mulia 3 Social Home, South Jakarta".

Method

This study uses a quasi-experimental design with a one-group pretest-posttest without a control design. The population of this study is the elderly affected by Osteoarthritis. Sampling using total sampling with a sample of 24 people. The research instrument used an NRS sheet.

Results

Univariate Analysis

Table 1. Characteristics of Respondents Based on Age

Number	Category Age	Amount (n)	Percentage (%)
1.	60-70 years old	10	41.7
2.	75-90 years old	14	58.3
Total		24	100

Based on table 1 shows that of the 24 respondents as many as 10 people (41.7%) were aged 60-70 years, and 14 people (58.3%) aged 75-90 years.

Table 2. Description of Knee Pain level before and after intervention

Variable	Mean	Sd	Min	Max
Pre. Knee Joint Pain	4.9308	1.25945	2.67	7.67
Post. Knee Joint Pain	3.8475	1.08155	2.00	5.67

Based on table 2 shows that before the intervention was given, the average knee joint pain was 4.9308 with an SD of 1.25945, the highest knee joint pain score showed 7.67 and the lowest showed 2.67. Based on the data above, it can be concluded that before the intervention, 24 respondents experienced a moderate level of joint pain. After the intervention was given, the average knee joint pain was 3.8475 with an SD of 1.08155. The highest knee joint pain score showed 5.67 and the lowest showed 2.00. Based on the data above, it can be concluded that after knee joint pain after the intervention, 24 respondents experienced a mild level of joint pain.

Table 3. The difference in the average degrees of knee pain before and after the intervention was given

Closed kinetic chain exercise	Before		After		Difference	N
Mean	Sd	Mean	Sd	Mean	Sd	
4.9308	1.25945	3.8475	1.08155	1.08333	-0.17	24

Based on table 3 shows that the difference in the average degree of knee joint pain before and after the closed kinetic chain intervention was given with a mean of 1.08333.

Bivariate Analysis

Bivariate analysis was used to examine the effect of giving closed kinetic chain exercises to decrease the level of knee joint pain in the elderly with osteoarthritis. To determine the effect of giving closed kinetic chain exercises to decrease the level of knee joint pain in the elderly affected by osteoarthritis, the Paired Samples T-Test statistical test (Test Dependent) was used. With the following conditions: there is an effect if the p-value <0.05 and no effect if the p-value > 0.05, with the following results:

Skewness Normality Test

Table 4. Normality Test Results Pre and Post Closed Kinetic Chain Exercise in the Elderly with Osteoarthritis

Knee Joint Pain Degree With CKC Exercise	Skewness	*standard Error of Skewness*	Result	Information
Pretest	0. 284	0. 472	0.787	Data is normally distributed
Post test	0. 025	0. 472	0.609	Data is normally distributed

Based on table 4 shows that the average degree of knee joint pain before intervention was 4.9308 with a standard deviation of SD 1.25945 with a minimum score of 7.67 and a maximum of 2.67 while the difference in the mean degrees of knee joint pain before and after 1.08333 means that there is a decrease in the level of pain indicating that the average degree of knee joint pain after the intervention was 3.8475 with a standard deviation of 1.08155 with a minimum score of 2 and a maximum of 5.67 while the difference in the mean degree of knee joint pain before and after 1.08333 means that there is a decrease in pain level. Statistical test results obtained a p-value = 0.000 (< 0.05), so H0 is rejected, meaning that there is a significant effect in giving close kinetic chain exercises to decrease the degree of knee joint pain.

Statistical Test Paired T-Test

Table 5. Analysis of the effect of giving closed kinetic chain exercises to reduce the degree of knee pain of respondents

Closed kinetic chain exercise	Mean	Difference	Sd	Min-Max	Df	N	P-Value
Before (*Pre-test*)	4.9308	1.08333	1.25945	7,67 - 2,67	23	24	0.000
After (*Post-test*)	3.8475		1.08155	2 - 5,67	23	24	

Based on table 5 shows that the average degree of knee joint pain before intervention was 4.9308 with a standard deviation of SD 1.25945 with a minimum score of 7.67 and a maximum of 2.67 while the difference in the mean degrees of knee joint pain before and after 1.08333 means that there is a decrease in the level of pain indicating that the average degree of knee joint pain after the intervention was 3.8475 with a standard deviation of 1.08155 with a minimum score of 2 and a maximum of 5.67 while the difference in the mean degree of knee joint pain before and after 1.08333 means that there is a decrease in pain level. Statistical test results obtained a p-value = 0.000 (< 0.05), so H0 is rejected, meaning that there is a significant effect in giving close kinetic chain exercises to decrease the degree of knee joint pain.

