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The effectiveness of combination of massage therapy and heat therapy towards reducing pain and increasing range of motion (rom) knee injury

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Abstract
Knee injuries are common in both the general public and sportsmen. This study aims to examine the effectiveness of the combination of massage therapy and heat therapy on reducing pain and increasing range of motion (ROM) of the knee joint after knee injury. This study used a pre-experimental design with a one group pretest - posttest design. The population in this study were patients with knee injuries who came to the Clinic for Sports Injury Therapy and Fitness. The sampling technique used purposive sampling with a span of 1 month and obtained a sample of 24 people. Subjects received massage therapy treatment which was carried out for 20 minutes, followed by heat therapy for 10 minutes. The instrument used to measure the pain scale was using the Numeric Rating Scale (NRS) and the joint space or Range of Motion (ROM) using goniometry. The data analysis technique used quantitative descriptive, hypothesis testing using the Wilcoxon signed rank test to test data that were not normally distributed with a significance level of 5%. The results of the data analysis showed the Wilcoxon signed rank test analysis showed the pretest flexion ROM value experienced by the subject was 110.0 - 139.0 with an average of 129.8 and a standard deviation of 7.22. While the posttest Flexion ROM value experienced by the subject with an average of 135.4 and a standard deviation of 4.15. The standardised Z value is -4.118 (based on negative rank) with a significance value of 0.000. The pretest extension ROM experienced by the subjects was 0 - 25 with a mean of 5.95 and a standard deviation of 5.27. While the posttest extension experienced by the subject with an average of 1.95 and a standard deviation of 1.82. The standardised Z value was -3.778 (based on negative rank), with a significance value of 0.000. Based on the results of the research that has been obtained, it can be concluded that the combination of massage and heat therapy can effectively reduce pain significantly ($p < 0.05$), with the effectiveness of reducing flexion pain by 51.87%, decreasing extension pain by 53% and increasing ROM. significantly ($p < 0.05$), with the effectiveness of increasing flexion ROM by 4.9%, increasing extension ROM by 67%.
Keywords: Massage therapy, Heat therapy, Pain, Range of motion and Knee injury

INTRODUCTION

Injury is a problem that affects human activities, both athletes and the general public. Humans as biopsychological and social beings, they perform activities based on their own needs, thus performing different activities for each individual (Bahrudin, 2017; Setyawati, 2013; Arovah, 2009). The knee joint is part of a very strong and complex inferior limb. Its job is to provide strength, support and flexibility when standing, walking and bending. The knee joint is a hinge joint that allows the leg to move in one direction by flexion and extension (Sahrudi, 2022). Anatomically the knee joint is the largest joint in the human body. The knee joint consists of the tibiofemoral joint, patellofemoral joint, and proximal tibiofibular joint (Bisa, 2018). The knee joint is a joint that supports most of the body's weight as well as a means of ambulation so that this makes the knee joint vulnerable to injury (Sjarwani et all, 2016: 180). Knee injuries characterised by pain are quite common injuries. According to WHO 2008, there are 151 million people worldwide suffering from joint pain. It is a very common condition experienced

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by many people, especially those who do a lot of physical activity by resting on the knees and feet. (Rohim & Kushartanti, 2017).

Pharmacological treatment is the administration of painkillers that act as painkillers, while non-pharmacological treatment is given with various types of treatment such as acupuncture, hot compresses, cold compresses, heat therapy, masasse therapy and others. One of the most popular non-pharmacological treatments is manual masasse therapy which is currently being combined with heat therapy or thermotherapy. Masasse therapy is a manual therapy used to help someone who is exhausted, injured, or treating the body. Manipulating masasse with hands on the surface of the skin to reduce muscle tension, reposition joints and increase blood flow will make the body feel healthy, fit, comfortable and can reduce inflammatory processes such as heat, redness, swelling, pain, and ROM disorders. (Jodi & Kushartanti, 2019; Kisner, Rustiasari, 2017; C & Allen, 2007).

