COMPETITOR:
JURNAL PENDIDIKAN KEPELATIHAN OLAHRAGA
e-ISSN: 2657-0734 & p-ISSN: 2085-5389 ‖ Volume 18, Number 2, 2026 ‖ P.3949-3960

The Effect Of Sport Massage And Static Stretching On Lower Extremity Muscle Spasm

Alvina Fadhilah Eka Salsabila[1A-E*], Nanang Indardi[2B-D]

[1,2] Universitas Negeri Semarang, Jawa Tengah, Indonesia

alvinafadhilah15@students.unnes.ac.id[1*], nanangindardi@mail.unnes.ac.id[2]

ABSTRACT

Lower extremity muscle spasm is a musculoskeletal condition characterized by involuntary muscle contractions accompanied by pain, stiffness, and restricted movement. This condition frequently occurs following intensive physical activity and may negatively affect physical performance, recovery processes, and daily functional activities. Effective recovery interventions are therefore required to reduce pain and restore normal muscle function. This study aimed to determine the effect of a combination of sport massage and static stretching on reducing lower extremity muscle spasm pain at Klinik Satu Sehat Semarang. This study employed a quantitative approach using a pre-experimental one-group pretest–posttest design. A total of 30 participants experiencing lower extremity muscle spasm were recruited through a total sampling technique. The intervention consisted of sport massage using effleurage, petrissage, friction, shaking, and tapotement techniques, followed by static stretching exercises targeting the gastrocnemius, hamstring, and quadriceps muscles. Pain intensity was assessed using the Numeric Rating Scale (NRS). Data were analyzed using descriptive statistics, the Shapiro–Wilk normality test, and a paired sample t-test with a significance level of 0.05. The results revealed a significant reduction in muscle spasm pain following the intervention. The mean pretest pain score was 7.50 ± 1.280, while the mean posttest score decreased to 2.57 ± 1.251. The mean difference was 4.93 ± 0.640. The paired sample t-test showed a value of t = 42.241 with df = 29 and p = 0.000 (p < 0.05), indicating a statistically significant reduction in pain intensity after treatment. In conclusion, the combination of sport massage and static stretching is an effective, safe, and practical recovery strategy for reducing lower extremity muscle spasm pain and improving muscle relaxation among individuals experiencing musculoskeletal discomfort.

ARTICLE HISTORY
Received: 2026/05/21
Accepted: 2026/05/25
Published: 2026/05/31

KEYWORDS
Sport Massage;
Static Stretching;
Muscle Spasm;
Lower Extremity;
Pain Reduction

AUTHORS' CONTRIBUTION
A. Conception and design of the study;
B. Acquisition of data;
C. Analysis and interpretation of data;
D. Manuscript preparation;
E. Obtaining funding

Cites this Article : Salsabila, A.F.E.; Indardi, N. (2026). The Effect Of Sport Massage And Static Stretching On Lower Extremity Muscle Spasm. **Competitor: Jurnal Pendidikan Kepelatihan Olahraga**. 18 (2), p.3949-3960

INTRODUCTION

Exercise and physical activity play an essential role in improving physical fitness, maintaining health, and enhancing athletic performance. Regular exercise contributes positively to cardiovascular endurance, muscular strength, flexibility, and overall

Alvina Fadhilah Eka Salsabila[1A-E*], Nanang Indardi[2B-D]
alvinafadhilah15@students.unnes.ac.id[1*]

physiological adaptation. However, excessive, repetitive, and high-intensity physical activity may also lead to various musculoskeletal problems, particularly muscle fatigue and muscle spasm when adequate recovery strategies are not implemented (Saragih et al., 2025). Recovery has become a critical component of modern sports science because improper recovery may negatively affect performance, increase injury risk, and delay physiological adaptation.

Muscle spasm is a common musculoskeletal complaint characterized by involuntary muscle contraction accompanied by pain, stiffness, tenderness, and restricted range of motion. Lower extremity muscles, including the gastrocnemius, hamstrings, quadriceps, and soleus muscles, are particularly vulnerable because they bear substantial mechanical loads during locomotor activities such as running, jumping, sprinting, and directional changes (Bachtiar et al., 2022). Persistent muscle spasm can significantly impair functional movement, reduce athletic performance, and interfere with daily activities.

