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The effectiveness of massage gun treatment combined with passive stretching in reducing non-specific lower back pain

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Abstract*:* Non-specific lower back pain is a common condition characterized by strain, muscle spasms, or weakness of the paraspinal muscles, particularly the multifidus muscle, which affects adjacent musculature such as the gluteus, hamstrings, and quadriceps. This study aimed to investigate whether massage gun treatment combined with passive stretching could reduce non-specific low back pain in patients experiencing subacute and chronic phases of this condition. This pseudo-experimental research employed a one-group pretest-posttest design with three treatments. Participants were selected using purposive sampling based on inclusion criteria: suffering from non-specific low back pain, willingness to participate, and age between 20 and 65 years. Exclusion criteria included anatomical abnormalities of the spine, fractures, open wounds, and specific spinal disorders. The visual analog scale (VAS) was used to measure pain intensity before and after each treatment session. Initial VAS scores averaged 65.6 units. Following the first treatment, scores decreased significantly to 52.1 units; subsequent reductions occurred at 42.1 units post-second treatment and 33.5 units post-third treatment. Statistical analysis revealed a significant difference across all three treatment sessions ($p = 0.000 < 0.05$), indicating a progressive improvement in pain control over time. Massage gun therapy coupled with passive stretching demonstrated efficacy in reducing non-specific lower back pain among participants. These findings suggest that repeated application of these interventions can lead to sustained improvements in pain management for individuals suffering from subacute and chronic non-specific low back pain conditions.

Keywords: non-specific low back pain, massage support, passive stretching

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INTRODUCTION

Pain is a sensory and emotional effect due to actual and potential tissue damage that is described in tissue damage. Pain can be felt due to stimulation received by nocciceptors with high or low intensity. Nocciceptors (pain receptors) are nerve endings found in muscles, skin, vascular, visceral, and joints that are responsible for noxious stimuli due to chemicals, temperature, and mechanical development (Bahrudin, 2018**).** Pain can be categorized into acute and chronic phases. Acute pain serves as a protective mechanism following an injury, helping the individual recognize and address the stimulus to facilitate recovery. In contrast, chronic pain persists even after the initial injury has healed, often due to continuous activation of nociceptors despite resolution of tissue damage (Putra, 2020). Four main types of pain exist: nociceptive, neuropathic, visceral, and somatic. Nociceptive pain originates from the activation or sensitization of peripheral nociceptors responding to chemical, thermal, or mechanical

stimuli. Neuropathic pain results from damage to peripheral nerves affecting both central and peripheral afferent pathways, commonly presenting as shooting or stabbing sensations. Visceral pain involves internal organs and may radiate to the body's surface, associated with issues like organ contractions or gallstones. Lastly, somatic pain manifests as sharp stabs or burns emanating from subcutaneous tissues, skeletal muscles, tendons, bones, and peritoneal membranes (Lyubashina et al., 2023).

In terms of location, there are four primary sites where pain frequently occurs. Muscle pain often arises due to intense physical activity causing elevated muscle tension and diminished blood flow. Reduced oxygenation impairs muscular functions contributing to perceived pain (Arovah, 2021). Pain in the tendons can result from excessive loads during exercise leading to inflammation and potentially long-term fibrotic changes hindering mobility. Joint pain is caused by degenerative processes exacerbated by aging or traumatic events disrupting cartilaginous integrity within joints. Cartilage lacks direct blood supply relying instead on synovial fluids; prolonged mechanical stress thins bone surfaces. Finally, nerve pain occurs due to mechanical pressures blocking nutrient delivery essential for neural functioning, manifesting symptoms ranging from tingling sensations through numbness culminating in debilitating pains if left untreated.

A hunched sitting position can trigger strong and long muscle work, so that blood flow to the muscles is blocked. This can cause excessive metabolic waste to accumulate, which then increases pressure inside and outside the muscle cells. This increase in osmotic pressure will then cause edema, which then presses on the sensory nerves. Then it will be felt as musculoskeletal disorders or muscle pain. Research has shown that an unergonomic sitting position has a risk of experiencing low back pain of 50.0%. A less ergonomic sitting position such as sitting in a hunched position can trigger strong and long muscle work, so that blood flow to the muscles is blocked. This can cause excessive metabolic waste to accumulate, which then increases pressure inside and outside the muscle cells. This increase in osmotic pressure will then cause edema, which then presses on the sensory nerves. Then it will be felt as musculoskeletal disorders or muscle pain (Anggraika, 2019).