Combining several therapeutic modalities can be an option in injury rehabilitation efforts, in several studies it has been proven that the use of several combinations of therapies can be more effective than the use of one therapeutic modality. In this study, the combination of masage therapy and heat therapy in an effort to heal knee injuries. Heat therapy and masage therapy have the same function of improving blood circulation and relaxing the muscles which will reduce pain. Heat therapy has the effect of increasing metabolism, increased blood flow can help supply protein, nutrients, and O2 to the injured area. By increasing metabolism, it will reduce pain levels. Heat therapy also has a physiological effect, namely muscle elasticity. Muscle elasticity, muscle relaxation, and joint stiffness will support joint repositioning which will reduce pain and increase the ROM of knee injury sufferers. Based on these problems, the researcher wishes to further examine the effectiveness of the combination of massage and heat therapy to reduce pain and increase ROM in knee injuries in patients of the Sports and Fitness Injury Therapy House.

METHOD

This study used a pre-experimental with Pretest-Posttest design to assess or measure the success rate of the combination of masage therapy and heat therapy at the Rumah Terapi Cedera Olahraga dan Kebugaran clinic. This study used a descriptive quantitative approach which is used to describe the results of the success rate of the combination of masage therapy and heat therapy at the Rumah Terapi Cedera Olahraga dan Kebugaran clinic.

The population and sample of this study were patients who had knee injuries who lived in the Special Region of Yogyakarta. The sample was taken by purposive sampling method for one month (29 July - 30 August 2022) at the Rumah Terapi Cedera Olahraga dan Kebugaran clinic and obtained a sample of 24 people. The characteristics or criteria used in this study are general people or sportsmen who meet the following criteria: 1. Inclusion Criteria a. Willing to be a research subject b. The injury has been more than 1 week or has entered the chronic phase c. Still feels pain and discomfort when using daily activities 2. Exclusion Criteria a. Acute knee injury b. There is still swelling c. There is an open wound. Sprain level III, the knee joint feels swaying when walking e. Fracture or fracture, feels very painful when holding the fracture and changes in the anatomical shape of the knee joint.

The instrument used to measure the pain scale was using the Numeric Rating Scale (NRS) and the joint space or Range of Motion (ROM) using goniometry. The data analysis technique used quantitative descriptive, hypothesis testing using the Wilcoxon signed rank test to test data that were not normally distributed with a significance level of 5%.

RESULT AND DISCUSSION

Result

Description of research results based on the following variables.

a. Pain Scale

Causes of Injury Overuse Impact Trauma The scale or level of pain in this study was measured using NRS (Numeric Rating Scale) with a range of numbers between 0 - 10. The number zero indicates no pain and the number ten indicates the heaviest pain felt. The average results and standard deviation of pain scale examination of 24 research subjects before and after treatment are presented in the table below:

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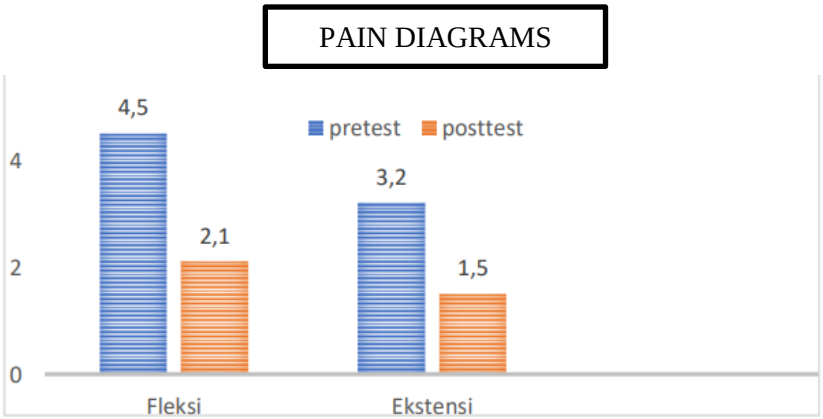
Table 1. Results of Pretest - Posttest Pain Scale Data Analysis

Variable	Pre test		Post test		Decrease
	Mean	SD	Mean	SD	
Flexion	4,5	2,6	2,1	1,6	2,4
Extention	3,2	2,4	1,5	1,5	1,7

The difference in the mean values of the pretest and posttest pain scales in the administration of massage followed by heat therapy can be seen in the following diagram:



b. ROM

Descriptive statistical data analysis of ROM pretest and posttest values for both flexion and extension movements is presented in the table as follows.

Table 2. Results of Descriptive Analysis of Pretest - Posttest ROM Data

Variable	Pre test		Post test		Increase
	Mean	SD	Mean	SD	
Flexion	129	7,2	135	4,1	6,4
Extention	5,9	5,2	1,9	1,8	4

Normality Test Based on the results of data processing using SPSS Statistic 20 software is as follows.