From a physiological perspective, muscle spasm is associated with neuromuscular dysfunction involving excessive motor unit activation and spontaneous electrical activity (SEA), which maintains muscle fibers in a prolonged contraction state (Coletti, 2022). Continuous contraction contributes to local ischemia, reduced oxygen delivery, metabolic waste accumulation, and sensitization of nociceptors, thereby increasing pain perception. Moreover, muscle fatigue resulting from repeated physical exertion may elevate the concentration of inflammatory mediators and metabolic by-products, which further exacerbate muscle tension and discomfort (Mighra & Djaali, 2021).

Several studies have demonstrated that muscle pain following intense exercise is closely related to increased neuromuscular activity, microtrauma within muscle fibers, accumulation of metabolic substances, and impaired circulation (Davis et al., 2020). If left untreated, these physiological disturbances may prolong recovery time, decrease muscle performance, and increase susceptibility to subsequent musculoskeletal injuries. Therefore, identifying effective recovery interventions capable of reducing muscle tension and restoring normal muscle function remains an important concern in sports medicine and physiotherapy.

Among various recovery modalities, sport massage has emerged as one of the most frequently utilized interventions for managing post-exercise muscle discomfort and enhancing recovery. Sport massage involves systematic manipulation of soft tissues designed to improve circulation, reduce muscle stiffness, accelerate metabolic waste removal, and promote relaxation (Zulaini et al., 2021). Physiologically, massage stimulates mechanoreceptors, increases local blood flow, enhances lymphatic drainage, and reduces sympathetic nervous system activity, thereby facilitating recovery processes.

Recent studies have consistently reported positive effects of sport massage on reducing pain intensity, muscle tightness, and perceived fatigue among athletes and physically active individuals (Akbar et al., 2026; Saragih et al., 2025). Research conducted among athletes demonstrated that sport massage significantly improved post-exercise recovery by reducing delayed onset muscle soreness (DOMS) and enhancing perceived muscle relaxation. Furthermore, massage interventions have been associated with

Alvina Fadhilah Eka Salsabila[1A-E*], Nanang Indardi[2B-D]
alvinafadhilah15@students.unnes.ac.id[1*]

improvements in circulation and tissue oxygenation, contributing to faster restoration of muscle function. Another widely implemented recovery strategy is static stretching. Static stretching involves elongating a muscle to a tolerable length and maintaining the position for a specific duration. This intervention is recognized for its effectiveness in increasing flexibility, improving range of motion, and reducing muscle tension (Radhiyyah et al., 2025). Neurologically, static stretching stimulates the Golgi Tendon Organ (GTO), which induces autogenic inhibition and decreases excessive muscle contraction.

Dewi et al. (2024) reported that static stretching significantly improved hamstring flexibility by enhancing connective tissue viscoelastic properties and increasing stretch tolerance. Similar findings have been documented in numerous sports rehabilitation studies, indicating that static stretching may contribute to muscle relaxation and reduction of muscular discomfort. Additionally, static stretching has demonstrated beneficial effects on joint mobility and movement efficiency, making it a commonly prescribed intervention in both clinical and sports settings.

Recent developments in sports rehabilitation emphasize multimodal interventions rather than isolated treatments. Combining different therapeutic approaches may produce synergistic effects by targeting multiple physiological mechanisms simultaneously. In this context, sport massage primarily addresses circulatory enhancement and tissue relaxation, whereas static stretching focuses on neuromuscular inhibition and flexibility improvement (Mulya et al., 2021). Theoretically, integrating these two interventions may optimize recovery outcomes and accelerate the normalization of muscle function following fatigue-induced spasm. Despite extensive research investigating sport massage and static stretching individually, empirical evidence regarding their combined effectiveness in treating lower extremity muscle spasm remains limited. Most previous studies have focused on either massage therapy or stretching interventions separately, primarily examining outcomes such as flexibility, recovery perception, delayed onset muscle soreness, or athletic performance enhancement.

Several studies have confirmed that sport massage effectively reduces pain and muscle stiffness; however, many investigations have focused on healthy athletes without specific musculoskeletal complaints. Likewise, research on static stretching has predominantly emphasized flexibility enhancement rather than direct evaluation of muscle spasm reduction. Consequently, there remains insufficient evidence regarding whether combining these interventions provides superior therapeutic outcomes compared with applying each treatment independently. Furthermore, previous studies have largely examined post-exercise recovery in athletic populations, whereas clinical populations experiencing active lower extremity muscle spasm have received relatively less attention. Variations in intervention duration, treatment frequency, outcome measurements, and participant characteristics also contribute to inconsistencies across the literature. These methodological differences make it difficult to establish definitive conclusions regarding the effectiveness of combined sport massage and static stretching interventions.