Back pain is pain in the lumbosacral area caused by muscle strain or pressure on the nerve roots (Kurniati, 2021)**.** Back pain is the most common symptom of disease found in everyday practice (Agustina & Khiong, 2023)**.** Lower back pain is a musculoskeletal disorder caused by poor ergonomics. Low back pain is defined as pain localized between the costal margin and the inferior gluteal fold and lasting for more than a day (Rahmawati, 2021). The pain of low back pain sufferers arises from trauma pain when moving so that it interferes with daily activities and can reduce productivity. The pain experienced can cause frustration in living daily life so that it can interfere with the quality of life (Mahasih, 2019). The main symptoms of low back pain injury are characterized by pain in the spine in the back. The symptoms felt are dull to sharp pain that can cause pain to spread to other areas of the body. This pain can make it difficult for sufferers to move or stand up straight (Mustagfirin et al., 2020), Cases of lower back pain result in limited joint movement of a person, thus affecting daily activities such as work, school, and sleep problems. Based on the phase of back pain, it is divided into three characteristics, including 1) acute phase lasting less than 6 weeks, 2) sub-acute phase lasting 6-12 weeks, and 3) chronic phase lasting more than 12 weeks (WHO, 2023). Based on the severity of the condition, lower back pain is divided into non-specific lower back pain and specific lower back pain. The prevalence of lower back pain cases based on gender is that 40% of cases occur in men and 35% of cases occur in women (Han et al., 2023).

Cases of back pain that are felt at least once in a person's lifetime occur in non-specific back pain with a prevalence of 90% of pain that cannot be associated with specific pathology, strain, muscle tension, paraspinal muscle weakness and affects the gluteus, hamstring, quadriceps muscles (Knezevic et al., 2021), most studies recommend treatment in cases of non-specific low back pain with exercise and manual therapy (Oliveira et al., 2018). Lower back pain is divided into two criteria, non-specific lower back pain and specific lower back pain. Empirical studies prove that 90% of cases of lower back pain are non-specific disorders and 10% experience specific lower back pain disorders (Amila et al., 2020). Non-specific lower back pain is the pain that occurs due to strain, muscle tension, weakness of the paraspinal muscles, especially the multifidus muscle and affects the gluteus, hamstring, quadriceps muscles, and is not caused by specific pathology, while specific back pain (Tungka et al., 2019). Lower back pain is a specific disorder that can be detected in medical conditions such as HNP, spondylothesis, osteoporosis, and spondyloathritis (Kim & Yim, 2020). Cases of lower back pain are classified into three

based on time, the acute phase, subacute phase, and chronic phase. The acute phase occurs ≤6 weeks, the subacute phase 6-12 weeks, and the chronic phase ≥12 weeks.

Non-pharmacological treatments are increasingly recognized as effective options for managing non-specific low back pain (LBP) (Gianola et al., 2019; Yeganeh et al., 2017), with massage guns emerging as a recommended tool. Massage gun is a tool that can be applied easily and can be used to massage the body. Massage gun consists of a handle connected to a massage head that vibrates quickly (Wardana et al., 2024). Previous research recommends massage gun as a clinical and sports therapy to support warming up and recovery (Ferreira et al., 2023). Massage gun can give effect on muscle activation (strength, speed, endurance, oxygen absorption); reaction, balance, agility; joint range, myofascial release; prevention of DOMS. Therapeutic tools have an impact on the tissue by regulating the level of frequency, amplitude, and friction strength (Comeaux, 2011). The massage gun works by providing a vibration effect on the myofascial tissue with the aim of increasing joint range, relieving pain, and eliminating thighness in the muscles (Cheatham et al., 2021). By targeting specific muscle groups, the massage gun helps alleviate tension and soreness, which can significantly reduce pain.

Giving a massage as a muscle relaxant followed by exercise therapy in the form of passive stretching is beneficial for the body to improve the quality of muscle flexibility and muscle strength and reduce pain (Buttagat et al., 2020; Delano et al., 2022, 2023). Using a massage gun as an alternative to massage tools offers a modern approach to muscle relaxation and recovery. This innovative device can be effectively combined with stretching exercises, creating a synergistic effect that enhances muscle flexibility and strength. Passive stretchingis an effective method in reducing muscle pain and increasing muscle flexibility. This process involves stretching the muscles with external assistance, such as using tools or assistance from another person. Research has shown that passive stretching can reduce pain and increase joint range of motion. This method is optimally used when the agonist muscles (the main muscles in movement) are weak, so it can help increase muscle and joint flexibility. In practice, passive stretching is done by stretching the muscles as far as possible and holding them for a while. This gives the muscles the opportunity to stretch to their maximum and reduce tension. However, it should be noted that passive stretching can pose a risk of pain if given excessive force or done quickly. Research showed that passive stretching can reduce tension in the flexor muscles in the cubital region in stroke patients (Mentari et al., 2024). In addition, this method is also useful in increasing overall body flexibility.