Discussion

Univariate Analysis

Characteristics of Respondents Based on Age

Based on table 1. shows that of the 24 respondents as many as 10 people (41.7%) were aged 60-70 years, and 14 people (58.3%) aged 75-90 years. This shows that the elderly population continues to increase in line with progress in the health sector, which is marked by an increase in life expectancy and a decrease in mortality. These demographic developments can have an impact on health, the economy, and society. The increase in the health and welfare of the population will affect the life expectancy (UHH) of Indonesia. The higher the life expectancy in the elderly, the more problems that arise in the elderly are caused by the aging process and degenerative problems that reduce endurance. The higher life expectancy in the

elderly causes more problems that arise in the elderly caused by the aging process and degenerative problems that reduce endurance. There are two types of biggest problems in the elderly in the first place, namely hypertension at the age of 55-64 years as much as 45.9% and age 65-74 years as much as 57.6%, for arthritis occupy the second position, namely age 55-64 years as much as 45% and aged 65-74 years as much as 51.9% 77.

These data are the results of research by Abdurrachman, Handayani, and Ramadanti (2019) explaining that osteoarthritis more often affects individuals older than 75 years by 80%, radiographic evidence shows that osteoarthritis rarely occurs under 40 years of age, osteoarthritis also does not occur in adults. children but often occurs at the age of over 60 years. This is due to changes in the morphology and structure of cartilage which is getting thinner due to age, loss of tensile strength, and stiffness of the bone matrix.[12] This is reinforced by the research of Kinandana, Nurmawan, and Adiputra (2016) which states that knee osteoarthritis is more at risk at the age of 45 years to 70 years, because in the elderly there is tissue degeneration in the body, especially in joints that often receive heavy loads. This can cause gradual destruction of the cartilage (cartilage) but is not followed by balanced healing.[13]

Knee Joint Pain Level Before Closed Kinetic Chain Exercise

Based on the results of the study before the close kinetic chain exercise was carried out, it was found that 16 people (67%) experienced a moderate degree of knee joint pain, and the average value before the close kinetic chain exercise was 4.9308. The results of this study are from research conducted by Theresia Titin Marlina (2015) under the title the effectiveness of knee exercises on reducing pain intensity of knee osteoarthritis patients in Yogyakarta. The results showed that 37 people (61.7%) experienced moderate pain levels.[14] As well as another study conducted by Cut Rahmiati, et al in 2017 entitled The Effectiveness of Stretching on Reducing Knee Joint Pain in the Elderly by using a quasi-experimental research method (quasi-experimental) with a pre and post-test design without control. The percentage of the results showed that the majority of respondents were at mild pain level before being given stretching, as many as 25 respondents (75.8%) and there were moderate pain levels for as many as 5 respondents (15.2%).[15] These results are by the results of Sonjaya's research (2015) that the 56-65 year age group is the age group with the highest incidence of primary knee osteoarthritis. This shows that patients with osteoarthritis are more at risk of occurring at the age of 60 years and over and at that age the elderly experience a process of changes in their bodies, especially in the joints.[16]

Research conducted by Dedi Firmasyah in 2018 entitled The Effect of Knee Joint Movement Exercises on Knee Joint Pain in Elderly Who Has Osteoarthritis in the Work Area of Pengasih 1 Kulon Progo Health Center Yogyakarta with the Quasi-Experimental Method: Time Series Design. with pre and post-test design.[16] For as many as 44 samples, the sampling technique was non-probability sampling, while the determination of the intervention group used proportional sampling. The exercise was carried out for 6 days, the pretest was carried out on the 2nd day and the post was carried out on the last day, namely the 8th day, with a frequency of exercise 2 times a day, in the morning and at night for 6 days. The measuring instrument used is the knee joint motion exercise guidelines. The percentage shows the level of pain in respondents before knee joint motion. Some of the pain levels are moderate (84.1%) and severe pain (15.9%). After doing knee joint motion, the respondent's pain level was mild pain (93.2%) and moderate pain (6.8%).[17]

