



The Effectiveness Of Sports Massage in Reducing Pain Levels and Increasing The Range Of Motion (ROM) Of Futsal Players' Ankle Joints

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ABSTRACT

Purpose of the study: This study aims to test the effectiveness of sports massage on reducing pain and increasing Range of Motion (ROM) of the lower extremities, especially the ankle joint, and to determine its level of effectiveness in futsal players.

Methodology: The study used a pre-experimental design with a one group pretest-posttest design. The instruments used were the Visual Analogue Scale (VAS) to measure pain and a goniometer to measure ROM. The sampling technique was carried out incidentally with 20 respondents. Data were analyzed using the Wilcoxon signed ranks test.

Main Findings: The results showed that sports massage significantly reduced pain levels and increased ROM in both plantar flexion and dorsiflexion movements. The effectiveness of reducing pain was 50.79%, increasing plantar flexion ROM by 92.19%, and dorsiflexion by 94.49%.

Novelty/Originality of this study: This study contributes to the non-pharmacological approach in the management of minor sports injuries, especially muscle pain and mobility limitations. This study shows the effectiveness of sports massage as a cheap, practical, and easy-to-apply physical recovery method for futsal athletes.

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1. INTRODUCTION

Sports are all forms of physical activity or movement of the body that use large muscles. According to the Indonesian National Sports System, the scope of sports is divided into educational sports, recreational sports, and competitive sports[1]-[3]. Educational sports are all forms of physical activity used for the learning system. Recreational sports are sports that are carried out by people with hobbies and abilities that grow and develop according to the conditions and cultural values of the local community for health, fitness, and joy. Competitive sports are sports that aim to compete for the highest achievements[4]-[6].

One of the games included in achievement sports is futsal. Futsal is played on a field that is smaller than a soccer field, and with fewer players from each team[7], [8]. Futsal players are more dominant in moving faster to anticipate goals being scored. The characteristics of the game in fast futsal require futsal players to have good technical and physical abilities[9]-[11].

Futsal is a sport that requires strong physical strength because players must continue to run and move quickly to put the ball into the opponent's goal. Futsal players are susceptible to injury due to external factors,

namely due to tackling or collisions, blows or impacts, poor equipment, and poor field conditions, as well as internal factors caused by incorrect training movements, poor body shape, poor physical condition, weakness in body muscles and ligaments.

The Central Statistics Agency explained that the number of injuries caused by futsal matches throughout Indonesia was 6,936 cases and in East Java there were 655 cases [12]-[14]. Injuries that often occur in extracurricular futsal sports are muscle injuries, bruises, wounds, cramps, heel pain, muscle pain, sprains, ankle injuries, and fractures [15]-[17]. Sports injuries are often responded to by the body with signs of inflammation consisting of rubor (red), tumor (swelling), calor (heat), dolor (pain) and functio laesa (decreased function).

Handling minor injuries in futsal players is expected to prevent serious injuries and accelerate the healing process of injuries [18], [19]. One of the treatments for sports injuries is sports massage which aims to reduce pain and eliminate muscle tension and increase flexibility in the joints [20]-[22]. This study will examine the effectiveness of sports massage on reducing pain and increasing Range of Motion (ROM) of the lower extremities in futsal players at the Faculty of Sport Sciences, Yogyakarta State University.

Previous research entitled "Effect of sports massage on performance and recovery: a systematic review and meta-analysis" has made an important contribution to the general understanding of the influence of sports massage on improving athlete performance and recovery in general [23]-[25]. The study utilized a systematic approach and meta-analysis to evaluate various research results related to the impact of sports massage on the general physical condition of athletes. The main focus of this study was more on the aspects of performance and recovery in the context of sports as a whole, without delving into specific effects on certain body parts or certain types of sports. However, there is a clear gap in terms of the context and focus of the application of sports massage. Previous studies did not specifically explore the effects of sports massage therapy on local pain and range of motion (ROM) in certain body parts that are prone to injury, such as the ankles of futsal players [26]-[28]. In fact, the ankle is one of the most frequently injured body parts in futsal, so it requires special attention and treatment. Therefore, there is not much empirical evidence explaining how the effectiveness of sports massage can specifically reduce pain and increase ROM in the ankle joint in the context of futsal. Based on this, this study is here to fill the gap that has not been touched by previous studies. By focusing on the effectiveness of sports massage on reducing pain levels and increasing the range of motion of futsal players' ankles, this study offers more focused practical and theoretical contributions [29], [30]. In addition, this approach can provide more applicable recommendations for coaches, physiotherapists, and sports health practitioners in dealing with micro and macro injuries that are common in futsal athletes. Thus, this study is expected to be able to enrich the literature on sports massage with a more specific and contextual perspective.

