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The Effect of Using Infrared and Massage Gun Based on Pain Period on Reducing Gastrocnemius Muscle Pain

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Abstract

Pain is an unpleasant sensory and emotional experience caused by tissue damage, either actual or potential. One of the causes of pain is the presence of DOMS (Delayed Onset Muscle Soreness) in muscles that contract for a long time or excessively. The purpose of this study was to determine the effect of using infrared and massage guns based on the 24-hour and 48-hour pain periods on reducing gastrocnemius muscle pain. This study used an experimental or quantitative method with a 2x2 factorial design. The population of this study was 69 people. A sample of 40 people was taken using a purposive sampling technique. The instruments used were infrared, massage guns, and Visual Analog Scale (VAS). Data analysis used paired sample t-test and Wilcoxon test with a significance level of $P < 0.05$. The results of the study are as follows: There is a significant effect of the use of infrared on reducing gastrocnemius muscle pain that has been experienced for 24 hours and 48 hours. There is a significant effect of the use of massage guns on reducing gastrocnemius muscle pain that has been experienced for 24 hours and 48 hours. The conclusion is that the use of infrared and massage guns based on the 24-hour and 48-hour pain periods to reduce gastrocnemius muscle pain has been proven to have a significant effect.

Key words: Delayed Onset Muscle Soreness, Gastrocnemius, Infrared, Massage Gun, Pain.

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INTRODUCTION

Pain is an unpleasant sensory and emotional experience caused by tissue damage, either actual or potential or that can be described in terms of such damage. Pain is a subjective experience, just like when someone smells something good or bad, tastes sweet and salty, all of which are perceptions of the five senses and are felt by humans since birth (Raja et al., 2020). However, pain is different from the stimulus of the five senses, because the stimulus of pain is something that comes from tissue damage or has the potential to cause tissue damage (Meliala, 2004). One of the causes of pain is DOMS (Delayed Onset Muscle Soreness) in muscles that contract for a long time or excessively. Delayed Onset Muscle Soreness (DOMS) is a condition where the muscles feel uncomfortable, painful and inflamed due to unusual or excessive exercise. Delayed Onset Muscle Soreness (DOMS) or pain occurs for 24 hours after exercise, the peak of DOMS occurs 48 to 72 hours after pain occurs, and will decrease after 5 to 7 days (a week) after exercise (Prihantoro, 2018). The pain that occurs due to Delayed Onset Muscle Soreness (DOMS) can be measured with the Visual Analog Scale (VAS) (Lau et al., 2013). Various theories about DOMS suggest that DOMS is an anomaly of lactic acid, muscle spasms, connective tissue damage, mechanical muscle damage, cellular inflammation, and enzymes (Contro et al.,2016). In general, the public understands that injuries are more risky and are often experienced by athletes or athletes, which are commonly called sports injuries. However, the public and even athletes still do not understand and need advice on the use of appropriate or effective therapy to reduce pain due to DOMS on the complaints they face, especially to help speed up the recovery process so that they can undergo training or matches as soon as possible.

DOMS can be treated with a variety of massage interventions, including effleurage techniques, sports massage, stretching, and Self-Myofascial Release, using several of these interventions has shown significant effectiveness in reducing muscle pain due to Delayed Onset Muscle Soreness (DOMS) and improving several functional abilities (Alpiah et al., 2025). Infrared and massage guns are examples of therapies to restore body fitness, especially for athletes who are experiencing pain due to DOMS. Infrared is an electromagnetic wave emission with a wavelength of 7,700 to 4 million Angstroms. Infrared rays can produce local heat that is superficial and is recommended in subacute conditions to reduce pain and inflammation. Superficial heating will affect superficial tissue and produce an analgesic effect. The resulting heat effect will cause vasodilation in blood vessels and increased circulation in the tissue (Prentice, 2002).