This is different from the research conducted by Anita Fera Sianturi in 2018 entitled The Effect of Elderly Gymnastics on Reducing Joint Pain in the Elderly at the Medan Tuntungan Health Center by using the pre-experimental method with the One Group Pre-Test Post-Test Design. The distribution of the frequency of the respondent's pain level before the

elderly exercise intervention was mostly in severe pain, namely 18 people (52.9%)82. Research conducted by Vivi Meliana Sitinjak 1 in 2016 entitled The Effect of Rheumatic Gymnastics on Changes in Pain Scale in Elderly with Knee Osteoarthritis showed a percentage of 75% in controlled severe pain (pain scale range 7–9) and 25% in moderate pain (pain scale range 4-6).[18]

Osteoarthritis is characterized by damage to the hyaline cartilage of the joints, increased thickness and sclerosis of the bone plates, growth of osteophytes at the joint margins, stretching of the joint capsule, inflammation, and weakening of the muscles that connect the joints. The main symptom that is often experienced by sufferers is pain that can cause limitation of movement, decreased muscle strength in general, balance, and functional inability78. The impact of pain on osteoarthritis is a decrease in the quality of life expectancies such as severe fatigue, decreased range of motion, and pain in movement. Joint pain level after closed kinetic chain intervention was given. The aging process is thought to be the cause of increased weakness around the joints, decreased joint flexibility, calcification of cartilage, and decreased function of chondrocytes, all of which contribute to the development of osteoarthritis. Studies on flexibility in osteoarthritis have found that there is a decrease in flexibility in elderly patients with osteoarthritis and the elderly, non-pharmacological therapy is very important and includes education, physical therapy, joint exercise, occupational therapy, and weight loss. In education, the important thing is to convince the patient to be independent, not always dependent on others. Although osteoarthritis cannot be cured, the patient's quality of life can be improved.[5]

Chronic osteoarthritis with severe pain can have an impact on decreased physical activity. Theoretically, osteoarthritis can affect all joints, the most common predilection is in the joints that bear the weight of the body such as the hips, knees, and lower lumbar spine joints. Joint pain in the elderly almost occurs in all the elderly, mainly due to joint and bone degeneration. The most common location for osteoarthritis is the knee.[19] This complaint is the main complaint of the patient. The pain usually increases with movement and decreases slightly with rest. These changes can be found even though osteoarthritis is still relatively early (radiologically). Generally, the pain will get worse until the joint can only be shaken and become contractures, the resistance to motion can be concentric (all directions of movement) or eccentric (one direction of movement only).[20] Based on the results of Magnetic Resonance Imaging (MRI), it was found that the source of the pain was thought to come from joint inflammation (synovitis), joint effusion, and bone marrow edema. Osteophytes are one of the causes of pain. As the osteophyte grows, the neurovascular innervation penetrates the base of the bone to the cartilage and into the developing osteophyte. This will cause pain.[7]

Pain is the biggest symptom in joints with osteoarthritis. Pain is an unpleasant sensory and emotional experience associated with actual or potential tissue damage. In general, people perceive that pain is a pure phenomenon without considering that pain also affects the body's homeostasis which will cause stress to restore that homeostasis.[22] Therefore, this disease can cause disability as a result of pain, joint stiffness, and inflammatory processes, thereby interfering with daily activities and causing severe socio-economic impacts, and affecting the quality of life of the sufferer.[22] The pain felt on average is still on a mild and moderate scale because the pain caused by arthritis can still be controlled.[23] Ayu (2012) explains that the average joint pain of the elderly who experience knee joint pain ranges from a scale of 1 to 687.[19]

The researcher argues that most of the elderly at the Tresna Werdha Budi Mulia 3 Social Home, South Jakarta suffers from a moderate degree of knee joint pain because based on observations, most of the respondents in this study did not carry out many activities that carried heavy loads and the elderly took more rest and did vibration massage therapy, magnetic therapy

which is done every week by the therapist, and doing gymnastics together 2 times a week. However, not all the elderly are given vibration massage and magnetic therapy.

