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Original Article

Effectiveness of manipulative massage therapy in pain reduction, enhancing range of motion, and improving shoulder function: A study in injury rehabilitation

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Abstract:
***Background*:** Shoulder injuries are the most common musculoskeletal or joint problems, causing pain, functional issues, and limitations in Range of Motion (ROM), which can hinder patients' mobility and quality of life. Manipulative massage therapy has the potential to alleviate pain, improve joint movement, and expedite the healing process. The high prevalence of shoulder injuries disrupting daily activities at any time forms the basis of this research. ***Objective*:** This study aimed to examine the effectiveness of massage therapy on pain levels, shoulder function in patients with shoulder injuries, and Range of Motion (ROM). ***Methods*:** The research methodology employed a Quasi-experimental study with a one-group pretest-posttest design. The treatment program consisted of massages conducted at the Physiotherapy Service Center, Sports Science Faculty, Universitas Negeri Padang, from April 2023 to October 2023. Participants included male athletes and sports enthusiasts (n = 17) and females (n = 3), aged 17-40 years experiencing shoulder pain, ROM issues, and shoulder function problems. Participants who willingly signed consent and completed the study became the treatment group receiving the same massage program with a consistent dose and intensity for 35 minutes three times a week. Data collection involves the Visual Analog Scale (VAS) for pain assessment, goniometer for ROM measurement, and SPADI for shoulder function evaluation. Data analysis utilized the Wilcoxon signed-rank test through SPSS version 25. ***Results*:** 20 participants completed the massage program over six weeks. After data analysis, the treatment group significantly decreased pain levels from 27.50 ± 5.46 to 3.85 ± 1.13 (85.80 ± 4.27% reduction). Additionally, there was an increase in ROM for flexion, abduction, and extension (Flexion = 156.25 ± 9.15 vs. 175.00 ± 5.12, abduction = 151.25 ± 9.98 vs. 174.00 ± 5.98, extension = 48.25 ± 9.21 vs. 57.00 ± 4.70) with percentage increases in ROM (flexion, abduction, and extension) (12.25 ± 5.35%, 15.40 ± 6.90%, 21.19 ± 17.89%). Inferential statistical tests indicated significant differences between the pre-test and post-test in each group ($P < 0.05$) for pain level, shoulder function, and ROM measurements. ***Conclusion*:** Therefore, the benefits of massage therapy have been verified as effective in reducing pain, improving ROM, and enhancing shoulder function. This research provided new insights into shoulder injury treatment through massage therapy, aiming to support the improved quality of life for those affected by shoulder injuries. Furthermore, these findings can serve as a reference for developing similar therapies in treating other musculoskeletal injuries. Further research is needed, including a larger participant pool for more in-depth investigation.
Keywords: Massage, Massage therapy, pain, shoulder function, ROM

Introduction

The prevalence of sports injuries has seen a continual rise, coinciding with the heightened public interest in various sporting disciplines. Injuries can manifest across diverse body segments, specifically causing pain, heat, swelling, disruptions to tendons, ligaments, and joints, and reduced range of motion attributable to overuse or accidents (contact or non-body contact) (Deetz & Petrie, 2022; Joseph et al., 2012; Ndayisenga et al., 2021). Sporting injuries necessitate significant attention due to their intimate connection with prospects for engaging in physical activities, notably among athletes. The three primary factors contributing to injuries are muscle fatigue, a history of previous injuries, and muscle imbalance. In this domain, shoulder injuries stand out as one of the most prevalent, substantially impeding sporting and daily physical activities.