Another important limitation concerns the lack of studies conducted within Indonesian clinical settings. Most available evidence originates from international contexts,

Alvina Fadhilah Eka Salsabila[1A-E*], Nanang Indardi[2B-D]
alvinafadhilah15@students.unnes.ac.id[1*]

which may differ in demographic characteristics, physical activity patterns, and rehabilitation practices. Therefore, investigating the effectiveness of combined sport massage and static stretching among patients experiencing lower extremity muscle spasm in Indonesian healthcare facilities is both scientifically and practically relevant.

Based on the aforementioned problems and research gaps, this study aims to determine the effect of combining sport massage and static stretching on reducing lower extremity muscle spasm among patients treated at Klinik Satu Sehat Semarang. Specifically, the study seeks to evaluate whether the integrated intervention can significantly decrease pain intensity and improve muscle relaxation in individuals experiencing lower extremity muscle spasm.

The novelty of this study lies in the integration of two evidence-based recovery interventions sport massage and static stretching within a single therapeutic protocol specifically targeting lower extremity muscle spasm. Unlike previous studies that investigated these interventions independently, this research examines their combined effect and potential synergistic mechanisms in reducing muscle tension and pain.

Additionally, this study contributes to the growing body of sports rehabilitation and physiotherapy literature by providing empirical evidence from an Indonesian clinical setting. The findings are expected to enrich current understanding regarding non-pharmacological management strategies for muscle spasm and offer practical recommendations for physiotherapists, sports therapists, coaches, and healthcare practitioners involved in musculoskeletal rehabilitation.

In summary, lower extremity muscle spasm represents a significant musculoskeletal problem that can negatively affect physical function, athletic performance, and quality of life. Although sport massage and static stretching have independently demonstrated beneficial effects on muscle recovery and relaxation, evidence regarding their combined effectiveness remains limited. Existing literature reveals substantial gaps related to integrated intervention approaches, clinical applications, and Indonesian-based evidence. Therefore, this study investigates the effect of combining sport massage and static stretching on lower extremity muscle spasm, with the expectation of providing a more comprehensive and effective recovery strategy. The findings are anticipated to contribute both theoretically and practically to sports rehabilitation, physiotherapy practice, and evidence-based musculoskeletal management.

METHODS

This study employed a quantitative approach using a pre-experimental research design with a one-group pretest–posttest model. This design was selected to evaluate changes in lower extremity muscle spasm pain before and after the administration of a combined sport massage and static stretching intervention within the same group of participants. According to contemporary rehabilitation research, the one-group pretest–posttest design remains appropriate for preliminary investigations aimed at determining the potential effectiveness of therapeutic interventions prior to conducting larger randomized

controlled trials (Setiawan et al., 2022; Creswell & Creswell, 2018). Although the design does not include a control group, it allows researchers to directly observe treatment-related changes and establish initial evidence regarding intervention efficacy (Fraenkel et al., 2019).

The study was conducted at Klinik Satu Sehat Semarang, Indonesia. The target population consisted of patients experiencing lower extremity muscle spasm complaints who sought physiotherapy and rehabilitation services at the clinic. A total sampling technique was employed, resulting in 30 participants who met the predetermined eligibility criteria. Total sampling was chosen to maximize participant inclusion and improve the representativeness of the available clinical population (Sugiyono, 2023).

The inclusion criteria were: (1) patients experiencing lower extremity muscle spasm pain; (2) aged between 18 and 50 years; (3) not currently consuming analgesic medication; (4) having no history of severe lower extremity injury; and (5) providing voluntary informed consent to participate in the study. Exclusion criteria included patients diagnosed with fractures, ligament ruptures, neurological disorders, or other pathological conditions requiring specialized medical intervention. Ethical considerations were implemented throughout the study, ensuring participant confidentiality, voluntary participation, and adherence to ethical standards for human research (World Medical Association, 2018).