Massage gun treatment is a new discovery or approach in the world of sports, especially for therapists and athletes. Research that has been done is the effect of massage from a massage gun on the calf or gastrocnemius muscles for 5 minutes, and has an effect on ROM and muscle performance of the plantar flexor muscles. ROM observations increased, but there was no change in muscle performance ability, so previous researchers suggested that adding a massage gun to the warm-up before exercise is the right choice to increase the level of athlete flexibility without losing muscle performance (Konrad et al., 2020). The benefits of this massage tool are to overcome fatigue, relax muscles, improve blood circulation, relieve muscle pain, and

help heal neck disorders due to sleeping wrong. This massage tool is safe and comfortable to use and does not cause side effects, it is also simple because it does not require special care and is very easy to operate (Basfiansa, 2022).

This study did not use massage treatment, this study only used infrared and massage guns. The use of infrared and massage guns adjusts to the conditions and needs of samples or athletes who experience pain, usually the adjustment of treatment is seen from the degree of pain and the sample's response to pain caused by DOMS. The pain conditions experienced by the sample depend on the chronology, initial treatment, duration of pain, muscle condition, exercise intensity and activity. This study exists because the author wants to know the effect of using infrared and massage guns on reducing gastrocnemius muscle pain that has been experienced for 24 hours and 48 hours in clients at Serayu Sehat Massage Therapy.

METHOD

This study uses quantitative research type. The research design that will be used in this study is factorial experiment design (2 x 2). Factorial experiment design considers the possibility of moderator variables that affect the treatment (independent variable) on the results (dependent variable) (Santoso, 2010). The factorial experiment design that has been made can be seen in table 3.1. The researcher uses factorial design because the researcher does not only want to see the effect of the independent variable on the dependent variable, but also the interaction effect of the independent variable on the dependent variable. The purpose of experimental research is to investigate whether or not there is a causal relationship and how big the causal relationship is using certain methods in several experimental groups (Nazir et al., 2014).

Table 1. The Research Design

Methods / Pain period	Infrared (A_1)	Massage Gun (A_2)
24 hour (B_1)	A_1B_1	A_2B_1
48 hour (B_2)	A_1B_2	A_2B_2

The population is the entire subject of the study. The population of this study was Serayu Sehat Massage clients who experienced gastrocnemius muscle pain, totaling 69 people from registered clients for a week. A sample is a portion of the number and characteristics possessed by a population (Sugiyono, 2016). The sample in this study was 40 clients of Serayu Sehat Massage Therapy. The clients tested in this study were 40 people who were divided into 4 experimental groups selected by the researcher using the purposive sampling technique, because in this study the researcher selected samples based on the specified criteria (Sugiyono, 2009). Each group consisted of 10 clients, 10 clients in the experimental group A_1B_1, 10 clients in the experimental group A_1B_2, 10 people were put into the experimental group A_2B_1, and the last 10 clients were put into the experimental group A_2B_2.

The inclusion criteria in this study were that the sample must be male aged 20 to 35 years, physically and mentally healthy, pain in the gastrocnemius muscle due to DOMS, have done sports activities within 24 hours and 48 hours, no strains and sprains, no inflammation, no open wounds and keloids in the gastrocnemius muscle, and finally willing to follow the existing research procedures. While the exclusion criteria in this study were if the

sample withdrew from the study, had a history of surgery on the gastrocnemius muscle, pain was not due to DOMS, there were strains and sprains in the gastrocnemius muscle, did sports activities within less than 24 hours and more than 48 hours, history of tibia and fibula fractures less than 2 years, there was inflammation in the gastrocnemius muscle, there were open wounds and keloids in the gastrocnemius muscle, and if they did not follow the study according to the procedure, then the sample was considered not to meet the criteria.

Data collection in this study used a data collection technique in the form of a pain reduction measurement scale test using VAS (Visual Analog Scale) before the study (pretest) and after the study (posttest). The instruments used in this study were infrared, massage gun, and Visual Analog Scale (VAS). This interpretation can vary slightly depending on the reference or specific clinical field, the scale contained in the VAS is subjective, meaning it depends on the perception of each individual. Currently there is no evidence to suggest superior and accurate measurement properties between VAS (Visual Analog Scale), NRS (Numeric Analog Scale), and BPI-PS (Brief Pain Inventory-Pain Severity) in measuring pain in low back pain. According to previous researchers, this evidence should come from clinimetric studies that are appropriate direct comparisons, with priority given to assessing content validity, test-retest reliability, measurement error, and responsiveness (Chiarotto et al., 2019). Measurements were carried out twice, before being given therapy using infrared and massage guns. Before therapy, the sample was asked about the level of pain between 1 and 10, after answering, they were given therapy in the form of infrared and/or massage gun for 10 minutes each and the level of pain was measured again using the VAS (Visual Analog Scale).