Shoulder injuries are the most common type of injury and can be caused by various factors, such as physical activity, degenerative diseases, and even age-related factors. (Kiliç et al., 2015; Ristolainen et al., 2012). Shoulder injury is a musculoskeletal condition that can significantly impact life, quality of life, and job satisfaction (Richardson et al., 2019). Clinically, symptoms of shoulder injuries encompass joint motion limitations, muscle restrictions, and unused pain, with the cause of this disorder being an autoimmune response to local tissue damage (Suryadi et al., 2021). Shoulder joint impairments greatly affect both movement activities and daily functions. Shoulder injuries are prevalent in sports that predominantly involve using the upper

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extremities, such as badminton, handball, basketball, and volleyball. It is evident in the prevalence of shoulder injuries based on incidents among badminton players, which stands at 67.5%, and at 43.5% among handball and judo athletes (Maghfiroh et al., 2013). Repetitive, explosive movements, and biomechanical issues within shoulder joint activities and overuse are typically the causes of problems and lead to inflammation in the rotator cuff (the muscles around the shoulder) or the bursa (the protective sac of fluid). Common shoulder injuries include sprains and strains, dislocations, separations, tendinitis, bursitis, rotator cuff injuries, frozen shoulder, fractures, and arthritis. Numerous previous studies have explored injury healing methods, both therapeutic and reconstructive surgery. However, several commonly used methods for managing shoulder injuries include physical therapy, manual therapy, and injections. Pain is caused by nerve constriction resulting from physical activity, whether body contact or non-body contact (Kisner & Colby, 2007; Santos-Júnior et al., 2023).

Anatomically, the structure of the shoulder joint and its frequency of use pose a high risk of injury. Shoulder injuries often significantly impact an individual's quality of life, hindering their ability to carry out daily activities, work, and participate in physical endeavors (Kiliç et al., 2015). One key issue associated with shoulder injuries is the discomfort and instability experienced by those affected (Ristolainen et al., 2012). It can encompass symptoms such as persistent pain, loss of mobility, and overall decreased quality of life (Kiliç et al., 2015). Therefore, a better understanding of shoulder injuries, the risk factors, and their management strategies becomes exceedingly essential. Additionally, shoulder injuries can have a significant economic impact, both in terms of required medical care costs and the inability of individuals to work optimally, leading to reduced productivity. Hence, effective shoulder injury management benefits the affected individuals and potentially alleviates the economic burden caused by this health issue.

Shoulder injuries and associated pain and disability constitute a prevalent and debilitating health issue, affecting a substantial portion of the population worldwide (Ndayisenga et al., 2021; Sukarmin et al., 2021). These conditions often result from a variety of factors, including trauma, overuse, and poor ergonomics (Hansrani et al., 2015; Klügl et al., 2010; Komaini, Anton; Saputra, Aidil; Syafrianto, Donal; Gusril; Syamsuar; Ayubi, 2022). While conventional medical approaches and physical therapy have played significant roles in managing and rehabilitating shoulder injuries, there remains a growing demand for innovative and more effective therapeutic interventions (Kisner & Colby, 2007; Kushartanti & Ambardini, 2020).

Manipulative massage therapy has emerged as a promising alternative in addressing shoulder injury-related pain and disability (Boguszewski et al., 2014; Goedecke, 2017; Rosser, 2004; Staude & Radzyshevska, 2021; Yuniana et al., 2022). This non-invasive, hands-on approach combines elements of massage and joint manipulation to alleviate musculoskeletal discomfort, enhance circulation, and promote the overall well-being of individuals suffering from shoulder injuries (Deetz & Petrie, 2022; Fritz, 2013; Kushartanti & Ambardini, 2020; Momeni et al., 2020). However, despite the potential benefits of manipulative massage therapy, there is a noticeable gap in the current body of scientific literature with respect to standardized protocols, evidence-based practices, and a comprehensive understanding of its mechanisms of action. Through rigorous experimentation, clinical assessments, and the integration of cutting-edge methodologies, we anticipate that the outcomes of this research will not only expand our understanding of the therapeutic potential of manipulative massage but also offer tangible solutions to improve the lives of those affected by shoulder injuries. Massage therapy is a manual therapy that works by releasing nerves and improving blood flow; additionally, it can enhance mood and comfort (Blackwood & Ghazi, 2012; Boguszewski et al., 2014; Field et al., 1997; Fritz, 1940; Park et al., 2017). When a massage program is administered with an adequate and measured approach, it can enhance the effectiveness of healing (Ndayisenga et al., 2021).