Despite extensive research on the individual benefits of massage guns and passive stretching, surprisingly, very little investigation has been conducted on the combined effects of these modalities. This study aims to fill this gap by investigating the efficacy of using a massage gun in conjunction with passive stretching as an alternative treatment for patients suffering from non-specific low back pain. The findings of this research are expected to contribute significantly to the understanding and application of integrated therapeutic techniques in managing chronic musculoskeletal conditions like non-specific low back pain, thereby enhancing patient outcomes and improving overall healthcare practices.

METHODS

This study employed a quasi-experimental design with a one-group pretest-posttest approach, where the research subjects formed a single group. The sampling technique involved purposive sampling based on inclusion and exclusion criteria. The inclusion criteria for this study were as follows: patients experiencing non-specific low back pain in either subacute or chronic phases; willingness to participate; and an age range of 20–65 years. Conversely, participants were excluded if they exhibited anatomical abnormalities of the spine, fractures, open wounds, or specific disorders. Data collection took place at the Manipulative and Rehabilitative Therapy Health and Sport Center, Universitas Negeri Yogyakarta, using sample size determinations calculated via a sample size calculator.

During the pretest phase, baseline measurements were obtained from participants, including their reported levels of pain assessed via the Visual Analog Scale (VAS). This widely recognized instrument quantifies subjective pain intensity on a scale ranging from 0 to 100. The VAS has demonstrated validity with a correlation coefficient r of 0.941 and reliability with an intraclass correlation coefficient ICC of 0.97, rendering it valid and reliable for use in data collection processes. Participants utilized the VAS mobile application to assess their pain perception accurately, which was developed specifically for measuring pain levels (Delgado et al., 2018; Escalona-Marfil et al., 2020; Zhu et al., 2023). They were

instructed to open the visual analog scale application and slide the button according to how much they felt their pain had intensified. Greater severity corresponded to sliding further along the scale towards higher numbers. Following measurement, participants received treatment involving massage therapy administered by a therapist starting from the back area extending upwards through parts of their upper leg region. Post-massage intervention included passive stretching assisted by therapists.

The collected data underwent statistical analysis utilizing SPSS software. Initially, normality tests were conducted to determine whether the data conformed to a normally distributed pattern before proceeding with difference testing via paired t-tests or Wilcoxon signed rank tests if appropriate conditions were met. These analyses aimed to evaluate effectively whether treatment outcomes showed significant improvements post-intervention compared against initial assessments.

RESULTS AND DISCUSSION

This research was conducted on the Health and Sport Center Universitas Negeri Yogyakarta, based on the criteria of the research sample experiencing complaints of injury non-specific low back pain sub acute phase and chronic phase.

Table1. Characteristics of The Samples

Gender	N
Man	13
Woman	7
Work	
Student	2
Private sector employee	8
Businessman	7
Etc	3
Causes of Injury	
Sport	6
Weightlifting	3
Inactive for a long time	11
Total	20

Table 1 presents the data obtained based on gender, type of work, and the case of injury. It is known that males experience more complaints low back pain compared to female gender, private employees experience more complaints low back pain and caused of sitting still for a long time is the most common cause of injury in LBP.

Table 2. VAS Normality Test Results

	Shapiro Wilk		
VAS 1	Data	Sig.	Information
	Posttest 1	0.190	Normal
	Shapiro Wilk		
VAS 2	Data	Sig.	Information
	Posttest 2	0.082	Normal
	Shapiro Wilk		
VAS 3	Data	Sig.	Information
	Posttest 3	0.226	Normal

Table 2 presents the outcomes of the ROM VAS normality tests conducted on the first, second, and third post-test data collections. Specifically, the significance values were observed as follows: Post-Test 1 = 0.190, Post-Test 2 = 0.082, and Post-Test 3 = 0.226. Across treatments from Treatment 1 to Treatment 3, the normality tests of the VAS pain scale measurements yielded significance values exceeding 0.05. This indicates that all collected data conform to a normal distribution. This revised paragraph maintains clarity and precision suitable for an academic journal format. It also ensures that

technical terms like "ROM VAS" and statistical concepts such as "significance values" are used accurately and concisely.