The novelty of this study lies in its specific focus on the effectiveness of sports massage in reducing pain levels and increasing the range of motion (ROM) of the ankle joint specifically in futsal athletes, which has not previously been studied in a focused and in-depth manner [31]-[33]. Previous studies generally discuss the effects of sports massage in a general context such as improving the performance or recovery of athletes in various sports, without highlighting in detail its effects on certain body parts that have a high risk of injury such as the ankles in futsal players. In fact, futsal is a sport that demands rapid movement, sudden changes in direction, and repeated loads on the ankle joint, so that specific interventions are needed [34]-[36]. This study also presents a practical approach by directly measuring two important indicators, namely pain and ROM, in homogeneous subjects (futsal players), so that the results are more contextual and relevant for real applications in the field [37], [38]. Thus, this study provides new theoretical and practical contributions in the development of sports rehabilitation strategies that are more focused, measurable, and according to the needs of futsal athletes, and fills the gap in empirical studies that have not been specifically explored in the scientific literature.

The implications of this study provide significant contributions in both practical and theoretical areas, especially in the fields of sports science and sports physiotherapy [39]-[41]. Practically, the results of this study can be used as a reference for coaches, physiotherapists, and sports medical personnel in designing more effective and focused recovery programs using sports massage as a non-pharmacological intervention to reduce pain and improve ankle joint mobility in futsal players [42]-[44]. This is very important considering that the ankle is one of the most vulnerable areas of the body to injury in this sport. Meanwhile, theoretically, this study enriches the scientific literature by providing empirical data on the relationship between sports massage, pain levels, and ROM specifically in the futsal athlete population, which has so far been limited. This study also opens up opportunities for further research to develop a more integrated and evidence-based therapeutic approach, and can be applied to various other sports that have similar injury characteristics [45], [46].

The urgency of this research lies in the high number of ankle injuries experienced by futsal athletes due to high game intensity, explosive movements, and rapid and sudden changes in direction. These conditions not only hinder athlete performance, but also risk causing long-term disorders if not treated properly. Although sports massage has been widely known in the world of sports, there are still few studies that specifically test its effectiveness in reducing pain and increasing the range of motion (ROM) of the ankle joint in futsal players. Therefore, this research is important to provide strong and focused scientific evidence regarding the benefits of sports massage as a simple, non-invasive recovery therapy method that can be applied directly in training or post-

match activities [47], [48]. The findings of this study are expected to be able to answer practical needs in the field and at the same time fill the gap in scientific studies related to specific, effective, and appropriate rehabilitative interventions for futsal athletes.

Based on the background, gaps, and urgency that have been described, it can be concluded that research on the effectiveness of sports massage in reducing pain levels and increasing the range of motion (ROM) of the ankle joint in futsal players needs to be conducted as an effort to provide targeted rehabilitative solutions. This study not only aims to strengthen scientific evidence on the benefits of sports massage, but also to present an applicable and relevant therapeutic approach to the needs of injury recovery in futsal athletes.

2. RESEARCH METHOD

The research design used in this study is Pre-Experimental design with one group pretest-posttest design. In this design there is a pretest before being given treatment and a posttest after being given treatment and without control [49], [50]. This design can determine the effect of treatment by comparing the conditions before and after being given treatment. The One Group Pretest-Posttest Design research design can be described as follows.

$$O1 - X - O2 \quad \dots(1)$$

Information :

- O1 : Pretest value (before sports massage treatment)
 X : Treatment (sports massage)
 O2 : Post Test Value (after Sport Massage treatment))

The population in this study was 60 FIK UNY students who played futsal. The sample was taken non-randomly, namely by incidental sampling. The number of samples was determined based on the Slovin formula as follows:

$$n = \frac{N}{1+N(e)^2} \quad \dots(2)$$

Information :

- n : Sample size
 e : Percentage of Allowance
 N : Population: 60 (number of futsal players)

$$n = \frac{60}{1+60(0,2)^2}$$

$$n = \frac{60}{1+2,4}$$

$$n = \frac{60}{3,4}$$

$$n = 17,6471$$

With this formula, it is obtained that the minimum sample is 17.6471 and in this study the number of samples was determined to be 20 people with the inclusion criteria of UNY students who play futsal aged 17-24 years and are willing to be research subjects. The exclusion criteria were severe injuries so that they could not play.