The procedure for providing therapeutic treatment to the sample is as follows: 1) Invite the sample to the massage bed that is already available 2) Ensure that the sample that the DOMS pain is in the gastrocnemius muscle. 3) Check or measure the level of pain using VAS (Visual Analog Scale), then record the results. 4) Make sure the lotion is ready. 5) Pour a little lotion into your hand, then rub it around the gastrocnemius muscle. 6) It should not be poured directly onto the sample's body, because it is unethical or impolite. 7) Provide treatment based on the groups that have been divided, namely using an infrared device with a pain period of 24 and 48 hours, and a massage gun group with a pain period of 24 and 48 hours. Infrared and massage gun treatments are given to each sample for 10 minutes. 8) Re-measure the level of pain after therapy, record the results. 9) Treatment is carried out once a day. 10) Enter the measurement results into the table or book that has been provided.

Before going to the data analysis stage, a prerequisite test must be carried out first. The prerequisite test for data analysis in the study is the normality test and the homogeneity test of the data that has been obtained during the study. The data normality test used to determine whether the research data is normal or not is using the Shapiro-Wilk test, while the homogeneity test used to determine whether the data is homogeneous or not is using the Levenne statistical test by comparing four predetermined sample groups. The data analysis used in this study uses parametric analysis in the form of a paired sample t-test for groups of variables whose data are normally distributed, while those that are not normally distributed use a non-parametric test in the form of a Wilcoxon test to

determine the effect of independent variables on dependent variables, or to determine the effect of each independent variable (use of infrared and massage gun) on one dependent variable (pain) by considering the significance value ($P < 0.05$).

RESULTS AND DISCUSSION

There are 5 objectives of this study, namely: 1) to determine the effect of infrared use with a 24-hour pain period on reducing gastrocnemius muscle pain, 2) to determine the effect of infrared use with a 48-hour pain period on reducing gastrocnemius muscle pain, 3) to determine the effect of massage gun use with a 24-hour pain period on reducing gastrocnemius muscle pain, 4) to determine the effect of massage gun use with a 48-hour pain period on reducing gastrocnemius muscle pain, 5) to determine the interaction between infrared use and massage gun based on 24-hour and 48-hour pain periods on reducing gastrocnemius muscle pain.

The procedures in this study have been approved by the Examiner and the thesis proposal examination committee, this study was conducted on 19-29 June 2025 and was only carried out in one place, namely at the Serayu Sehat Massage Therapy massage house located in Kaliori Village, Kalibagor District, Banyumas Regency. In the process of collecting research data, assisted by volunteers who had been given directions and explanations in advance. The sample in this study were 40 male clients or customers of Serayu Sehat Massage Therapy aged 20-35 years who had met the Inclusion and Exclusion criteria. This study was conducted by measuring pain or pain due to DOMS in the gastrocnemius muscle, after doing sports activities for 24 hours and 48 hours. The division of sample groups based on the inclusion and exclusion requirements that have been determined using the purposive sampling method, 40 sample people were divided into 4 sample groups, each group consisting of 10 people in group A_1B_1, 10 people in group A_2B_1, 10 people in group A_2B_1 and the last there were 10 sample people in group A_2B_2.

Measurements were taken twice, before being given therapy using infrared and massage guns. Before therapy, the sample was asked about the level of pain between 1 and 10, after answering, they were given therapy in the form of infrared and/or massage guns for 10 minutes each and the level of pain was measured again using the VAS (Visual Analog Scale) scale. The following is the data obtained through measurements before and after treatment using the VAS (Visual Analog Scale) measurement scale.