Knee Joint Pain Level After Closed Kinetic Chain Exercise

Based on the results of the study after the close kinetic chain exercise, it was found that 22 people (92%) experienced a mild degree of knee joint pain. The results of this study are the same as the research conducted by Theresia Titin Marlina (2015) with the title of the effectiveness of knee exercises on reducing pain intensity of knee osteoarthritis patients in Yogyakarta. The results showed that 38 people (63.3%) experienced a mild level of pain.[14] And another study conducted by Cut Rahmiati, et al in 2017 showed that after being given stretching the majority of respondents were at a mild pain level, as many as 29 respondents (87.9), while those experiencing moderate pain levels were not 80. Research conducted by Asnita Fera Sianturi in 2018 entitled The Effect of Elderly Gymnastics on Reduction of Joint Pain in the Elderly at the Medan Tuntungan Health Center used a pre-experimental method with the One Group Pre-Test Post-Test Design. The distribution of the frequency of respondents' pain levels after the elderly exercise intervention was carried out with the majority of pain levels being mild pain, namely 20 people (58.8%).[18] Research conducted by Riska Yunda Bistanti in 2018 entitled The Effect of Tai Chi Exercise on Joint Pain and Joint Flexibility in the Elderly at the Elderly Posyandu, Keniten Village, Geneng District, Ngawi Regency using the pre-experimental method with One Group Pretest Posttest design. Respondents' tai chi decreased for the level of pain which can be seen for the level of mild pain amounting to 17 respondents or (68%) while moderate pain levels amounted to 8 respondents or (32%).[20]

Another study conducted by Kuswardani, et al. entitled The Effect of Graston Technique and Closed Kinetic Chain Exercise on Osteoarthritis Knee Dextra: Case Report used the pretest-posttest method with a quasi-experimental approach. The intervention given was in the form of the Graston technique and closed kinetic chain exercise. Evaluation of measurements was carried out pretest-posttest, namely by: measuring pain with the Visual Analog Scale (VAS) The parameter used for pain was measuring the Visual Analog Scale (VAS) by showing a point on the pain scale line (0-10 cm). one end (0) indicates no pain and the other end (10) indicates severe pain. The results showed that the use of exercise therapy in the form of the Closed Kinetic Chain and Graston Technique was effective in increasing the range of motion of the joints, reducing pain, increasing muscle strength, and improving the participants' functional activities.[21]

A closed kinetic chain exercise is an exercise that strengthens the agonist and antagonist muscles simultaneously and is an exercise that is more focused on the lower limbs. A closed kinetic chain is performed in a standing position, this exercise must be done carefully because the knee joint supports the body weight. To reduce joint loading, the exercise is performed in a semi-flexed knee joint position. The types of exercises include squats and wall sits. Osteoarthritis is the most common joint disease.[6]

In Indonesia, the prevalence of joint disease diagnosed by health workers has increased with age. The highest prevalence is at age < 75 years. The incidence of osteoarthritis in Indonesia from 1990 to 2010 has increased. Per 100,000 men and women peak at 80 years of age. Women peaked at 1,327.4 compared to men at 907.7. Osteoarthritis knee has problems such as pain, decreased LGS, edema, and decreased muscle strength. To overcome the problems in the case of knee osteoarthritis, physiotherapy measures can be given in the form of the Graston Technique and Closed Kinetic Chain. done with the type of Closed Kinetic Chain. All types of Closed Kinetic Chain exercises can be performed with or without weights. Closed Kinetic Chain exercise provides antagonistic muscle group activation to several joint groups.[9]

The Closed Kinetic Chain program can improve balance and walking ability by increasing rotational force, and traction strength, and providing joint stability. A closed kinetic chain is a muscle strengthening exercise in the Osteoarthritis knee that can be done with the Closed Kinetic Chain type. The Kinetic Chain exercise is done with relative strength and still maintains the position. Partial squat exercise This exercise is carried out by starting in a standing position, both legs open wider than the hips and both hands can be straightforward. The subject should keep the trunk upright, concentrate on maintaining weight shift, and lower the hips as if sitting down before moving the knees. Position both knees flexed between 30° to 45°. The knee should be kept in line with the toes to prevent knee valgus and not move forward beyond the toes to ensure activation of the gluteal muscles and decreased strength at the patellofemoral joint.[13]

Osteoarthritis pain is hidden at the onset but appears progressively. This pain is a mixture of various kinds of pain/disease from several structures (bone, synovial, ligament, and muscle capsule). Patients often find it difficult to explain the pain is present at rest and that the pain increases with activity, especially with weight support. At night the pain increases (related to body temperature) resulting in increased blood flow and stimulation of pain receptors.[10]