The data collection technique in this study was using a measurement test. Data collection was carried out by measuring the level of pain using the Visual Analogue Scale (VAS) and joint range of motion using a goniometer before and after sports massage was performed on the subject. The instruments in this study are as follows :

Table 1. Data Collection Instruments and Techniques

Data Types	Scale	Instrument	Data collection
Name	Nominal	Questionnaire	Reading data from form entries
Gender	Nominal	Questionnaire	Reading data from form entries
Age	Interval	Questionnaire	Reading data from form entries
Painful	Interval	VAS	Reading the measurement scale
ROM	Interval	Goniometer	Reading the measurement scale

Data analysis in this study began with a descriptive analysis of the research subjects. This analysis aims to describe the characteristics of the subjects including gender, occupation, age, and level of muscle fatigue. The data obtained will be presented in the form of tables, pie charts, or bar charts to provide a clear picture of the distribution of the characteristics of the research subjects. Then, a descriptive analysis and normality test were carried out on the variables related to the study. This descriptive statistical analysis is used to describe the statistics of all research variables, both in the pretest and posttest. The data presented includes the average value and standard deviation of each variable. Furthermore, to find out whether the data is normally distributed, a normality test is carried out as one of the requirements for analysis. The normality test used in this study is the Shapiro-Wilk test. And inferential statistical analysis is carried out. This analysis aims to determine the significant difference between the pretest and posttest values after being given treatment. If the results of the normality test indicate that the data is normally distributed, then parametric statistical analysis will be used with the paired t-test difference test. However, if the data is not normally distributed, then non-parametric statistical analysis will be used with the Wilcoxon signed rank test to compare the pretest and posttest values.

3. RESULTS AND DISCUSSION

3.1. Description of Research Subject

The subjects in this study were 20 FIK UNY futsal players, who received sports massage treatment after physical activity. Details of height, weight and height are shown in the following table.

Table 2. Average and Standard Deviation of Research Subjects

Data	Mean	Standard Deviation
Weight	64.0850	12.63030
Height	169.8500	3.93734

Next, Figures 6 and 7 show the frequency distribution of height and weight of the subjects as a whole (n=20).

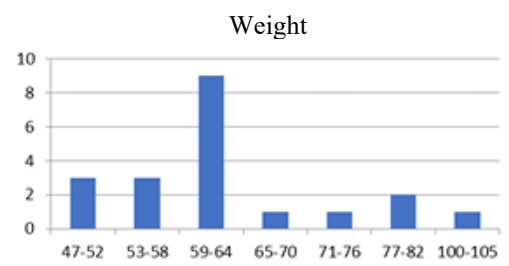


Figure 6. Frequency Distribution of Subjects Based on Body Weight

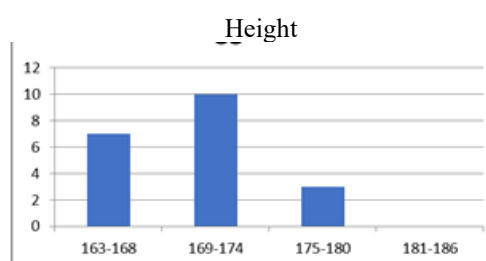


Figure 7. Frequency Distribution of Subjects Based on Height

3.2. Research Data Description

The study aims to determine the effectiveness of sports massage in reducing pain perception and increasing ROM in FIK UNY Futsal players. The results of the descriptive analysis are as follows.

perception Pain. The results of the study showed that the average pain before sports massage was 57.95 while after sports massage was 19.50. The complete results can be seen in the table below:

Table 3. Summary of Pain Perception Statistics Before and After Sports Massage

Information	Value	
	Mean	Standard Deviation

Protest	57.95	21.42177
Posttest	19.50	12.17201

From the results above, when displayed in diagram form, it can be seen in the image below :

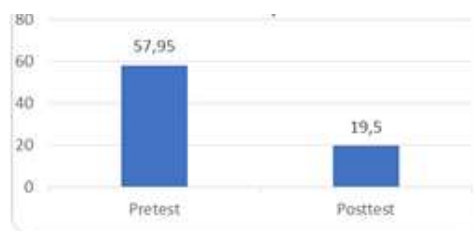


Figure 8. Average Perception of Pain Before and After Massage

The ROM scale in this study was measured by plantar flexion (extension) and dorsiflexion (flexion) movements on the ankle. The results of the study showed that the average ROM scale before and after sports massage in the table below.