Table 2. Table of Research Data on Pain for All Groups

NO	Pain Data											
	A_1B_1 (Infrared 24 hour)			**A_1B_2 (Infrared 24 hour)**			**A_2B_1 (Massage gun 24 hour)**			**A_2B_2 (Massage gun 48 hour)**		
	Pre	**Post**	**↓**	**Pre**	**Post**	**↓**	**Pre**	**Post**	**↓**	**Pre**	**Post**	**↓**
1	6	5	1	6	4	2	7	3	4	7	5	2
2	7	4	3	7	5	2	7	3	4	7	4	3
3	7	5	2	6	6	0	8	5	3	6	4	2
4	6	5	1	6	5	1	6	2	4	6	5	1
5	6	4	2	8	8	0	6	4	2	7	6	1
6	7	6	1	7	6	1	7	2	5	6	4	2
7	6	5	1	6	4	2	5	3	2	8	5	3
8	7	5	3	6	5	1	6	3	3	6	4	2
9	7	5	2	7	6	1	7	4	3	6	3	3
10	6	6	1	6	4	2	6	2	4	7	5	2
	6,5	**5**	**1,7**	**6,5**	**5,3**	**1,2**	**6,5**	**3,1**	**3,4**	**6,6**	**4,5**	**2,1**
Min	**6**	**4**	**1**	**6**	**4**	**0**	**5**	**2**	**2**	**6**	**3**	**1**
Max	**7**	**6**	**3**	**8**	**8**	**2**	**8**	**5**	**5**	**8**	**6**	**3**

Testing to prove the normality or otherwise of research data obtained using Kolmogorov-Smirnov and Shapiro-Wilk analysis (Quraisy, 2022). The first prerequisite test carried out was the data normality test first, in this study, researchers preferred to use the Shapiro-Wilk test because the number of samples in this study was ≤ 50 people (Varsha et al., 2017).

	Statistic	df	Sig.	Description
A1B1_PRE	0,655	10	0,000	Abnormal distribution
A1B1_POST	0,815	10	0,022	Abnormal distribution
A1B2_PRE	0,731	10	0,002	Abnormal distribution
A1B2_POST	0,871	10	0,102	Normal distribution
A2B1_PRE	0,906	10	0,258	Normal distribution
A2B1_POST	0,866	10	0,152	Normal distribution
A2B2_PRE	0,781	10	0,008	Abnormal distribution
A2B2_POST	0,906	10	0,258	Normal distribution

Table 3. Shapiro -wilk Test of Normality

Homogeneity test is a data analysis technique to determine whether or not data from two variants of each sample group is homogeneous (Hambali, 2019). The homogeneity test in this study uses the Levene's test technique which is the most popular homogeneity test method in the Statistical Package for Social Sciences (SPSS) application. The test of homogeneity of variances using Levene's statistic shows that the significance value (sig.) of the pain variable in the gastrocnemius muscle in 4 groups, namely groups A_1B_1, A_1B_2, A_2B_1, and A_2B_2 is 0.179. The sig. value of 0.179> 0.05, according to the decision making in the homogeneity test that if P> 0.05, then the data obtained in this study is data that is the same or homogeneous.

The effect of using infrared devices on reducing pain in the gastrocnemius muscle that has been experienced for 24 hours (A_1B_1).

The average age of the sample in the infrared group with a 24-hour pain period (A_1B_1) was 26 years, with the youngest age being 20 years and the oldest age being 31 years. In the pre-measurement, there was a lowest pain value or scale of 6 and the highest was 8, then the average was 7.3. The post-measurement showed that the lowest pain felt by the sample was 4 and the highest was 6 with an average pain of 4.8. The results after providing treatment in the form of infrared use showed an average decrease in the pain scale of 2.5 with the lowest pain scale decrease of 2 and the highest of 4.

The data of the infrared use group during the 24-hour pain period (A_1B_1) is data with a non-normal distribution. In non-normally distributed data, parametric tests such as paired t-tests are not allowed or the results of the ANOVA are unreliable (Blanca et al., 2017). Non-normal data are directed to use non-parametric tests, namely the Wilcoxon test which can be used for hypothesis testing if the data is not normally distributed. The Wilcoxon test was discovered and developed by Frank Wilcoxon, this test is to test two paired populations, or paired groups such as the paired t-test with a non-normally distributed data version (Fadilatunnisyah et al., 2024).