In the American College of Sports Medicine and the American Heart Association, it is also said that physical activity is highly recommended for the elderly because it can directly improve the health of the elderly, namely by increasing joint mobility, strengthening muscles that support and protect joints, reducing pain, and reducing joint stiffness. Osteoarthritis, pain is the most common symptom. Pain is caused by thinning of the joint pads, the pain will disappear at rest. However, over time the pain will appear at rest if the osteoarthritis gets worse. If there is frequent pain even when at rest, crepitations often occur during activity, and experiencing swelling is a type of arthritis symptom. Osteoarthritis causes disability as a result of painful stimulation, stiffness in the joints, and inflammation so that daily activities are disrupted, causing impacts and affecting the lives of sufferers.[22]

According to the researchers, most of the respondents suffered from the mild knee joint pain because of the therapy that had been given in the form of physical exercise stretching exercises independently which was carried out while in the room, because the elderly felt good changes after doing the physical exercise the pain was reduced, the elderly felt comfortable, and the activities of the elderly began to increase.

Bivariate Analysis

The Effect of Closed Kinetic Chain Exercise on Reducing Knee Joint Pain Levels in the Elderly with Osteoarthritis at Tresna Werdha Budi Mulia 3 Margaguna Social Homes, South Jakarta with a statistical test p-value = 0.000.

The results of this study are in line with research conducted by Vivi Melania Sitinjak (2016) under the title the effect of rheumatic exercise on changes in the joint pain scale of the elderly with knee OA at the Sinar Abadi Nursing Home in Singkawang City in 2016 with a statistical test of P-value = 0.000 which has a value of 0.000. smaller than which is 0.05 so it shows the influence of rheumatic exercise and joint pain scale in the elderly with knee OA.[23] And another study conducted by Warih Anjari Dyah in 2018 entitled The Effect of Closed Kinetic Chain Exercise With Static Quadriceps on Increasing Functional Activity in Osteoarthritis Patients. The research method used is comparative, using a quasi-experimental approach and two groups pre and post-test two groups design. The results of the Shapiro-Wilk normality test for functional activities with $p > 0.005$ which means the data distribution is normal, then the data analysis was tested using the Paired Sample t-test. The test results show that there is a relationship between close kinetic chain and Static Quadriceps Exercise with an

increase in functional activity with a p-value of <0.05. In the different effect tests, the results show that the close kinetic chain has more effect on increasing functional activity.[24] Research conducted by Dedi Firmasyah in 2018 showed that the Friedman test results from the data above obtained p = 0.000 where p = <0.005 so it can be concluded that there is an effect of knee joint motion exercise in the elderly who experience osteoarthritis in the Work Area of the Pengasih 1 Health Center Kulon Progo Yogyakarta.[17]

In Lasaara's research (2018), the results of the isometric exercise intervention showed a decrease in pain scale in the treatment group by 1.6 after exercise, while in the control group the average pain reduction was 0.190. These results indicate a decrease in pain in patients with knee osteoarthritis with a p-value of 0.002. Based on the results of Lasaara's research (2018), it was found that isometric exercise carried out for 4 (four) weeks with a frequency of twice a week was effective in reducing pain in knee osteoarthritis patients, with a decrease in pain of 1,690. Patients who were given isometric exercises not only experienced a decrease in pain but also reduced stiffness in the joints around the knee.[25] The research of Varghese, Rani, and Bhardwaj (2016) explains that isometric exercise performed once a day with a frequency of once a week and a duration of 20 (twenty) minutes can reduce pain by 1.72. which is most appropriate to use for osteoarthritis patients because this exercise causes the least pressure, and intra-articular inflammation, this exercise is also easy to do.[26]

Osteoarthritis is a degenerative disease of the knee joint due to the abrasion of joint cartilage and the formation of new bone on the joint surface which can cause muscle and tendon weakness, limiting movement and causing pain. Osteoarthritis attacks the knee joint which causes the knee to become abnormal, the knee is a supporter of the body so when experiencing osteoarthritis it will result in disruption of the patient's activities. The Osteoarthritis Research Society International Disease State Working defines osteoarthritis as a progressive disease that describes the failure to repair joint damage, this condition is triggered by abnormal intra-articular stress.

