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The Effect of Hydrotherapy Exercise on Pain Intensity and Functional Ability in Genu Osteoarthritis Patients

Alda Trie Amelia[1]*, Nyimas Fatimah[1], Margareta Dewi Dwiwulandari[1]

[1] Faculty of Medicine, Universitas Sriwijaya, Palembang, Indonesia

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***Corresponding author:**
Alda Trie Amelia

E-mail address:
aldatrieamalia@gmail.com

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ABSTRACT

Background: Genu osteoarthritis (OA) is the most common arthritis disease caused by a degenerative joint process that causes knee pain and functional disorders. One of the recommended therapies for the treatment of OA genu from several studies is hydrotherapy exercises. Hydrotherapy exercises can reduce pain and improve the patient's quality of life. This study aims to determine the effect of hydrotherapy exercises on pain intensity and functional ability in OA genu patients. **Methods:** This study is a quasi-experimental study with a one-group pretest-posttest design conducted by the Medical Rehabilitation Installation of dr. Mohammad Hoesin Palembang during the month of October-November 2019. Primary data was collected using interviews to assess pain intensity based on the Numerical Paon Rating Scale (NPRS) score and functional ability based on the WOMAC (Western Ontario and McMaster Universities Osteoarthritis Index) questionnaire before and after training. hydrotherapy for 4 weeks for one therapy a week. The data was carried out by the Shapiro-Wilk normality test, then analyzed using the paired T-test or Wilcoxon test using the SPSS tool. **Results:** In as many as 31 study subjects, the results showed that there was a significant effect before and after hydrotherapy exercises on reducing pain intensity (p = 0.000) and improving functional ability (p = 0.000) in patients with OA genu for 4 weeks. **Conclusion**: There is an effect of hydrotherapy exercise on pain intensity and functional ability in genu osteoarthritis (OA) patients.

1. Introduction

Osteoarthritis (OA) is one of the most common types of arthritis. The prevalence of OA is quite high, especially in the elderly, and is a major cause of disability in the elderly.[1] According to the American College of Rheumatology (ACR), osteoarthritis is a degenerative joint disease that can affect two-thirds of people over the age of 65. In Indonesia, the prevalence of OA that occurs at the age of 61 years was found to be 5%, then in the radiographic knee, joint OA cases, namely 15.5% in men and 12.7% in women.[2] Osteoarthritis is a chronic disease characterized by joint pain, joint stiffness in the morning, limited joint movement, crepitus, joint swelling, and varying degrees of local inflammation.[3] Characteristic in OA shows a thickening of the joint capsule, progressive cartilage loss, and osteophyte formation that leads to disability.

Currently, the goals of treatment in OA patients are to reduce symptoms, prevent further disease progression, and improve the patient's quality of life.[4] OA therapy is symptomatic which includes education, control of risk factors, physiotherapy intervention exercises, and pharmacological therapy. If necessary, in the advanced phase of surgery, exercise therapy is the essence of osteoarthritis management because it has no side effects.[5]

OA exercise therapy can be done in two options, namely hydrotherapy exercises or land-based exercise (ground exercises). Hydrotherapy exercises are often

recommended as a treatment option for the elderly population because they are performed in a safer and less risky environment than ground exercises.[6] Hydrotherapy exercises are exercises that are carried out in the water and have been used in therapeutic therapy for more than 18 years. Hydrotherapy exercises are carried out in three phases of training, namely warm-up (warm-up), core movement, and cooling down (cooling). The time needed for hydrotherapy exercises is about 65 minutes with a different portion of the time for each phase. Hydrotherapy exercises have various advantages, namely improving blood circulation, easing soft tissue contractures, relieving muscle spasms, increasing muscle strength and the ability to float in the water can reduce the likelihood of injury and protect against joint loss.[7,8]

Patients with knee OA who underwent hydrotherapy exercises showed a significant improvement in the performance of the knee muscles such as knee flexor and extensor strength, knee flexor ability, and knee extensor resistance. Hydrotherapy exercises are recommended in knee OA therapy because of the characteristics of water, especially bouyancy (water buoyancy) which has the potential to reduce joint load and hydrostatic pressure, and water temperature can also reduce pain in the joints.[9]

Based on previous research and findings, it was found that there is still little research in Indonesia regarding the effect of hydrotherapy exercises on pain intensity and functional ability in genu osteoarthritis (OA) patients. Therefore, it is necessary to do more research on the effects of hydrotherapy exercises.