Table 3. Normality Test Results with Shapiro Wilk

No	**Variable**	**P Value**	**Distribution**	**Test**
1	Pre Test Flexion Pain	0,223	Non Normal	Wilcoxon
2	Pre Test Extention Pain	0,047	Non Normal	Wilcoxon
3	Post Test Flexion Pain	0,036	Non Normal	Wilcoxon
4	Post Test Extention Pain	0,002	Non Normal	Wilcoxon
5	Pre Test ROM Flexsion	0,001	Non Normal	Wilcoxon
6	Pre Test ROM Extention	0,000	Non Normal	Wilcoxon
7	Post Test ROM Flexsion	0,015	Non Normal	Wilcoxon
8	Post Test ROM Extention	0,000	Non Normal	Wilcoxon

Based on the table above, it is known that all test results with the Shapiro Wilk test, the variables are not normally distributed because they have a significance value of $p < 0.05$ ($p > 0.05$). The results of the data analysis of this study are as follows:

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Inferential Statistical Analyst Test Hypothesis testing in this study used non-parametric statistical analysis of Wilcoxon signed rank test. The hypothesis proposed in this study is the combination of masage and heat therapy on the healing efforts of knee injuries. Hypothesis accepted if the value of Asymp. Sign < 0.05 (p 0.05 (p>0.05).
The results of the data analysis of this study are as follows:

a. Pain Scale

Table 4. Pretest - Posttest Pain Scale Data Wilcoxon Signed Rank Test Results

Pain Variable	N	Mean	SD	Minimum Value	Maximum Value	Z Value	Asymp. Sig
Flexion Pre Test	24	4,54	2,62	0,00	9,00	-4,092	0,000
Flexion Post Test	24	2,16	1,68	9,00	5,00		
Extention Pre Test	24	3,25	2,47	0,00	6,00	-3,827	0,000
Extention Post Test	24	1,50	1,58	0,00	5,00		

The range of motion flexion pain scale pretest experienced by the subjects was 0 - 9 with an average pain of 4.54 and a standard deviation of 2.62. The difference in standardised Z values from posttest flexion and pretest flexion motion pain data is -4.092 (based on positive rank), if the significant level used is 0.05 then the cumulative probability value of -4.092 is 0.000 (Asymp. Sig 2-tailed) and (0.00 <0.05) then H0 is rejected and H1 is accepted. While the range of the extension pretest motion pain scale experienced by the subject is 0 - 6 with an average pain of 3.25 and a standard deviation of 2.47. The difference in standardised Z values from posttest extension and pretest extension motion pain data is -3.827 (based on positive rank), if the significant level used is 0.05 then the cumulative probability value of -3.827 is 0.000 (Asymp. Sig 2-tailed) and (0.00 <0.05) then H0 is rejected and H1 is accepted. Based on the data, all subjects experienced a decrease in the level of motion pain scale and through hypothesis testing it was accepted, it can be stated that there was a significant change between the pretest and posttest subject data scales or it can be concluded that the combined treatment of masasse therapy and heat therapy effectively reduces flexion and extension pain significantly in knee injuries.

b. ROM

Tablel 5. Pretest - Posttest ROM Scale Data Wilcoxon Signed Rank Test Results

ROM	N	Mean	SD	Minimum Value	Maximum Value	Z Value	Asymp. Sig
Flexion Pre Test	24	129,1	7,22	110	139	-4,118	0,000
Flexion Post Test	24	135,4	4,15	124	140		
Extention Pre Test	24	5,95	5,27	0,00	25	-3,778	0,000
Extention Post Test	24	1,95	1,82	0,00	5		

Based on the table above, the results of statistical analysis using the Wilcoxon signed rank test, the pretest flexion ROM value experienced by the subject is 110.0 - 139.0 with an average of 129.8 and a standard deviation of 7.22. While the posttest Flexion ROM value experienced by the subject with an average of 135.4 and a standard deviation of 4.15. The standardised Z value is -4.118 (based on negative rank), if the significant level used is 0.05 then the cumulative probability value of -4.118 is 0.000 (Asymp. Sig 2-tailed) and (0.00 <0.05) then H0 is rejected and H1 is accepted. The pretest extension ROM experienced by the subjects was 0 - 25 with a mean of 5.95 and a standard deviation of 5.27. While the posttest extension experienced by the subject with an average of 1.95 and a standard deviation of 1.82. The standardised Z value is -3.778 (based on negative rank), if the significant level used is 0.05 then the cumulative probability value of -3.778 is 0.000 (Asymp. Sig 2-tailed) and (0.00 <0.05) then H0 is rejected and H1 is accepted. Based on the data, the subject experienced an increase in ROM and