Joint pain in patients with OA is included in the category of deep somatic pain where these pain receptors are located in muscles and bones and other body supports. The body has natural neuromodulators that can inhibit the transmission of pain impulses, one of which is beta-endorphins. According to the American Geriatric Society, physical exercise such as stretching three times a week significantly improves the health of arthritis patients, including OA. Physical exercise can stimulate an increase in the release of endorphins. Endorphins provide an analgesic effect by blocking the process of releasing substance p from sensory neurons so that the transmission of pain impulses in the spinal cord is inhibited and pain sensation is reduced.

Several factors that affect joint pain that occur in the elderly include the level of education and physical activity. The level of education will affect the understanding of the knowledge gained. The elderly with a low level of education are more at risk of experiencing arthritis pain. Knowledge plays an important role in improving the health status of the elderly, including its relation to arthritis, this will affect the elderly in the management of arthritis management34. Another factor is physical activity or exercise that will train the body to move so that it can have an impact on the production of synovial joint fluid which functions as a lubricant and prevents friction in the joints which can cause pain. Activity will also activate the immune system and prevent inflammation in the joints which has one of the signs and symptoms in the form of joint pain.[16]

Research by Iversen et al (2013) explains that moderate-intensity exercise can be done routinely 2 times a week to reduce joint pain91. Ayu's research (2012) found that 15 people who experienced joint pain after doing elderly exercise for 15-45 minutes were effective in

reducing joint pain.[27] Marlina (2015) stated that knee exercises are effective in reducing pain intensity in osteoarthritis patients, knee exercises are carried out twice a day for four weeks.[28] Research by Peungsuwan et al (2014) states on the contrary that exercises performed to reduce pain in osteoarthritis sufferers will be effective if carried out for a long period, namely for 2 months. Researchers concluded that frequent knee joint motion exercises will have a positive impact on reducing knee joint pain levels in the elderly with osteoarthritis.[29]

Active motion exercise is to move each joint maximally and freely without causing pain. Active motion exercise is a series of movements to expand the range but does not cause pain. The movements implemented in this study are movements that are often carried out daily. Any movement in the joints will cause an increase in blood flow in the joint capsule. The active motion applied in this study is based on the open kinetic chain technique, the initial concept of the kinetic chain published by Reuleux in 1875, which studies various types of movement, the series of movements are generated from several segments that are interconnected through a joint where this will be a system to allow the movement of one segment in one joint or several segments followed by other joints.

In an open kinetic chain, the distal segment only moves one joint without movement in the proximal segment. For example, the open kinetic chain movement is swinging the legs when walking, kicking or throwing a ball, and swinging the arms when walking. Kachanathu (2013) in his article entitled Open or Closed Kinetic Chain Exercise After Anterior Cruciate Ligament Reconstruction states that the difference between open and closed kinetic chain exercise is in the load force that is transmitted to the knee joint (single joint) while in the closed kinetic chain the load is transmitted to the knee joint (single joint). ankle, knee, and hip joints (multiple joints).[30]

Physical activity in the form of knee joint motion exercises will reduce the sensation of pain in the joints. Physical activity can improve the quality of life of arthritis sufferers. In addition, physical activity will have a positive effect on muscle strength and function, as well as mood in the elderly. Physical activity in the form of knee joint motion which is proven to reduce joint pain, 70% of respondents have a joint pain scale of 3 (mild pain) and 30% of respondents have a joint pain scale of 2 (mild pain) after intervention in the form of knee joint motion exercises during 4 weeks.[31]

Pain in patients with grade I and II osteoarthritis can be reduced by doing exercises such as Range of Motion (knee extension flexion), strengthening exercises, and aerobics. Exercise can reduce pain in knee osteoarthritis patients because with exercise there will be physiological stress which will increase the formation of proteoglycans by mature cartilage cells, increase muscle strength so that it can support the load on the joint area, increase synovial joint fluid metabolism which will provide nutrition to the surrounding cartilage.[31]

One form of osteoarthritis management is non-pharmacological therapy with knee joint motion exercises. Knee joint motion exercises are defined as the maximum possible movement of a joint without causing pain in the joint area. The purpose of knee joint motion exercises is to maintain or maintain muscle strength, maintain joint mobility, stimulate blood circulation, and prevent deformities.