2. Methods

This study uses primary data, namely by interviewing and filling out a questionnaire on genu osteoarthritis (OA) patients who undergo hydrotherapy training at the Medical Rehabilitation Installation of dr. Mohammad Hoesin Palembang. Measurements in the study were seen based on pain intensity and functional ability of daily activities in the pre-test and post-test groups undergoing hydrotherapy exercises.

The measurement uses the NPRS score (Numerical Pain Rating Scale) and the WOMAC (Western Ontario and McMaster Universities Osteoarthritis Index) questionnaire.

This type of research is a quasi-experimental study with a one-group pretest-posttest design, in which the researcher measures the intensity of pain and functional ability in a group of research subjects. In this research design, the researcher gave a pretest before the intervention, then given the intervention, namely hydrotherapy exercises, and after the intervention was given a posttest.[10]

The research was conducted from July to December 2019 at the Medical Rehabilitation Installation of dr. Mohammad Hoesin Palembang.

The population in this study were all knee osteoarthritis (OA) patients undergoing hydrotherapy exercises at the Medical Rehabilitation Installation of dr. Mohammad Hoesin Palembang for the period from October to November 2019.

The samples in this study were all knee osteoarthritis (OA) patients undergoing hydrotherapy exercises at the Medical Rehabilitation Installation of dr. Mohammad Hoesin Palembang for the period from October to November 2019 met the inclusion criteria and did not meet the exclusion criteria.

Inclusion criteria were all patients with a diagnosis of knee osteoarthritis (OA) at the Medical Rehabilitation Installation of dr. Mohammad Hoesin Palembang. Knee OA patients who will undergo hydrotherapy exercises at the Medical Rehabilitation Installation of dr. Mohammad Hoesin Palembang. Knee OA patients are more than 30 years old. Patients were willing to participate in the research.

Exclusion criteria were patients who were unwilling to participate in the study. Deaf and mute patients. Patients with functional disabilities, such as Low Back Pain and Nucleosus Pulposus Hernia (HNP) undergo hydrotherapy exercises. Patients who have contraindications to hydrotherapy exercises, including open wounds, skin diseases, uri and alvi incontinence, neurological fractures or trauma, instability conditions

in the cardiovascular and respiratory systems, fever and infection

Drop Out criteria are patients who experience serious illness during the study. Patients withdrew from the study for some reason. The patient did not undergo twice the amount of therapy.

The independent variable in the research is hydrotherapy exercise. Bound variables are pain intensity and functional ability.

The data collected from the results of this study were then processed and analyzed using the Statistical Package for the Social Sciences (SPSS) 24.0 for Windows program and presented in tabular form and will be explained in a narrative as follows.

Univariate analysis is intended to obtain an overview of the frequency distribution of the research variables. The distribution of frequencies and percentages is described as a categorical scale. Meanwhile, the mean value, standard deviation, minimum value, and maximum value are described as numerical scale data. The results of the univariate analysis are presented in tabular form and narrated in paragraph form.

Bivariate analysis was carried out to determine the effect of the independent variable on the dependent variable by looking at the mean difference of one paired data group (before and after the intervention) so that the Paired T-Test was used. To use the Paired T-Test, the normality test must be done first. This study used the Shapiro-Wilk normality test (n <50). If normally distributed data were obtained (p value> 0.05) it would be statistically tested using the Paired T-Test. However, if the data are not normally distributed (p-value <0.05), it will be tested with Wilcoxon. The statistical decision if the p value> α indicates no difference in the mean value of NPRS and WOMAC before and after undergoing hydrotherapy exercises. Meanwhile, if p<α indicates that there is a difference in the mean value of NPRS and WOMAC before and after undergoing hydrotherapy exercises.