Table 4. Results of Descriptive Analysis of ROM

Information	Value		Standard Deviation	
	Pretest	Posttest	Pretest	Posttest
Plantarfleksi	30.30	53.20	4.426	2.621
Dorsofleksi	5.50	14.50	1.670	946

From the results above, when displayed in diagram form, it can be seen in the image below :

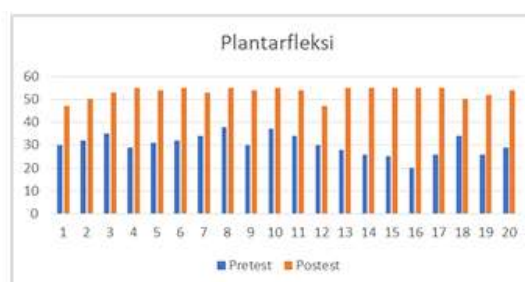


Figure 9. Plantar Flexion Analysis Before and After Sports Massage

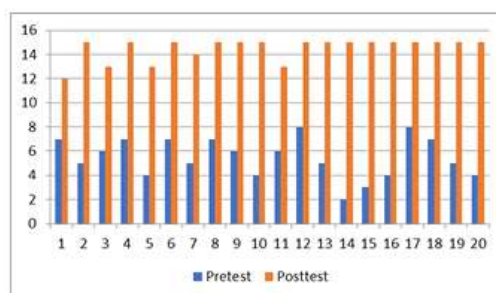


Figure 10. Descriptive Analysis of Dorsiflexion Before and After Sports Massage

3.3. Prerequisite Test

Normality test is a test of the normality of the data distribution to be analyzed. The test is carried out depending on the variables to be processed. The normality test on multivariate is actually very complex, because it must be carried out on variables together. However, this test can also be carried out on each variable, with the logic that if individually each variable meets the assumption of normality, then together (multivariate) these variables can also be considered to meet the assumption of normality. In this study, a normality test was used with variables that together used the Shapiro Wilk technique ($p > 0.05$). Normality test of sport massage on reducing pain and increasing ROM. The results of the data normality test can be seen in the table below:

Table 6. Normality Test Results

Data	Time	Significant P	Information
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Pain	Pretest	.266	Normal
	Post	.592	Normal
Plantarfleksi	Pretest	.874	Normal
	Post	.000	Abnormal

Based on the results of the data normality test listed in the table above, overall the results of the normality test analysis found a significance of $p > 0.05$, indicating that 3 data were normally distributed and 1 data was not normal.

In this study, the Homogeneity statistical test is used to determine whether the variables of several samples are the same or not. To determine the level of Homogeneity of the variance in this study, the p.i value is used. If the p value is greater ($>$) than the α value = 0.05, then the variance in this research group is homogeneous and if the p value is smaller ($<$) than the α value = 0.05, then it is said to be non-homogeneous. In this study, the homogeneity test uses ANOVA with variables that are together with the pretest and posttest difference values. The homogeneity test of sport massage on reducing pain and increasing ROM is as follows :

Table 7. Results of data homogeneity test

Types of tests	Variabel	Sig.f	Information
Pre-test and final test	Pain	0.00	Not Homogeneous
	Planterfleksi	0.00	Not Homogeneous
	Dorsofleksi	0.00	Not Homogeneous

From the results of the homogeneity test data, the results were the same and not the same. The table shows the results of the non-homogeneous data.