In line with this, advancements in medical science and technology, research, and innovation in managing shoulder injuries are becoming increasingly crucial. The primary aim is to identify more effective treatment strategies and preventive interventions to reduce the incidence of injuries and to enhance the quality of life for individuals suffering from shoulder injuries (Clarsen et al., 2013; Kiliç et al., 2015; Ristolainen et al., 2012). Massage is a manual therapy proven effective in alleviating pain, relaxing muscles, improving blood circulation, releasing nerves as a form of recovery, and enhancing the function of various joints (Radziejowska et al., 2020). Various massage approaches have been developed, including deep tissue, soft tissue, Swedish, sports, and forage. Each masseur utilizes massage according to its function and purpose, for example, sports massage for recovery, relaxation, and injury relocation (Deetz & Petrie, 2022; Fritz, 2013; Hasanpour-Dehkordi et al., 2021; Romanowski et al., 2017; Rosser, 2004). Conversely, frirage, for instance, is aimed at joint healing and pain alleviation. Massage therapy, as a manual therapy with adequate frequency, intensity, and volume, can enhance the healing of patients with painful injuries in various body segments (Ndayisenga et al., 2021; Priyonoadi et al., 2020; Yuniana et al., 2022; Zhang et al., 2022).

While numerous verified studies have shown the ability to reduce pain, increase range of motion (ROM), and improve shoulder function, massage treatment with a straightforward program is still minimally practiced or limited. Therefore, based on the issues, benefits, and objectives of massage therapy set as the boundaries in this study, the aim was to determine and verify that a combined manipulation therapy of sports massage and forage influences the level of pain, shoulder function, and ROM. This also served as an effort towards rehabilitating shoulder injuries in athletes and sports enthusiasts.

Material & methods

Research design

The research methodology involved a quasi-experimental design with an intervention group (without a control) (Montgomery, 2013). The subjects of this research were athletes with inclusion criteria within the age range of 17-40 years (both males and females). Data was collected through pain assessment scales (VAS), disability evaluations, and SPADI. The intervention program implemented on the patients combined sports massage and forage. The sports massage in this research refers to a comprehensive and complex series of massage manipulations, including stroking, effleurage, kneading, cupping, trigger point, hacking, wringing, vibration, percussion, and stretching. Frirage, on the other hand, encompasses effleurage and deep friction techniques.

Participants

The participants in this study were athletes meeting the following inclusion criteria: 1) aged between 17 and 40 years, 2) without metabolic health issues, 3) experiencing subchronic shoulder pain, 4) actively engaged in sports or athletics that involve the active use of the shoulder joint, 5) participants agree not to undergo any other treatment apart from the provided therapy, 6) informed consent. Each participant signed an agreement to partake in the entire research process. Based on these inclusion criteria, a sample of 20 individuals was obtained (17 males and 3 females).

Intervention Procedure

In the initial phase of this research, research authorization was obtained. A research brochure and Google form were provided to facilitate sample recruitment. The research infrastructure, funding, equipment, and required masseur resources were also checked. Each individual was provided with documentation for measurements and treatments to be administered. After collecting all the research requirements, initial measurements (pre-test) were conducted at different times to determine the initial capabilities of all participants. Participants who completed the study became the treatment group receiving the same massage program with a consistent dose and intensity for 35 minutes three times a week. All participants received the developed manipulation therapy (Sports massage and Frirage) for 6 weeks, with a frequency of 3 treatments per week, totaling 18 sessions. The final phase of this study involves data analysis obtained, descriptively and inferentially, which will be reported by the researcher in the research findings.

Measurement/Instruments

Measurements were conducted using a goniometer to assess the range of motion (ROM). Meanwhile, shoulder function was evaluated using SPADI. On the other hand, VAS was used to measure the pain level.