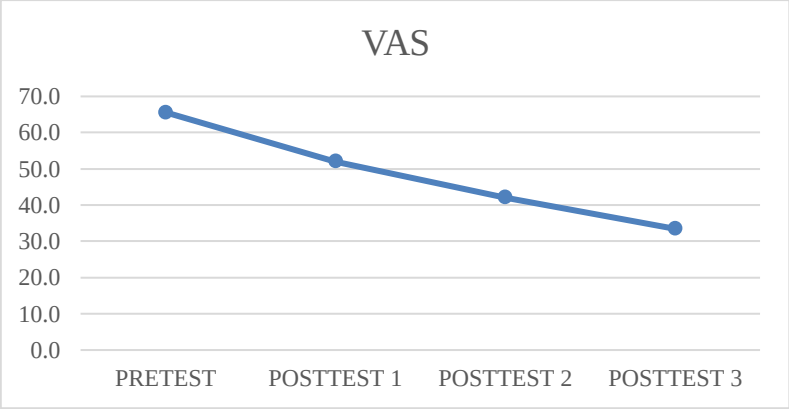
After conducting a normality test, the next step was to perform a difference test to evaluate the hypothesis. This test helped determine whether the null hypothesis (H_0) was accepted or rejected, based on a comparison between the p-value and the significance level ($\alpha = 0.05$). If the p-value was less than 0.05, H_0 was rejected in favor of the alternative hypothesis (H_1). Conversely, if the p-value was greater than 0.05, H_0 was accepted, and H_1 was rejected. A summary of the difference test results was presented in Table 3.

Table 3. Difference Test Results

Treatment 1 VAS	Sig. 0,000	**Conclusion** Significant
Treatment 2 VAS	Sig. 0,000	**Conclusion** Significant
Treatment 3 VAS	Sig. 0,000	**Conclusion** Significant

This research involved conducting three separate trials utilizing massage gun therapy combined with passive stretching to assess its efficacy in treating non-specific low back pain. The results indicated that massage gun treatment significantly reduced pain levels among patients suffering from low back pain. Statistical analysis revealed a highly significant outcome, with a calculated p-value of 0.000, which is below the threshold of 0.05. Consequently, the data supports the conclusion that combining massage gun therapy with passive stretching is effective in alleviating pain in patients experiencing non-specific low back pain

Figure 1. Mean VAS Value



Based on the Figure 1, it shows that there was a decrease when measuring using a visual analog scale (VAS) measuring instrument taken from the average value of all pretest and posttest data. The study results indicate that the initial score was 65.6 before treatment. Following treatment, the scores decreased significantly: to 52.1 for Treatment 1, 42.1 for Treatment 2, and 33.5 for Treatment 3. Notably, the significance value was 0.000, which is less than the threshold of 0.05, confirming the effectiveness of all treatments from Treatment 1 to Treatment 3.

This study sought to investigate the efficacy of combining massage gun therapy with passive stretching in managing non-specific low back pain. The findings revealed that the integrated approach significantly diminished pain levels in participants. Utilizing a massage gun offers several advantages, including the absence of the need for lubricants like lotions or oils and the convenience of administering treatment without disrobing. Following massage gun therapy with passive stretching enhances flexibility in the back muscles and upper limbs, thereby alleviating pain. Specifically, this study demonstrated that a 20-minute massage gun session focused on the lumbar region, hamstrings, and quadriceps, coupled with 5 minutes of passive stretching, effectively reduced pain scales in individuals suffering from non-specific low back pain.

The results of the study in the Figure 1 prove that 20 participants of low back pain patients who were given treatment in the form of a combination of massage gun and passive stretching experienced a significant decrease in pain from the pretest, 24 hours after treatment, 48 hours after treatment, and 72 hours after treatment. Research conducted in line with Nugraha et al (2024) that the combination of mobilization and percussive massage using a massage gun device can provide problematic improvements caused by non-specific low back pain in the form of increased lumbar range of motion (ROM). Other research conducted by Rahman et al., (2022) showed that the use of massage guns has an effect on reducing pain. The research conducted by Cheatham et al., (2021) entitled "physiotherapy management in cases of low back pain et causa ischialgia with TENS, ESWT, exercise, and stretching: case report" that passive stretching can reduce pain, provide lower body stabilizers through active development of the abdominal muscles, gluteus maximus, and hamstrings. And can reduce the scale of pain in low back pain sufferers. The results of the study conducted by Mustagfirin et al., (2020) also prove that the use of stretching has an effect on reducing the scale of back pain.