Hypothesis testing of this study uses paired t-test statistical analysis for homogeneous or parametric data, and Wilcoxon signed rank statistical analysis for non-homogeneous or non-parametric data. The hypothesis of this proposed study is the manipulation of sport massage to reduce pain that occurs in leg muscles and increase ROM. The results of the hypothesis can be accepted if the value of A to Sign 0.05 ($p > 0.05$). The results of the data analysis of this study are as follows :

Hypothesis testing of sports massage data can reduce pain using the Wilcoxon signed rank test in the following table :

Table 8. Results of Pain Difference Test

Variabel	Asymp Sig. 2 Tailed	Information
Pain	.000	Significant

From the above test, significant results were obtained. Hypothesis testing of sports massage data can increase ROM using the Wilcoxon signed ranks test in the following table :

Table 9. ROM Difference Test Results

Variabel	Asymp Sig. 2 Tailed	Keterangan
Plantarfleksi	0.000	Significant
Dorsofleksi	0.000	Significant

From the test above, significant results were obtained for all variables.

3.4. Effectiveness Test

Percentage of effectiveness of pain reduction and increased ROM after being given Sport massage manipulation after physical activity. Calculated using the following effectiveness formula :

$$Effectiveness = \frac{posttest - pretest}{nilai\ max - pretest} \times 100\% \quad \dots(3)$$

Through the calculation of effectiveness with the formula above, the results of the calculation of the effectiveness of reducing pain and increasing ROM are obtained as follows. From the results of the effectiveness of sports massage on reducing pain and increasing ROM, the results on pain were obtained with an average pretest-posttest effectiveness of 50.79%. Meanwhile, for sports massage manipulation on ROM with an average pretest-posttest effectiveness of Plantarflexion of 92.19%, the pretest-posttest effectiveness of Dorsiflexion of 94.49%.

3.5. Discussion

The main objective of this study was to determine the effectiveness of sports massage on reducing pain and increasing Range Of Motion (ROM) in the lower extremities of FIK UNY futsal players after training. The results of the data analysis used in this study used non-parametric analysis (Wilcoxon Signed Rank) which showed

that sports massage manipulation had a significant success rate in reducing pain or muscle pain levels and increasing ROM of FIK UNY futsal players after training. Based on the results of this study, it can be observed that there was a significant decrease in pain using sports massage manipulation.

In the treatment of sports massage on pain calculated with Wilcoxon signed rank, the p value $(0.000) < 0.05$ was obtained, so it can be concluded that the provision of sports massage manipulation is effective in reducing pain. In the treatment of sports massage on ROM calculated with Wilcoxon signed rank, the p value $(0.000) < 0.05$, the p value $(0.000) < 0.05$, the p value $(0.000) < 0.05$, the p value $(0.000) < 0.05$, the p value $(0.000) < 0.05$, it can be concluded that the provision of sports massage is effective in increasing ROM.

Based on the results of this study, it can be seen that the provision of sport massage manipulation on pain obtained an effectiveness result of 67.67%, then on the increase in plantarflex ROM obtained an effectiveness result of 92.19% on dorsiflex ROM it was concluded that sport massage manipulation is more effective. The decrease due to high pain in the muscles after exercise can be overcome by applying sport massage which consists of rubbing, grinding, shaking, hitting, patting, rubbing resulting in smooth blood circulation because it helps to flow blood containing metabolic waste and increased oxygen will facilitate the development of inflammatory chemicals so that pain and muscle tension are reduced so that it can reduce pain. The pressing movement technique helps relax the muscles through pressure on the trigger point, resulting in ischemia. The ischemia that occurs causes pain and causes lactic acid to start. Ischemia causes a lack of blood flow to the part that is pressed so that it is able to release increased local blood flow, increased oxygen supply, thus helping the tissue return to its circulation. Gate Control Theory Illustration explains that pain fibers stimulate pain to the brain smaller and slow down the journey of sensation than wider touch fibers. Movement by giving touch and pain simultaneously, the sensation of touch goes to the brain and closes the gate into the brain. By doing massage manipulation, it can increase the formation of endorphins into the dosenden control system and can create a sense of relaxation in the muscles. According to the basic opiate endogenesis theory, where the receptors in the brain and spinal cord choose where the central nervous system rests the morphine substance called endorphin and enkephalin when the pain is received. Endogenous opiates can be stimulated out assisted by skin stimulation through massage. These opiate receptors are located at the ends of peripheral sensory nerves.