Statistical analysis

This study used SPSS (Ver 25. IBM Co. USA) for statistical analysis. The normality of data distribution was analyzed using the Shapiro-Wilk method. Different tests were applied: paired t-tests and one sample t-test. Meanwhile, non-normally distributed data were examined using the Wilcoxon signed-rank test. Difference tests were performed on three variables: determining the differences in ROM, shoulder function, and pain levels of the treatment groups.

Results snd Discussion

Results

The results of this research will be presented sequentially, covering (1) results, data description (see Table. 1), testing data normality (see Table 3), (2) Inferential statistical analysis using the Wilcoxon signed-rank test to demonstrate significant differences in data, pain, shoulder function, and ROM (see Table 4).

Initially, the descriptive outcomes are presented, comprising the minimum and maximum values, totals, averages, and standard deviations for each pre and post-test variable. The data provided encompass reductions/increases in pre or post-values due to the manipulative massage treatment, which served as the intervention in this research. The average pain level during the pre-test was obtained at 27.50 ± 5.46. Post the manipulative massage treatment, the average pain level decreased to 3.85 ± 1.13 in the same group, indicating a percentage decrease of 85.80 ± 4.27%. Similarly, the pre-test and post-test results for shoulder dysfunction exhibited a change (90.58 ± 3.24 vs. 23.00 ± 5.57) with a percentage decrease in the SPADI score of 74.55 ± 6.51%, indicating an improvement in shoulder function. As for ROM in flexion, abduction, and extension, the pre-test and post-test outcomes demonstrated an increase (Flexion = 156.25 ± 9.15 vs. 175.00 ± 5.12, abduction = 151.25 ± 9.98 vs. 174.00 ± 5.98, extension = 48.25 ± 9.21 vs. 57.00 ± 4.70) with percentage increments (ROM flexion, abduction, and extension) of 12.25 ± 5.35, 15.40 ± 6.90, 21.19 ± 17.89. For a clearer understanding, the descriptive results of this research can be observed in Table 1.

Table 1. Description of the average results of each group pretest-posttest

Group	*n*	Min	Max	Total	*M* ± *SD*
pre_pain	20	20.00	37.00	550.00	27.50 ± 5.46
post_pain	20	2.00	6.00	77.00	3.85 ± 1.13
pre_s_func	20	85.00	97.56	1811.63	90.58 ± 3.24
post_s_func	20	15.00	35.00	460.00	23.00 ± 5.57

pre_romf	20	140.00	170.00	3125.00	156.25 ± 9.15
post_romf	20	30.00	60.00	965.00	175.00 ± 5.12
pre_romab	20	135.00	165.00	3025.00	151.25 ± 9.98
post_romab	20	160.00	180.00	3480.00	174.00 ± 5.98
pre_romex	20	30.00	60.00	965.00	48.25 ± 9.21
post_romex	20	45.00	60.00	1140.00	57.00 ± 4.70
dec_pain	20	74.00	92.00	1716.00	85.80 ± 4.27
dec_dis	20	60.00	84.00	1491.00	74.55 ± 6.51
inc_romf	20	2.94	24.14	245.19	12.25 ± 5.35
inc_romab	20	6.45	29.63	308.13	15.40 ± 6.90
inc_romex	20	.00	66.67	423.94	21.19 ± 17.89

Information: *prep_pain: Prestest Pain. post_pain: Postest Pain. pre_s_func: Pre-test Shoulder Function. post_s_func: Posttest Shoulder Function. pre_romf: Pre-test ROM Flexion. post_romf: Post Test ROM Flexion. pre_romab: Pre-test ROM Abduction. post_romab: Post Test ROM Abduction. pre_romex: Pre-test ROM Extension. post_romex: Post Test ROM Extension. dec_pain: Decreasing of pain rate. dec_dis: decreasing of score function of a shoulder injury. Inc_romf: Increasing of ROM Flexion. inc_romab: Increasing of ROM Abduction. inc_romex: Increasing of ROM Extension.*

The decrease and increase in each variable and indicator between the pre-test and post-test revealed a decrease in pain levels after manipulative massage treatment, with an average reduction of 86 ± 4.30%. The reduction in shoulder joint dysfunction showed an average of 75 ± 6.45%. Meanwhile, the increase in ROM for flexion, abduction, and extension showed an average increment of 12 ± 5.35%, 15 ± 6.90%, and 21 ± 17.89%. Refer to Table 1.