The steps to conduct a Wilcoxon test using the IBM SPSS Statistics 25 application are, first open the IBM SPSS Statistics 25 application, then select the analyze option on the ribbon bar then click nonparametric tests, then select legacy dialogs and continue to option 2 Related Samples Tests. The last step to find out the results of the Wilcoxon test is to enter the data obtained from VAS measurements before and after the use of infrared during the 24-hour pain period, the data is in the form of a pain scale from A_1B_1pre and A_1B_1post. Below is a table of the results of the hypothesis test using the Wilcoxon test in the infrared use group during the 24-hour pain period.

Table 4. Hypothesis Test Summary with Wilcoxon test (A1B1).

	Null Hypothesis	Test	Sig.	Decision
1	The median of differences between A_1B_1Pre and A_1B_1Post equals 0.	Related-Sampel Wilcoxon Signed Rank Test	0,007	Reject the null hypothesis.

Asymptotic significances are displayed. The significance level is 0,05

If the asymptotic significance value > 0.05 then H_0 is accepted, but if the asymptotic significance value <0.05, then H_0 is rejected, and H_1 is accepted. The use of infrared on gastrocnemius muscle pain that has been experienced for 24 hours has been proven to have an effect on reducing the pain scale by 34.25%, the results of the calculation or hypothesis test using the Wilcoxon test can be seen in table 4 which shows that the Asymptotic significance is 0.007 <0.05 which means that H_0 is rejected, and H_1 is accepted. According to the hypothesis that has been determined in this study, if H_0 is rejected because P <0.05, then the results can be explained that infrared has an effect on reducing gastrocnemius muscle pain that has been experienced for 24 hours.

The effect of using infrared devices on reducing pain in the gastrocnemius muscle that has been experienced for 48 hours (A_1B_2).

The average age of the sample in the infrared use group with a 48-hour pain period (A_1B_2) was 25.6 years, with the youngest age being 21 years and the oldest age being 31 years. In the pre or before measurement, the lowest pain scale was 6 and the highest was 9, the post measurement (after using infrared) had an average of 6.8. The post measurement showed that the lowest pain felt by the sample in the A_1B_2 group was 4 and the highest was 7 with an average pain of 5.1. The results after providing treatment in the form of using infrared showed an average decrease in the pain scale from 6.8 (pre) to 5.1 (post) so that it decreased by 1.7 with the lowest pain scale decrease of 0 and the highest of 2. Based on the results of the data normality test in table 2, it is concluded that the data for the infrared use group during the 48-hour pain period (A_1B_2) is data with an abnormal distribution, and in the homogeneity test in table 3, all data is homogeneous. Below is a table of the results of the hypothesis test using the Wilcoxon test in the infrared use group during the 48-hour pain period.

Table 5. Hypothesis Test Summary with Wilcoxon Test (A_1B_2).

	Null Hypothesis	Test	Sig.	Decision
1	The median of differences between A_1B_2Pre and A_1B_2Post equals 0.	Related-Sampel Wilcoxon Signed Rank Test	0,010	Reject the null hypothesis.

Asymptotic significances are displayed. The significance level is 0,05

If the Asymptotic significance value is > 0.05 then H_0 is accepted. Asymptotic significance value <0.05, then H_0 is rejected, and H_1 is accepted. The use of infrared on gastrocnemius muscle pain that has been experienced for 48 hours has been proven to have an effect on reducing the pain scale by 25%, the results of the calculation or hypothesis test using the Wilcoxon test can be seen in table 4 which shows that the Asymptotic significance is 0.010 <0.05 which means that H_0 is rejected, and H_1 is accepted. According to the hypothesis that has been determined in this study, if H_0 is rejected because P <0.05, it is concluded that the use of infrared has an effect on reducing

gastrocnemius muscle pain that has been experienced for 48 hours after exercise. When compared with the measurement results in the infrared group with a pain period of 24 hours, this group has a lower decrease or has a smaller difference in influence compared to the effect of infrared use on reducing pain in the pain period that has only been experienced for 24 hours.