The data presented include a univariate analysis consisting of age and gender characteristics, the frequency distribution of pain intensity using the NPRS score (Numerical Pain Rating Scale), and functional ability using WOMAC (Western Ontario and McMaster Universities Osteoarthritis Index). Then, the results of the bivariate analysis in the form of a comparison of the values of pain intensity and functional ability in the group before and after undergoing hydrotherapy exercises for 4 weeks.

3. Results

The distribution of Age and Gender is the distribution of research subjects based on age and sex can be seen in table 1. This study shows that OA genu patients who came to the Medical Rehabilitation Installation in October-November 2019 obtained an age range of 41-80 years and the most at age. 51-60 years, as many as 10 people (32.3%) from 31 research subjects. Furthermore, 4 people aged 41-50 years (12.9%), aged 61-70 years were 7 people (22.6%), ages 71-80 years were 9 people (29.0%), and ages 81- 90 years as many as 1 person (3.2%) from 31 research subjects.

Based on gender, it was found that most of the OA genu patients were female, namely 23 people (74.2%), while the rest of the male gender was 8 people (25.8%) from 31 study subjects.

The measurement of pain intensity in genu osteoarthritis patientsundergoing hydrotherapy exercises used the Numerical Pain Rating Scale (NPRS) score. The NPRS score is measured by a numerical scale ranging from 0 to 10, which aims to measure the pain symptoms in genu osteoarthritis patients. The measurement of pain intensity in the study was carried out twice, namely before and after undergoing hydrotherapy exercises for 4 weeks.

Table 2 shows that the 31 research subjects measuring pain intensity before undergoing hydrotherapy exercises for 4 weeks had a mean value of 6.45 on a total scale of 10 with the smallest to the greatest value ranging from 3 to 10, the standard deviation value was 1.670 and the median value was Measurement of pain intensity after undergoing

hydrotherapy exercises for 4 weeks had a mean value of 3.94 from a total scale of 10 with the smallest to largest value ranges of 1-7, the standard deviation value of 1.209 and the median value of 4.

This study showed that of the 31 study subjects experienced a decrease in the pain intensity scale with the measurement of the NPRS score so that there was a reduction in pain symptoms in genu osteoarthritis patients before and after undergoing hydrotherapy exercises for 4 weeks.

Table 3 shows that the difference in the measurement of pain intensity before and after undergoing hydrotherapy exercises for 4 weeks has a mean value of 2.52 on a total scale of 10 with the smallest to a largest value ranging from 1 to 6, and the standard deviation value is 1.180.

Measurement of functional ability in patients with OA genu undergoing hydrotherapy exercises using the WOMAC (Western Ontario and McMaster Universities Index). WOMAC is a scale that is assessed from the level of daily ability in patients with osteoarthritis genu which includes symptoms of pain, stiffness, and level of difficulty in daily activities. The measured WOMAC ranges from 0 to 100 and the highest scale indicates that the scale is the toughest for patients with OA genu. Measurement of functional ability in the study was carried out twice, namely before and after undergoing hydrotherapy exercises for 4 weeks

Table 4 shows that of the 31 research subjects on the measurement of functional ability before undergoing hydrotherapy training for 4 weeks, the mean value was 43.48 on a total scale of 100 with the smallest to largest value range being 15-74, the standard deviation value of 18.053 and the median value of 45. This study shows that of the 31 research subjects on the measurement of functional ability after undergoing hydrotherapy exercises for 4 weeks, the mean value is 25.68 on a total scale of 100 with the smallest to the largest value range of 7-48, the standard deviation value of 12.849 and the median value. 26.00.

Table 5 shows that the difference in the measurement of functional ability before and after undergoing hydrotherapy exercises for 4 weeks has a mean value of 17.81 on a total scale of 100 with the smallest to a largest value ranging from 3 to 65, and the standard deviation value is 10.971.

To perform a statistical analysis test of the difference in the mean value of pain intensity (NPRS) in the group of research subjects before and after hydrotherapy exercises that lasted for 4 weeks, a normality test must be performed first.