The mechanism of pain reduction can be explained by gate control theory, namely pain intensity is reduced by blocking pain transmission at the gate, and by endorphin theory, namely decreasing pain intensity is influenced by increasing levels of endorphins in the body. Knee joint motion exercises can stimulate A-beta fibers which are abundant in the skin, so they can deliver impulses more quickly. This continuous stimulation of exercise makes the input of impulses dominant from A-beta fibers so that the gate closes and pain impulses cannot be

transmitted to the cerebral cortex to be interpreted as pain. In addition, endorphins which are natural morphine in the body can block the transmission of pain and the perception of pain does not occur so that the intensity of the pain felt is decreased.[4]

The benefits of physical exercise are joint mobility and strengthening muscles that support and protect joints, reduce joint pain and stiffness, and can reduce swelling. 96 Active range of motion exercise is a series of physical movements carried out to heal or improve the patient's quality of life, manage the disease, and delay or eliminate the complications it will cause. The use of physical activity as a therapeutic effort cannot stand alone but is complementary to other therapeutic efforts such as seating arrangements and conventional medicine which have proven roles.[32]

Giving active exercise aims to improve joint stability and strength of the muscles around the knee, especially the Quadriceps, especially in the m. vastus medialis because this exercise is useful for reducing irritation that occurs on the surface of the patellar articular cartilage, maintaining and increasing active stability in the knee joint, and can maintain synovial nutrition for the better. With repeated movements in this exercise, there will be an increase in the work of the muscles around the joints thereby accelerating blood flow so that metabolism also increases so that metabolic waste will be carried away by the blood flow so that pain is reduced.

According to researchers, this study can have a significant effect because one of the disorders caused by pain is a decrease in muscle strength, which can be prevented by providing exercises. Various physical exercise exercises can be used to prevent muscle stiffness or increase muscle strength, including close kinetic chain exercise therapy. Closed kinetic chain exercises refer to movements that occur in a closed kinematic chain in which the body moves, for example, lower body movements such as wall sits to increase the strength and flexibility of the knee muscles.[33]

A close kinetic chain is very useful for training lower leg muscles, especially to improve functional ability. Because in principle Closed Kinetic Chain exercise is an exercise that strengthens the agonist and antagonist muscles simultaneously and is a more physiological exercise for the lower limbs, and the role of each muscle itself is for the quadriceps muscle as an eccentric contract to control knee flexion or contract. concentrically to extend the knee, hamstrings, and soleus to stabilize the tibia. The closed Kinetic Chain movement technique is a motion exercise according to the anatomy of the knee joint, namely flexion-extension motion and motion intended for daily activities (Activity daily living or ADL) such as squatting standing, and toileting. Good flexibility and muscle strength will support the ability to move in carrying out daily activities. Flexibility plays an important role for all age levels in supporting Squat Exercise with Progressive Resistance Exercise (PRE) for Osteoarthritis (OA) sufferers in their daily life activities. This is what causes an increase in functional activity in patients with OA, with increased muscle strength and flexibility, so achieving LGS values with increased muscle strength helps in moving body functions.

Physiotherapy has an important role in the management of pain complaints caused by knee osteoarthritis. The role of physiotherapy that can be done to reduce pain in cases of knee osteoarthritis includes using modalities in the form of Infra-Red, Ultrasound, Microwave Diathermy, Short Wave Diathermy, Transcutaneous Electrical Nervus Stimulation (TENS), and Exercise. Many exercises can be used for exercise therapy for patients with knee osteoarthritis, one of which is a closed kinetic chain. A closed kinetic chain is a closed chain relationship in which joint movement simultaneously results in the movement of other joints of the extremity. So both the proximal and distal parts contract at the same time, and can increase joint stability, increase muscle strength and reduce pain.[5]

Conclusions

Based on the results of the research and discussion described in the previous chapter, the authors can conclude that most of the respondents are aged 60-70 years and 75-90 years old. Before the intervention, the average respondent suffered from a moderate knee joint pain scale of 4.9308. After being given the intervention, the average respondent suffered from a mild knee joint pain scale of 3.8475. The average difference in the degree of knee joint pain before and after being given closed kinetic chain action was 1.08333. There was a significant effect of giving closed kinetic chain action to decreasing the scale of knee joint pain with osteoarthritis.

Conflict of Interest Declaration

The researcher states that this research is free from conflicts of interest, both individuals and organizations

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