Previous research entitled "The Effect of Sport Massage Toward the Decrease of Fatigue" showed that sports massage has benefits in reducing the level of fatigue in athletes' bodies after physical activity [51]. The results of the study focused on the general recovery aspect, especially in the context of reducing muscle fatigue as the main indicator. The discussion presented emphasized more on how sports massage can accelerate the muscle relaxation process and restore athletes' physical stamina, but has not touched on the specific effects on certain parts of the body that experience functional disorders due to injury or excessive physical stress. However, from the results and discussion there are still gaps, especially in the measurement and focus of therapeutic interventions. Previous studies have not examined in depth the impact of sports massage on reducing local pain (pain level) or on increasing joint motion function (Range of Motion/ROM), especially in the ankles which are very crucial in sports such as futsal [52], [53]. In addition, there are no objective indicators in the form of joint range of motion or specific pain intensity measurements that are benchmarks for the effectiveness of massage therapy locally on the musculoskeletal structure. This study is here to fill the gap by directly testing the impact of sports massage on two relevant and specific clinical indicators, namely pain levels and ankle ROM in futsal athletes. The expected results of this study not only show the effectiveness of massage in relieving fatigue in general, but also as a targeted physiotherapeutic intervention to restore joint function due to micro-injuries that are often experienced by futsal players. Thus, the discussion in this study is expected to broaden the scope of understanding regarding the benefits of sports massage with a more measurable, focused, and applicable approach according to the rehabilitation needs of certain sports.

This study not only relies on subjective observations of fatigue, but also presents quantitative data through pretest and posttest measurements that are statistically tested with the Wilcoxon Signed Rank test. The novelty is also seen from the ROM measurements that are distinguished in detail between plantar flexion and dorsiflexion movements, providing a sharper biomechanical evaluation dimension [54], [55]. In addition, the calculation of effectiveness in the form of a percentage (with a certain formula) strengthens the quality of measurement that has not been found in previous studies that only emphasize subjective changes after training. Thus, this study enriches the literature with a more focused, standardized approach that has high relevance to the functional rehabilitation needs of futsal players, especially in the recovery of ankle injuries that often occur due to the characteristics of movement in the sport.

Based on the results of the study showing that sports massage is significantly effective in reducing pain levels and increasing the range of motion (ROM) of the ankles of futsal players, the implications of these findings provide important contributions to the practice of post-exercise or post-injury recovery in athletes [56], [57]. Practically, these results can be utilized by coaches, physiotherapists, and sports medical personnel as a basis for integrating sports massage therapy as part of the routine physical recovery program for athletes, especially in sports with high ankle movement intensity such as futsal. In addition, the significant increase in ROM after the application of sports massage indicates that this method has the potential to prevent recurrent injuries due to limited joint

mobility. The academic implications also encourage further research with a deeper biomechanical and physiological approach, as well as opening up opportunities for the development of more specific massage protocols for each part of the body that is prone to injury.

The limitations of this study lie in several aspects that may affect the generalization of the results. First, the number of research subjects was limited to only 20 futsal players from one institution (FIK UNY) making the results of this study not necessarily widely applicable to the population of futsal athletes from various levels of competition or different physical backgrounds. Second, this study only focused on the short-term effects of sports massage after one treatment session, so it cannot provide an overview of the cumulative or long-term effects of the intervention. Third, the measurement of range of motion (ROM) and pain perception still relies on manual and subjective methods, which although standardized, still have the potential for measurement bias. In addition, the absence of a control group or comparison with other recovery methods also limits the inferential strength of the results obtained.

Based on the results and discussions that have been presented, it can be concluded that the provision of sport massage manipulation is significantly effective in reducing pain levels and increasing range of motion (ROM) in the ankles of FIK UNY futsal players after physical activity. These findings confirm that sport massage can be a useful recovery method in improving muscle and joint function and comfort after exercise, while potentially preventing recurrent injuries in futsal athletes.

4. CONCLUSION

Based on the research results, it can be concluded that sports massage is proven to be effective in reducing pain perception and increasing range of motion (ROM) in the lower extremities of futsal players at FIK UNY. This finding provides implications that sports massage can be used as an alternative post-exercise treatment, especially to reduce muscle pain complaints and increase body flexibility. Thus, the application of sports massage has the potential to support the athlete's physical recovery process more optimally, so that it can support their performance in training activities and subsequent matches. Further research is recommended to involve a larger and more diverse sample size from various levels of competition to increase the generalizability of the results. In addition, long-term observation is needed to determine the cumulative effects of sports massage and involve a control group or other recovery methods as a comparison. The use of more objective measuring instruments and advanced technology is also recommended to improve the accuracy of pain and range of motion measurements.

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