The Shapiro-Wilk normality test was performed before conducting inferential statistical tests to determine the significance value between pre and post-tests in this research. The results showed inconsistency/non-normality in each variable (data); thus, normality was disregarded. Evidence that not all data are consistently normal can be seen in Table 2. Consequently, non-parametric analysis was conducted using the Wilcoxon test.

Table 2. Normality Data Testing.

	Normality test					
Variabel	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	*df*	*P*	Statistic	*df*	*P*
Pain (Pre-test)	0.208	20	0.023	0.900	20	0.040
Pain (Post-test)	0.223	20	0.010	0.903	20	0.046
Disabilities (Pre-test)	0.117	20	0.200*	0.981	20	0.944
Disabilities (Post-test)	0.115	20	0.200*	0.958	20	0.500
Range of Motion Flexion Pre-test	0.180	20	0.088	0.930	20	0.156
Range of Motion Flexion Post-test	0.125	20	0.200*	0.922	20	0.110
Range of Motion Abduction Pre-test	0.150	20	0.200*	0.914	20	0.075
Range of Motion Abduction Post-test	0.316	20	0.000	0.820	20	0.002
Range of Motion Extension Pre-test	0.125	20	0.200*	0.922	20	0.110
Range of Motion Extension Post-test	0.388	20	0.000	0.686	20	0.000
Decrease of Pain Rate	0.169	20	0.138	0.932	20	0.168
Decrease of dysfunction in the shoulder	0.139	20	0.200*	0.953	20	0.423
Increase of Range of Motion Flexion	0.155	20	0.200*	0.952	20	0.396
Increase of Range of Motion Abduction	0.168	20	0.140	0.894	20	0.032
Increase of Range of Motion Extention	0.127	20	0.200*	0.919	20	0.096

Due to the minimal number of participants, the above data proved that the data was not consistently normal overall. Thus, non-parametric statistical analysis was employed and tested using the Wilcoxon rank-sum test.

Based on the statistical test, the rank value of post-test pain is lower than the rank of pre-test pain. This indicated a reduction in pain after the massage manipulation treatment. Following the post-test, the level of shoulder pain was lower than the pre-test level of shoulder dysfunction. This suggests an improvement in shoulder joints, as indicated by the decreased shoulder dysfunction score. For more details, refer to **Table 3.**

On the other hand, for ROM (flexion, abduction, and extension), after undergoing statistical analysis using the Wilcoxon rank-sum test, the mean rank of the post-test in each ROM (flexion, abduction, and extension) is higher than the pre-test ROM for flexion. This implies that massage manipulation can enhance ROM measurements. Furthermore, inferential statistical testing using the Wilcoxon rank-sum test shows a P-value < 0.05 (P=0.00) (Refer to Table 2), indicating a significant influence between the pre-test and post-test results through the massage intervention.

Table 3. Difference Test of Pre-test and Post-test using the Wilcoxon Signed Rank Test.

Variable	Total	P-Value	Z
Posttest - Pretest Pain	20	0.000	-3.925[b]
Posttest - pre-test Shoulder Function	20	0.000	-3.920[b]
Flexion ROM	20	0.000	-3.935[b]
Abduction ROM	20	0.000	-3.947[c]
Extension ROM	20	0.000	-3.555[c]

Information: based on positive ranks. c based on negative ranks.