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through the hypothesis significance test for 2 variables, it can be stated that there was a significant change between the pretest and posttest subject data scales for 2 variables, namely ROM Flexion and extension or it can be concluded that the combined treatment of masage and heat therapy is effective in significantly increasing ROM flexion and extension in patients with knee injuries.

c. Efectiveness

Through the analysis of effectiveness by finding the difference between the posttest value and the pretest and divided by the pretest value then multiplied by 100%, the percentage value of the effectiveness of reducing flexion pain is 51%, the effectiveness of reducing extension pain is 53%. While through the calculation of effectiveness by finding the difference in posttest values with pretest and divided by the pretest value then multiplied by 100%, the percentage value of the effectiveness of increasing ROM in flexion motion is 4.9%, the effectiveness of increasing ROM in extension motion is 67%.

Discussion

Movements that occur during activities can usually cause injuries that occur in muscles, tendons, ligaments, joints, and bones (Rahmaniar et al, 2019: 2). The body often responds to signs of sports injury in the acute phase with inflammation consisting of rubor (red), tumour (swelling), calor (heat), dolor (pain), and functiolaesa (decreased function of motion (Setiawan, 2011; Rodrìguez 2013). Knee injuries are caused by force on the tendons. There are several types of knee injuries that are commonly experienced by athletes and the general public, namely injuries to the medial collateral ligament (MCL), meniscus, anterior cruciate ligament (ACL) and posterior cruciate ligament (PCL) whether it is a tear in the tissue, or a break in the tissue (Bhadjwa, 2013). Knee injuries can affect ROM (range of motion). Tissue damage due to injury causes synovial fluid production and impaired muscle tone in the joints, making the ligaments stiff, inflexible and the range of motion of the knee joint is reduced (indrayana & warijan, 2020; Ferguson, M & Collins, R., 2010). ROM limitations can also be caused by a number of factors, including muscle imbalances, and impaired normal motor function. Limitations in joint range of motion are also caused by pain, swelling, muscle stiffness, muscle spasm, joint contractures and nerve damage, and aging. (Wilson et al., 2011: 15). Pain and limited range of motion of the knee joint due to injury are significant effects that can interfere with activities. The buildup of metabolic waste and other chemicals stimulates the nerve endings at the injury site and causes pain. Apart from that, pain is also caused by pressure on the nerve endings due to swelling that occurs at the injury site (Setiawan, 2011). From the explanation above, we can conclude that knee injuries require proper diagnosis and treatment. If not managed properly, the problem can delay and delay the healing process, which can interfere with daily activities and exercise activities. In practice, treating pain and decreased ROM due to injury can be done pharmacologically and non-pharmacologically.

Many of the studies that have been conducted mainly focus on general knee injuries, but not enough have examined the effectiveness of this combination of therapies for more specific types of knee injuries, such as ligament injuries or cartilage injuries. Further research on the combination of physical exercise, massage therapy and heat therapy should be conducted for future research to provide further insight into the best treatment options.

CONCLUSION

This study aims to determine whether the combined treatment of masasse therapy and heat therapy is effective for reducing pain levels and increasing the range of motion of the knee joints (ROM) in patients with knee injuries. The results of data analysis using non-parametric statistical analysis (Wilcoxon signed rank test) show that the combined treatment of masase and heat therapy has a significant success rate for reducing pain levels and increasing knee ROM in patients with knee injuries. Based on the results of the research that has been done, it can be seen that changes in the form of decreased pain and increased ROM (Flexion and extension) are significant in the data before and after treatment as indicated by the results of the p value (0.000) < 0.05. So it can be concluded that the provision of a combination of massages and heat therapy is effective in reducing pain and increasing ROM significantly. In the data obtained the percentage of effectiveness of decreasing flexion pain by 51%, extension pain by 53% and the average percentage effectiveness of increasing flexion ROM by 4.9%, increasing extension ROM by 67%.

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