In the results of the Shapiro-Wilk normality test (n <50), the p-value before (p = 0.029) and the p-value after (p = 0.038) were obtained, which means that the NPRS data is not normally distributed (p <0.05) can be seen in table 6.

The Wilcoxon test results showed that the value of pain intensity (NPRS) in patients with OA genu before and after undergoing hydrotherapy exercises for 4 weeks obtained a value of p = 0.000 (p <0.05). There is a significant difference in the pain intensity value before and after undergoing hydrotherapy exercises. This means that hydrotherapy exercises can have an effect on reducing pain symptoms in patients with OA genu.

Table 1. Distribution of research subjects by age and gender

Variable	N	%
Age		
41 – 50 years	4	12.9
51 – 60 Years	10	32.3
61 – 70 Years	7	22.6
71 – 80 Years	9	29.0
81 – 90 Years	1	3.2
Sex		
Male	8	25.8
Female	23	74.2

Table 2. Distribution of research subjects based on pain intensity (NPRS) before and after hydrotherapy exercises

Variable	Category	Min	Max	Median	Average	Standard Deviation
NPRS	Before	3	10	6	6.45	1.670
NPRS	After	1	7	4	3.94	1.209

Table 3. Distribution of research subjects based on the difference in pain intensity (NPRS) before and after hydrotherapy exercises

Min	Max	Average	Standard Deviation
1	6	2.52	1.180

Table 4. Distribution of Research Subjects based on Functional Ability (WOMAC) before and after hydrotherapy exercises

Variable	Category	Min	Max	Median	Average	Standard Deviation
W OMAC	**Before**	15	74	45.00	43.48	18.053
W OMAC	**After**	7	48	26.00	25.68	12.894

Table 5. Distribution of Research Subjects based on Difference in Functional Ability (WOMAC) before and after hydrotherapy exercises

Min	Max	Average	Standard Deviation
3	65	17.81	10.971

Table 6. Normality test of the NPRS before and after

NPRS	N	*Shapiro-Wilk*	P-value
Before	31	0.924	0.029
After	31	0.928	0.038

4. Discussion

The results of this study showed genu osteoarthritis (OA) patients who came to the Medical Rehabilitation Installation of Dr. Mohammad Hoesin Palembang in October-November 2019obtained an age range of 41-80 years and the most at the age of 51-60 years, namely 10 people (32.3%) from 31 study subjects. that the prevalence of OA genu in Palembang mostly occurred at the ages of 56-60 years and 50-59 years.[11] Which states that 25% of people over 55 years of age can show

episodes of knee pain that persist in the same time period. About 10% of people over the age of 55 have painful genu OA and one-fourth of people have a severe disability.[12]

Based on gender, it was found that most of the OA genu patients were female, namely 23 people (74.2%), while the rest of the male gender was 8 people (25.8%) from 31 study subjects. The results of this study are the same as the research that most of the patients with OA genu occurred in women than men.[13] This study also supports that OA is found in women, namely 85.7%. This is related to risk factors for OA disease in women due to the presence of hormonal factors that can affect the pathogenesis of OA.[14] It is the same as stated in other studies that women aged ≥ 55 years tend to develop OA genu, especially after entering menopause.[15]

The results obtained from 31 research subjects showed that the mean value of NPRS was before 6.45 ± 1.670 and the mean value of NPRS was after 3.94 ± 1.209. The mean value of NPRS before 6 is in the medium NPRS category (NPRS 4-6), while the mean value of NPRS after 3 is in the mild NPRS category (NPRS 1-3). This indicates that there is a decrease in pain intensity in OA genu patients who after undergoing hydrotherapy exercises compared to before.

Based on the Wilcoxon test results showed that the value of pain intensity (NPRS) in OA genu patients before and after undergoing hydrotherapy exercises for 4 weeks obtained a value of p = 0.000 (p <0.05). This is a significant mean difference in the value of pain intensity before and after undergoing hydrotherapy exercises. This means that hydrotherapy exercises can have an effect on reducing pain symptoms in genu osteoarthritis (OA) patients.