The intervention consisted of a combination of sport massage and static stretching applied to the lower extremity musculature. Sport massage was administered for approximately 20 minutes using standardized techniques, including effleurage, petrissage, friction, shaking, and tapotement. These techniques have been reported to enhance local blood circulation, stimulate lymphatic drainage, reduce muscle stiffness, and promote neuromuscular relaxation (Best et al., 2021; Zulaini et al., 2021; Weerapong et al., 2019). Following the massage session, participants performed static stretching exercises targeting the gastrocnemius, hamstring, and quadriceps muscles. Each stretch was maintained for 20–30 seconds and repeated three times. Previous studies have demonstrated that static stretching effectively improves muscle flexibility, decreases passive muscle tension, and stimulates Golgi Tendon Organ-mediated relaxation responses (Radhiyyah et al., 2025; Behm et al., 2021; Dewi et al., 2024).

Pain intensity associated with muscle spasm was assessed using the Numeric Rating Scale (NRS), a validated and reliable instrument widely used in musculoskeletal and rehabilitation research (Hawker et al., 2019). The scale ranges from 0 to 10, where 0 indicates no pain and 10 represents the worst imaginable pain. Pretest measurements were obtained before intervention, whereas posttest measurements were collected immediately after the intervention protocol.

Data analysis was performed using IBM SPSS Statistics software. Descriptive statistics were used to summarize participant characteristics and pain scores. Data normality was assessed using the Shapiro–Wilk test, which is recommended for small sample sizes (Ghasemi & Zahediasl, 2021). Subsequently, a paired sample t-test was conducted to examine differences between pretest and posttest scores. Statistical significance was established at $\alpha = 0.05$, consistent with contemporary standards in clinical and sports science research (Field, 2022).

Alvina Fadhilah Eka Salsabila[1A-E*], Nanang Indardi[2B-D]
alvinafadhilah15@students.unnes.ac.id[1*]

RESULTS AND DISCUSSION

Result

The following presents the results of descriptive statistical analysis, normality test, and hypothesis test from the study of the effect of the combination of sport massage and static stretching on reducing lower extremity muscle spasm.

Table 1.
Descriptive Statistics of NRS Pretest and Posttest Values

Variable	N	Min	Max	Mean	SD	Sum	Var
Pretest (NRS)	30	5	10	7.50	1.280	225	1.638
Posttest (NRS)	30	0	5	2.57	1.251	77	1.564

Based on Table 1, the mean pretest NRS value was 7.50 (SD = 1.280) with a range of 5–10, classified as severe pain. After intervention, the mean posttest value dropped to 2.57 (SD = 1.251) with a range of 0–5, classified as mild pain. There was a decrease in the mean NRS score of 4.93 points. This decrease indicates that the change that occurred was not only statistically significant, but also had clinical significance because the shift from the severe pain category to the mild pain category can directly impact the subject's comfort in activities. In other words, the intervention provided produced a quite noticeable change in the patient's pain perception.

Table 2.
Shapiro-Wilk Normality Test Results

Variable	Statistic	df	Sig.	α	Distribution
Pretest NRS (VAR00001)	0.944	30	0.116	0.05	Normal
Posttest NRS (VAR00002)	0.938	30	0.081	0.05	Normal

Based on Table 2, the Shapiro-Wilk significance values for pretest = 0.116 and posttest = 0.081, both > α = 0.05. The data were normally distributed so the parametric paired sample t-test could be used. These results indicate that the distribution of pretest and posttest data was relatively stable, so further analysis with the parametric test was deemed appropriate to examine differences before and after the intervention. These findings also reinforce that the changes in pain scores that emerged can be analyzed more convincingly statistically.

Table 3.
Paired Sample T-Test Results

Pair	Mean	SD	SE Mean	r	95% CI	t (df=29)	Sig.
Pretest – Posttest NRS	4.933	0.640	0.117	0.872	[4.694; 5.172]	42.241	0.000*

Based on Table 3, the value of t = 42.241 with df = 29 and p = 0.000 (p < 0.05), so H0 was rejected and H1 was accepted. The pretest-posttest correlation r = 0.872 indicates a very strong relationship. The 95% confidence interval [4.694; 5.172] does not include 0, confirming that the pain reduction is both clinically and statistically significant.

Alvina Fadhilah Eka Salsabila[1A-E*], Nanang Indardi[2B-D]
alvinafadhilah15@students.unnes.ac.id[1*]

The research results showed a significant decrease in muscle spasm pain after the administration of the combination of sport massage and static stretching, with the mean NRS value dropping from 7.50 (severe pain) to 2.57 (mild pain). This decrease of 4.93 points was confirmed as statistically significant ($t = 42.241$; $p = 0.000$). This quite large mean difference shows that the combination of interventions used did not only provide a small effect, but truly produced a meaningful change in the subject's condition. This is important because in cases of muscle spasm, pain reduction felt by the patient often becomes an early indicator that the muscle relaxation process has begun.