The effect of using massage gun devices on reducing pain in the gastrocnemius muscle that has been experienced for 48 hours (A_2B_1).

The average age of the sample in the massage gun group with a 24-hour pain period (A_2B_1) was 23.8 years, with the youngest age being 20 years and the oldest age being 28 years. Pre or before measurements showed the lowest pain scale of 5 and the highest 8 with an average of 6.9. Post measurements showed that the lowest pain felt by the sample in group A_2B_1 was 3 and the highest 6 with an average pain of 4. The results after providing treatment in the form of using a massage gun showed an average decrease in the pain scale from 6.9 (pre) to 4 (post) so that it decreased by 2.9 with the lowest pain scale decrease of 2 and the highest of 4. The data for the massage gun group during the 24-hour pain period (A_2B_1) is data with a normal distribution, and in the homogeneity test, all data are homogeneous. In normally distributed data, the parametric test, namely the paired t-test, can be used for hypothesis testing.

					95% Confidence Interval of the				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	Sig. (2-tailed)
Pair 1	A_2B_1Pre-A_2B_1Post	3,4	0,966	0,306	2,709	4,091	11,129	9	0

The following are the guidelines for making paired sample t-test decisions according to Singgih Santoso (2019), the guidelines for making decisions for paired sample t-tests based on the significance value (Sig.) of the SPSS output results, are as follows: If the significance value or Sig. (2-tailed) < 0.05. Then H_0 is rejected and H_1 is accepted, conversely if the significance value or Sig. (2-tailed) > 0.05, then H_0 is accepted and H_1 is rejected. The use of a massage gun for gastrocnemius pain that has been experienced for 24 hours has been shown to have an effect on reducing the pain scale by 42%, this percentage is the largest compared to that which occurred in other groups. The results of the calculation or hypothesis test using the paired sample t-test can be seen in table 5 which shows that the significances are 0.000 <0.05 which means that H_0 is rejected, and H_1 is accepted. According to the hypothesis that has been determined in this study, if H_0 is rejected because P < 0.05, then the results can be explained that the massage gun has an effect on reducing the pain in the gastrocnemius muscles that has been experienced for 24 hours after exercise.

The effect of using massage gun devices on reducing pain in the gastrocnemius muscle that has been experienced for 48 hours (A_2B_2).

The average age of the sample in the massage gun group with a 48-hour pain period (A_2B_2) was 26.6 years, with the youngest age being 20 years and the oldest age being 34 years. The pre or before measurement column shows the lowest pain scale of 6 and the highest 8 with an average of 6.6. The post column shows that the lowest pain felt by the sample in group A_2B_1 was 3 and the highest 6 with an average pain of 4.3. The results after providing treatment in the form of using a massage gun showed an average decrease in the pain scale from 6.6 (pre) to 4.3 (post) so that it decreased by 2.2 with the lowest

pain scale decrease of 1 and the highest of 4. The data for this group is not normally distributed, so the hypothesis test uses the Wilcoxon test like groups 1 and 2. Below is a table of the results of the hypothesis test using the Wilcoxon test in the massage gun use group during the 48-hour pain period.

Table 7. Hypothesis Test Summary with Wilcoxon Test (A_2B_2).

	Null Hypothesis	Test	Sig.	Decision
1	The median of differences between A_2B_2Pre and A_2B_2Post equals 0.	Related-Sampel Wilcoxon Signed Rank Test	**0,004**	Reject the null hypothesis.

Asymptotic significances are displayed. The significance level is 0,05

Decision making from the Wilcoxon test. The following are guidelines for Wilcoxon decision making, namely if the Asymptotic significance value is > 0.05, then H_0 is accepted, but if the Asymptotic significance value is < 0.05, then H_0 is rejected, and H_1 is accepted. According to the hypothesis that has been determined in this study, if H_0 is rejected because P < 0.05, then the results can be explained that the massage gun has an effect on reducing the pain in the gastrocnemius muscles that has been experienced for 48 hours after exercise.

Interaction between the use of infrared and massage guns based on pain period on reducing pain in the gastrocnemius muscle.