The results of this study are consistent with the results but differ in the duration of the study which was conducted for 4 weeks. Nonetheless, this can result in a significant reduction in pain intensity.[16] Hydrotherapy exercises can reduce pain symptoms in osteoarthritis genu.

This is due to the bouyancy effect (water buoyancy) which can reduce pain in the knee.[17] The research supported that the pain reduction in OA genu was caused by the temperature and water pressure in the Hydrotherapy Pool. In addition, another most important characteristic of hydrotherapy exercises is the bouyancy effect, which is also able to reduce the load while pressing on the lower limbs so that it can reduce pain and is carried out effectively in muscle and joint exercises.[18]

From the results of the study, 31 research subjects were taken in OA genu patients who underwent hydrotherapy exercises for 4 weeks at the Medical Rehabilitation Installation of dr. Mohammad Hoesin Palembang obtained the mean value of WOMAC before 43.48 ± 18.053 and the mean value of WOMAC after 25.68 ± 12.849. The mean value of WOMAC before 43.48 is in the moderate category (40% - <70%) and the mean value of WOMAC after 25.68 is in the mild category (0 - <40%). This means that there is a decrease in the WOMAC value before and after undergoing hydrotherapy exercises. This means that there is an improvement in functional ability which includes reduced pain symptoms, stiffness symptoms, and the level of difficulty in OA patients after undergoing hydrotherapy exercises than before undergoing hydrotherapy exercises.

After being analyzed based on the Paired T-Test, the WOMAC results before and after had a value of p = 0.000 (p <0.05), this means that there is a significant mean the difference between before and after hydrotherapy exercise on functional ability. (WOMAC). That is, hydrotherapy exercises have an effect on functional ability (WOMAC) in patients with OA genu. The results of this study are consistent with the results of research conducted but differ in the duration of the hydrotherapy exercises performed. Different from previous studies, this study was conducted for 4 weeks for one therapy due to limited research time. However, this study provides significant results in improving functional abilities.[19,20,21]

Joint stiffness can be reduced with hydrotherapy exercises, this may be due to the warm water

temperature of the hydrotherapy pool. Warm water temperatures also promote muscle relaxation, thereby reducing guarding around the joints and increasing movement.[22] It is known that OA genu patients who undergo hydrotherapy exercises show an increase in muscle strength, flexibility in the legs, and quality of life after hydrotherapy exercises. Increased muscle strength can also be caused by water resistance during exercise in hydrotherapy pools.[23]

Other studies have also stated that hydrotherapy exercises on OA genu are the most important for improving balance control and reducing the risk of falls. This is due to the presence of water resistance and the bouyancy effect in increasing exercise ability in OA genu patients.[24] The study showed that hydrotherapy exercises were able to improve quality of life and functional ability with a marked reduction in WOMAC scores similar to other studies.[25]

5. Conclusion

A quasi-experimental study has been conducted, namely on the effect of hydrotherapy training on pain intensity and functional ability in genu osteoarthritis (OA) patients at the Medical Rehabilitation Installation of dr. Mohammad Hoesin Palembang based on the results of interviews and questionnaires with 31 research subjects, can be concluded as follows.

Measurement of pain intensity using the NPRS scale in OA genu patients who underwent hydrotherapy exercises for 4 weeks, the mean value of NPRS before 6.45 ± 1.670 is in the moderate NPRS category (NPRS 4- 6) and the mean value of NPRS after 3.94 ± 1.209 is a category NPRS is light (NPRS 1-3).

Measurement of functional ability using WOMAC in OA genu patients who underwent hydrotherapy exercises for 4 weeks, the mean value of WOMAC before 43.48 ± 18.053 was in the moderate category (40% - <70%) and the mean value of WOMAC after 25.68 ± 12.849 was included in the category mild (0- <40%). There is an effect of hydrotherapy exercises on pain intensity ($p < 0.000$) and functional ability ($p < 0.000$) in genu osteoarthritis patients at the Medical Rehabilitation Installation of dr. Mohammad Hoesin Palembang.

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