Discussion

The findings of this study demonstrated that the combination of sport massage and static stretching significantly reduced lower extremity muscle spasm pain among patients at Klinik Satu Sehat Semarang. The mean Numeric Rating Scale (NRS) score decreased from 7.50, categorized as severe pain, to 2.57, categorized as mild pain, resulting in a mean reduction of 4.93 points. Statistical analysis confirmed that this decrease was highly significant ($t = 42.241$; $p < 0.001$), indicating that the intervention produced substantial therapeutic effects rather than merely random fluctuations in pain perception. These findings support the hypothesis that combining sport massage and static stretching is an effective non-pharmacological strategy for managing lower extremity muscle spasm.

From a physiological perspective, the reduction in pain can be explained through the neuromuscular and circulatory effects induced by sport massage. Soft tissue manipulation techniques such as effleurage, petrissage, friction, shaking, and tapotement stimulate cutaneous and muscular mechanoreceptors, which activate parasympathetic responses and suppress excessive sympathetic nervous system activity (Best et al., 2021; Akbar et al., 2026). Reduced sympathetic activation promotes muscle relaxation, decreases muscle tone, and improves tissue extensibility. According to Coletti (2022), chronic muscle spasm is associated with spontaneous electrical activity (SEA) that maintains muscle fibers in a persistent state of contraction. Sport massage may contribute to the reduction of SEA, thereby interrupting the ischemia–pain–contraction cycle that perpetuates muscular dysfunction. When local circulation improves, oxygen delivery increases and accumulated metabolites are removed more efficiently, leading to reduced nociceptive stimulation and pain perception.

Improved blood circulation represents another important mechanism underlying the observed outcomes. Previous studies have shown that massage therapy increases peripheral blood flow, enhances lymphatic drainage, and accelerates the removal of metabolic by-products such as lactate, hydrogen ions, and inflammatory mediators that accumulate after intense physical activity (Davis et al., 2020; Crane et al., 2017; Mighra & Djaali, 2021). The accumulation of these metabolites has been linked to increased muscle soreness, stiffness, and fatigue. Therefore, enhanced circulation following massage intervention contributes significantly to pain reduction and tissue recovery. Similar physiological adaptations were reported by Weerapong et al. (2019), who concluded that massage therapy improves local vascular function and facilitates post-exercise recovery processes.

The present findings are consistent with previous studies investigating the effectiveness of sport massage on musculoskeletal complaints. Bachtiar et al. (2022) reported significant reductions in lower extremity muscle pain among football players following sport massage intervention. Likewise, Saragih et al. (2025) demonstrated that sport massage effectively reduced muscle tension, improved flexibility, and accelerated recovery in physically active individuals. Alpiah et al. (2025) further reported a decrease in delayed onset muscle soreness (DOMS) pain scores from 7.17 to 2.26 following massage treatment. These studies collectively support the current findings and suggest that sport massage serves as an evidence-based intervention for alleviating muscle discomfort and enhancing musculoskeletal recovery.

The effectiveness of the intervention was further enhanced through the addition of static stretching. Stretching exercises maintained for a prolonged duration stimulate the Golgi Tendon Organ (GTO), which plays a critical role in regulating muscle tension through autogenic inhibition (Behm et al., 2021). Activation of the GTO sends inhibitory signals to alpha motor neurons, resulting in decreased muscle contraction and increased relaxation. Consequently, muscles experiencing prolonged spasm become more capable of returning to their normal resting length. This mechanism is particularly important in lower extremity muscles, where repetitive physical loading often contributes to excessive muscular tension and reduced flexibility.

Static stretching also promotes structural adaptations within muscle and connective tissues. Dewi et al. (2024) demonstrated that static stretching significantly improved hamstring flexibility through alterations in viscoelastic properties and increased tolerance to stretch. Similar findings have been reported by Konrad et al. (2021), who observed that regular static stretching improves range of motion and reduces passive muscle stiffness. From a biomechanical perspective, improved flexibility decreases resistance during movement and reduces excessive stress on musculotendinous structures, thereby minimizing the likelihood of recurrent spasm episodes. Therefore, the contribution of static stretching extends beyond immediate pain reduction and may support long-term musculoskeletal health.