Massage gun provides benefits in relaxing all muscle groups, including the quadriceps, hamstrings, glutes, back muscles, biceps, triceps, and shoulder muscles. Massage guns can be used in several ways such as combined with dynamic stretching and cardio warm-up exercises, using the massage gun for 30 seconds to 1 minute at the targeted points. This can prepare the muscles by increasing blood flow and improving muscle mobility. Massage guns are able to reduce the scale of pain by improving blood circulation and reducing lactic acid, thereby reducing pain and increasing muscle flexibility (Wardana et al., 2024). Previous research recommends massage gun as a clinical and sports therapy to support warming up and recovery (RM Ferreira et al., 2023). Effects of using a massage gun are: 1) muscle activation (strength, speed, endurance, oxygen absorption), 2) reaction, balance, agility, 3) Joint range, myofascial release, 4) prevention of DOMS. Giving a massage gun as a muscle relaxant followed by exercise therapy in the form of passive stretching is beneficial for the body to improve the quality of muscle flexibility and muscle strength.

This study use massage gun was combined with passive stretching, which is a technique for stretching muscles by moving or adjusting the body position in a certain position with the aim of providing optimal lengthening of muscle and tendon tissue (Hidayati & Novrianti, 2017). Stretching is included in manual interventions to lengthen soft tissue structures due to shortening and decreased movement and has an analgesic effect (Büyükturan et al., 2021), so as to prevent the onset of pain (Lee et al., 2021), and provides a relaxing effect on the muscles (Tian et al., 2012). Stretching or muscle stretching is given to pain that occurs due to doing heavy and long work, resulting in the accumulation of excessive amounts of metabolic waste, which causes increased pressure inside and outside the muscle cells. This increase in osmotic pressure will then cause edema, which will then press on the sensory nerves. Then it will be felt as a musculoskeletal disorder or muscle pain, with muscle stretching, which can be done by contracting the antagonist muscles or by stretching the muscles concerned passively in various ways. Stretching aims to lengthen the muscle tendons, viscoelastic changes in muscles and tendons that can reduce pain levels (Bolarinde et al., 2017). Stretching can also reduce muscle stiffness caused by decreased muscle flexibility and muscle capacity (Zulkarnain & Nugraha, 2023).

Passive stretchingis an effective method in reducing muscle pain and increasing muscle flexibility. This process involves stretching the muscles with external assistance, such as using tools or assistance from another person. Research has shown that passive stretching can reduce pain and increase joint range of motion. This method is optimally used when the agonist muscles (the main muscles in movement) are weak, so it can help increase muscle and joint flexibility. In practice, passive stretching is done by stretching the muscles as far as possible and holding them for a while. This gives the muscles the opportunity to stretch to their maximum and reduce tension. However, it should be noted that passive stretching can pose a risk of pain if given excessive force or done quickly. Research showed that passive stretching can reduce tension in the flexor muscles in the cubital region in stroke patients (Mentari et al., 2024). In addition, this method is also useful in increasing overall body flexibility. Thus, passive stretching is a good alternative in reducing muscle pain and improving quality of life.

The research conducted focuses on the use of non-pharmacological methods as alternative treatments in the form of massage gun therapy and passive stretching. Massage guns are one of the currently popular recovery therapy tools. The performance of massage guns is by providing vibrations to the musculoskeletal part at varying amplitudes aimed at increasing joint mobility and reducing pain (Leabeater et al., 2023), while passive stretching is a muscle stretching movement with the help of a

therapist or tool and is done repeatedly to increase mobility, flexibility and relaxation (Marufan et al., 2021). Research on the use of massage guns is often used to accelerate the recovery process when Delayed Onset Muscle Soreness (DOMS) occurs. Therefore, this study aims to use a massage gun with passive stretching as an alternative and effective treatment without using lubricants in patients with non-specific low back pain.

CONCLUSION

Based on the findings of the study, it is conclusively demonstrated that both massage gun and passive stretching therapies significantly reduce pain levels among individuals suffering from lower back pain. Participants initially reported a pain score of 65.6; however, after each successive treatment session—the first at 52.1, then at 42.1, and finally at 33.5—their pain scores progressively declined. The statistical analysis revealed a highly significant difference ($p = 0.000$) between these measurements, indicating a substantial improvement over time. The research suggests that repeated applications of these treatments yield a cumulative beneficial effect, leading to more controlled and reduced pain levels. Passive stretching proved effective by targeting stiff muscle structures in the back, while the use of a massage gun enhanced this impact through its manipulative techniques. Future studies are recommended to explore combining massage guns and passive stretching as a comprehensive therapeutic approach. This integrated method could serve as a valuable reference point in advancing scientific understanding and clinical practice related to managing chronic lower back pain. Continuing to refine such interventions might help healthcare professionals develop even more efficacious strategies for alleviating discomfort and enhancing overall well-being among patients afflicted with this common condition.

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