Discussions

Based on the research findings, each measured variable between the pre-test and post-test in the entire sample experienced decreases and increases in pain levels, shoulder function, and ROM. This was verified through the assistance of massage manipulation treatment (sports massage combined with forage) provided over a program comprising 18 sessions. The results indicated significant changes in each measured variable between the pre-test and post-test. Decreases and increases in each variable and indicator were observed between the pre-test and post-test. A decrease in pain levels after the massage manipulation treatment was found, averaging 86 ± 4.30%. The reduction in shoulder joint dysfunction averaged 75 ± 6.45%. Meanwhile, the increases in ROM for flexion, abduction, and extension averaged 12 ± 5.35%, 15 ± 6.90%, and 21 ± 17.89%, respectively. Refer to Table 1 for further details.

This study corroborates previous research, specifically the impact of sports massage on the hip, ankle, and knee joints concerning pain and problematic ROM (Ndayisenga et al., 2021). Previous research has confirmed the efficacy of forage in joint recovery and pain reduction, although earlier studies combined this with stretching (Priyonoadi et al., 2020; Utomo & Kushartanti, 2019). A more detailed discussion can be pursued regarding the benefits of manual therapy that emphasizes sensation to communicate the applied pressure or manipulation effectively. Pain emerges from nerve compression and subsides when the nerves are adequately alleviated. Deep-pressure massage is more effective in relieving nerve compression (Kushartanti & Ambardini, 2020). The ROM condition through massage improves when muscles are relaxed, the joints are trained, and healing occurs (Chu et al., 2023; Fritz, 1940; Hasanpour-Dehkordi et al., 2021; Miake-Lye et al., 2019).

When combined, sports massage with forage massage, involving effleurage and friction (deep tissue), can introduce variety and positive effects on pain, ROM, and healing stimulation. The novelty of this research lies in presenting an effective program for shoulder joint rehabilitation through combined massage therapy, employing sports massage and forage. The offered massage therapy involves a well-structured program. For instance, it includes various massage options, treatment frequency, intensity, and duration, making it accessible for anyone seeking this treatment. Furthermore, the findings indicated that integrating manipulative massage therapy into shoulder injury rehabilitation programs can significantly ease pain and restore shoulder function. This integration could be considered by clinicians and physiotherapists to enhance their treatment protocols, potentially resulting in more effective and comprehensive rehabilitation strategies. While this study presents promising results, its ongoing implications call for further exploration.

Subsequent research could delve into the long-term impacts of manipulative massage therapy, examine potential variations in response across different demographics, and assess the sustainability of the observed improvements over extended periods. Additionally, comparative studies involving other rehabilitation modalities could offer a more comprehensive understanding of the therapy's relative efficacy.

Conclusions

The findings confirm the effectiveness of massage therapy in decreasing pain, enhancing ROM, and improving shoulder function. This research contributes valuable insights into treating shoulder injuries, highlighting the potential of massage therapy to enhance the quality of life for individuals affected by such injuries. These results revealed the practical application of massage therapy as an effective intervention for individuals with shoulder injuries. The substantial reduction in pain levels and the concurrent enhancement of ROM indicate the potential of massage therapy to contribute significantly to the rehabilitation and recovery of individuals experiencing shoulder-related musculoskeletal issues. This research reinforces the notion that massage therapy can be a valuable and scientifically supported approach in musculoskeletal rehabilitation. The study's findings contribute to developing evidence-based physiotherapy and sports science practices. Clinicians and healthcare professionals can consider incorporating massage therapy into their treatment plans for individuals with shoulder injuries. The documented improvements in pain levels and ROM provide practical guidance for designing effective rehabilitation programs, potentially improving patient outcomes and overall satisfaction with the treatment process. While acknowledging the significance of these outcomes, the study emphasizes the need for further research, recommending a larger participant pool for more comprehensive investigations into the benefits of massage therapy in musculoskeletal injury treatment.

Conflicts of interest

If the authors have any conflicts of interest to declare.

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