An important aspect of the present study is the synergistic interaction between sport massage and static stretching. While sport massage primarily improves circulation and tissue relaxation, static stretching targets neuromuscular inhibition and flexibility enhancement. The combination of these interventions addresses multiple physiological pathways simultaneously, creating a more comprehensive recovery response than either modality alone. Mulya et al. (2021) reported that combining massage and stretching interventions resulted in superior recovery outcomes compared with isolated treatments, including more effective reductions in blood lactate concentration and muscle fatigue. This synergistic effect likely explains the substantial reduction in pain observed among participants in the current study.

The observed improvements may also be interpreted through contemporary recovery theories. The integrated recovery model suggests that effective rehabilitation should address circulatory, neuromuscular, metabolic, and psychological factors

simultaneously (Kellmann et al., 2018). Sport massage contributes to physiological restoration through improved circulation and muscle relaxation, whereas static stretching restores normal muscle length and neuromuscular balance. Together, these interventions facilitate both structural and functional recovery, supporting the body's natural healing processes.

Beyond physiological mechanisms, psychological responses may have contributed to the intervention outcomes. Massage therapy has been associated with reductions in anxiety, stress, and perceived fatigue through modulation of cortisol levels and increased release of endorphins and serotonin (Field, 2020; Zulaini et al., 2021). Reduced psychological stress may influence pain perception through central pain modulation pathways, thereby enhancing overall recovery outcomes. This interaction between physiological and psychological mechanisms highlights the multidimensional benefits of sport massage within rehabilitation settings.

The statistical findings further strengthen the validity of the intervention effects. The strong correlation between pretest and posttest scores ($r = 0.872$) indicates a highly consistent treatment response across participants. Furthermore, the 95% confidence interval ranging from 4.694 to 5.172 did not include zero, confirming both statistical and clinical significance. According to Hopkins et al. (2019), clinically meaningful improvements are particularly important in rehabilitation studies because they reflect tangible benefits experienced by patients rather than solely statistical differences. The magnitude of pain reduction observed in this study suggests that participants experienced substantial improvements in comfort, mobility, and functional capacity.

From a practical perspective, the findings have important implications for sports medicine, physiotherapy, and rehabilitation practice. The intervention protocol is simple, cost-effective, non-invasive, and does not require sophisticated equipment. Consequently, it can be implemented in sports clinics, physiotherapy centers, fitness facilities, and community healthcare settings. Athletes, recreational exercisers, and individuals experiencing lower extremity muscle spasm may benefit from incorporating sport massage and static stretching into routine recovery programs. The intervention may also contribute to injury prevention by maintaining optimal muscle flexibility and reducing excessive muscular tension. Despite the positive findings, several limitations should be acknowledged. The use of a one-group pretest–posttest design without a control group limits the ability to establish causal relationships definitively. Future studies should employ randomized controlled trials with larger sample sizes and longer follow-up periods to examine the sustained effects of the intervention. Additional outcome measures such as electromyographic activity, blood lactate concentration, flexibility assessment, and functional performance tests would further strengthen the evidence base.

Overall, the present study demonstrates that the combination of sport massage and static stretching is an effective, safe, and comprehensive intervention for reducing lower extremity muscle spasm pain. By simultaneously addressing circulatory, neuromuscular, biomechanical, and psychological factors, this integrated recovery strategy offers substantial benefits for musculoskeletal rehabilitation and athletic recovery programs.

CONCLUSION

There is a significant effect of the combination of sport massage and static stretching on reducing lower extremity muscle spasm pain in patients at Klinik Satu Sehat Semarang. The mean NRS value significantly decreased from 7.50 (severe pain) to 2.57 (mild pain), with a mean difference of 4.93 points ($t = 42.241$; $df = 29$; $p = 0.000$). This intervention is recommended as part of a structured recovery program in sports healthcare facilities. These results show that targeted and directed intervention can help accelerate muscle function recovery while also improving the subject's comfort in carrying out daily activities. Future research is suggested to use designs with a control group and add outcome variables such as muscle flexibility and range of motion to obtain a more comprehensive picture of effectiveness.

ACKNOWLEDGMENTS

The authors would like to express their sincere gratitude to Klinik Satu Sehat Semarang for providing research facilities and supporting the implementation of this study. The authors also thank the Department of Sport Science, Universitas Negeri Semarang, for the institutional support and academic guidance throughout this study. Special appreciation is extended to all thirty participants who willingly gave their time and cooperation as research subjects in this study.

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