Interaction testing for 2x2 factorial research design with non-normal data using the Scheirer-Ray-Hare test which is a development of the Kruskal-Wallis test for factorial design with non-normal data or an alternative to two-way ANOVA for non-normal data (non-parametric). This test uses ranking data, not original values, so it is robust to non-normal or non-homogeneous data. SPSS does not directly provide a feature for the Scheirer-Ray-Hare test, but it can still be done manually with the steps explained above. The following are the results of the Scheirer-Ray-Hare test analysis through the IBM SPSS Statistics 25 application which aims to find the interaction between the infrared and massage gun use methods based on the 24-hour and 48-hour pain periods on reducing pain in the gastrocnemius muscle.

Table 8. Tests of Between-Subjects Effects with Scheirer Ray Hare Test

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	640,000[a]	3	640,000	11,287	**0,023**	0,485
Intercept	16.810,000	1	16.810,000	237,490	**0,000**	0,868
Metode	1.651,225	1	1.651,225	23,328	**0,000**	0,393
Masa Nyeri	640,000	1	640,000	9,042	**0,005**	0,201
Metode x Masa Nyeri	105,625	1	105,625	1,492	**0,230**	0,040
Error	2.548,150	38	70,782			
Total	21.755,000	40				
Corrected Total	4.945,000	39				

a. R Squared = 0,485 (Adjusted R Squared = 0,442)

The significance criteria in the Scheirer-ray-hare test are if P <0.05, then the variables have significant interaction, but if P> 0.05, then the variables do not have significant interaction. From the Scheirer-ray-hare test criteria, it can be interpreted that the method (infared and massage gun) has a significance value (Sig.) <0.05 or 0.000 <0.05, which indicates that there is a significant effect of the method on reducing pain experienced for 24 hours and 48 hours. Then in the pain period has a significance value (Sig.) <0.05 or 0.005 <0.05, it can be concluded that there is a significant effect of the 24-hour and 48-hour pain period on reducing pain. Finally, in the line Interaction of the method with the pain period has a significance value (Sig.) > 0.05 or 0.230 > 0.05, meaning that there is no significant interaction between the method and the pain period.

Analysis of the interaction between the

method (infrared and massage gun) and the pain period on pain reduction of 0.230. This value is greater than the significance limit of 0.05 indicating that 0.230> 0.05 which means there is no significant interaction between the infrared and massage gun methods and the pain period of 24 hours or 48 hours on reducing gastrocnemius muscle pain. It can be concluded that the effectiveness of infrared and massage guns in reducing pain does not depend too much on the length of the pain period, and vice versa the pain period (24 hours and 48 hours) does not affect the use of the method used, either infrared or massage gun. This shows that both factors or variables work independently (independent variables).

The interaction in this study explains to all readers that the method of using infrared and massage guns based on the 24-hour and 48-hour pain period affects the reduction of pain in the gastrocnemius muscle. However, the interaction is not seen from the effect of the 24-hour or 48-hour pain period on the use of infrared or massage guns. This can be developed further to the next stage by improving or increasing the number of methods or aids used such as certain massage techniques, dry cupping, or the use of foam rollers, or even adding a 72-hour pain period and so on. Giving ice massage with a duration and measurement that is appropriate to the degree of muscle damage also helps reduce or decrease pain due to muscle damage that causes DOMS (Rakasiwi, 2014).

CONCLUSION

The conclusion of this study is that there is an effect of infrared use on reducing gastrocnemius muscle pain due to Delayed Onset Muscle Soreness that has been experienced for 24 hours and 48 hours after exercise. In addition to infrared, the use of massage guns also has an effect on reducing gastrocnemius muscle pain that has been experienced for 24 hours or 48 hours, but the most visible effect in reducing pain is the use of massage guns on muscle pain that has only been experienced for 24 hours or one day. There is an interaction between the use of infrared and massage guns based on the 24-hour and 48-hour pain periods affecting the reduction of pain in the gastrocnemius muscle. However, the interaction is not seen from the effect of the 24-hour or 48-hour pain period on the use of infrared or massage guns. This study is expected to help therapists, athletes and trainers in handling muscle pain due to DOMS and can direct the community and athletes to do warm-ups and cool-downs more routinely to prevent injury.

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