

Literature Study: The Effect of Cold-Water Immersion or Sport Massage Techniques on Muscle Pain

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Abstract

Pain is the most common symptom of sports injuries. Studies suggest that sports massage and or cold-water immersion may improve pain. This study aimed to synthesize findings from previous research on sports massage and cold-water immersion for pain treatment in athletes. Relevant article search method using the Garuda database, Onesearch, and Google Scholar originating from SINTA 2 or 3 indexed journals with the keywords "Cold-Water Immersion", "Sports Massage Technique", and "Pain". Article searches started from 2017 to 2022; literature analysis used PRISMA guidelines, and feasibility assessments used JBI critical assessment. Five articles were included in the literature review. Cold-water immersion and sports massage techniques significantly affect the treatment of muscle pain. These two alternative interventions have been proven to alleviate the effects of muscle pain and speed up the healing process for athletes who experience muscle pain problems.

Keywords: Cold-water immersion; injury; sport massage; muscle pain

1. Introduction

Physical activity can be interpreted as muscle contractions that can increase energy expenditure due to body movements (Berawi & Agverianti, 2017). There are several physical activities, and one of the most popular physical activities is sports. The concern for health causes this phenomenon is increasing, so there is an increase in enthusiasts of sports activities at this time (Rusdiawan et al., 2020).

Sports activities do not require the possibility of injury while undergoing it. One of the most common injuries during sports is muscle pain. Myalgia, often called muscle pain, is muscle pain that occurs due to repetitive or continuous and static muscle contractions, which will cause the muscles to spasm or become inflamed. When a muscle is inflamed, swollen, or stiff from fatigue, the space between the skin and muscle is compressed, narrowing the lymphatic vessels. Pressure also affects pain receptors under the skin, which signal discomfort to the brain, so humans experience pain (Kalron & Bar-Sela, 2013).

Muscle pain has another name, namely delayed onset muscle soreness (DOMS). DOMS typically manifests within the initial 24 hours following exhaustive or intense physical activity, with its intensity peaking between 24 and 72 hours (Owens, Twist, Cobley, Howatson, & Close, 2019). Muscle swelling and a decline in muscle performance are frequently observed in conjunction with this condition (De

Marchi et al., 2017; Kargarfard et al., 2016). Additionally, a decrease in range of motion has been reported (Veqar & Imtiyaz, 2014). While the precise mechanism of Delayed Onset Muscle Soreness (DOMS) remains uncertain, the prevailing theory posits that exercise leads to initial mechanical damage, which subsequently triggers inflammation responsible for the symptoms associated with DOMS. The aforementioned assertion is substantiated through microscopic examination, which reveals the presence of muscle fiber disruption. Furthermore, it has been observed that there is a rise in intracellular enzymes, specifically creatine kinase (CK), as well as inflammatory markers in the bloodstream (Longo, Jacobson, Fessell, & Mautner, 2016; Mizumura & Taguchi, 2016).

Several alternative treatments can be done, one of which is cold-water immersion and the application of sports massage techniques. Sports massage itself is a message that is used or given to people who are in good physical condition, especially athletes. Sports massage is a massage aimed at healthy people (Irawan, 2017). Sports massage is massage, sorting, et cetera, carried out in certain parts with the hands or special tools to improve blood circulation as a treatment effort or relieve fatigue (Ningsih, 2016). According to Gasibat & Suwehli (2017), in massage, there are various kinds of basic manipulation, including effleurage (rubbing), petrissage (plucking), shaking/vibration (shaking), tapotement (hitting), and friction (grinding).

Meanwhile, cold-water immersion uses cold-water in a vertical position (Kurniawan & Sifaq, 2018). Akhsan (2018) also explained almost the exact definition; in his research, he explained that Cold-water Immersion is a method of recovery by immersing part or all of the body in cold-water at a specific temperature. Cold Therapy or Cold-water Immersion is the use of cold-water to help treat pain and other symptoms of inflammation (Rijal, 2019). This method is carried out after athletes do the exercise with high duration, aiming to help athletes recover effectively. Soaking in cold-water can help break down the lactic acid accumulated in the body due to physical activity. This method is done by immersing the body in cold-water from the bottom to the top with a temperature of 10°C-15°C (Kurniawan & Sifaq, 2018) for approximately 11-15 minutes. The benefits of cold-water immersion can help athletes recover from fatigue after training.

Many studies have been conducted, and it has been proven that Cold-water Immersion and Sports Massage Techniques significantly affect muscle pain. Based on this, the authors want to conduct research to review the Effects of Cold-Water Immersion and Sports Massage Techniques on Muscle Pain.

2. Method

The purpose of this study is to review previous research that has been researched on the Effects of Cold-Water Immersion or Sports Massage Techniques on Muscle Pain. Search articles using relevant data such as Scopus, One Search, Dimensions, and Search Engine Google scholar with the keywords "Cold-Water Immersion" + "or" + "Sports Massage Technique" + "Muscle Pain." Article search starts from 2002 to 2022, with criteria 1). using Indonesian and English, 2). there is data according to keywords, 3). full-text article. This study uses the analysis guide from PRISMA and the feasibility assessment of articles reviewed using the Joanna Briggs Institute (JBI) critical appraisal.

3. Result

The results of an article search using the One Search, Dimensions, and Google Scholar Search Engine databases obtained 388 articles, then screening was carried out, and 74 articles were obtained. Then the abstract selection was carried out so that 28 articles were obtained. The final stage included selecting inclusion criteria and obtaining 6 articles for review.

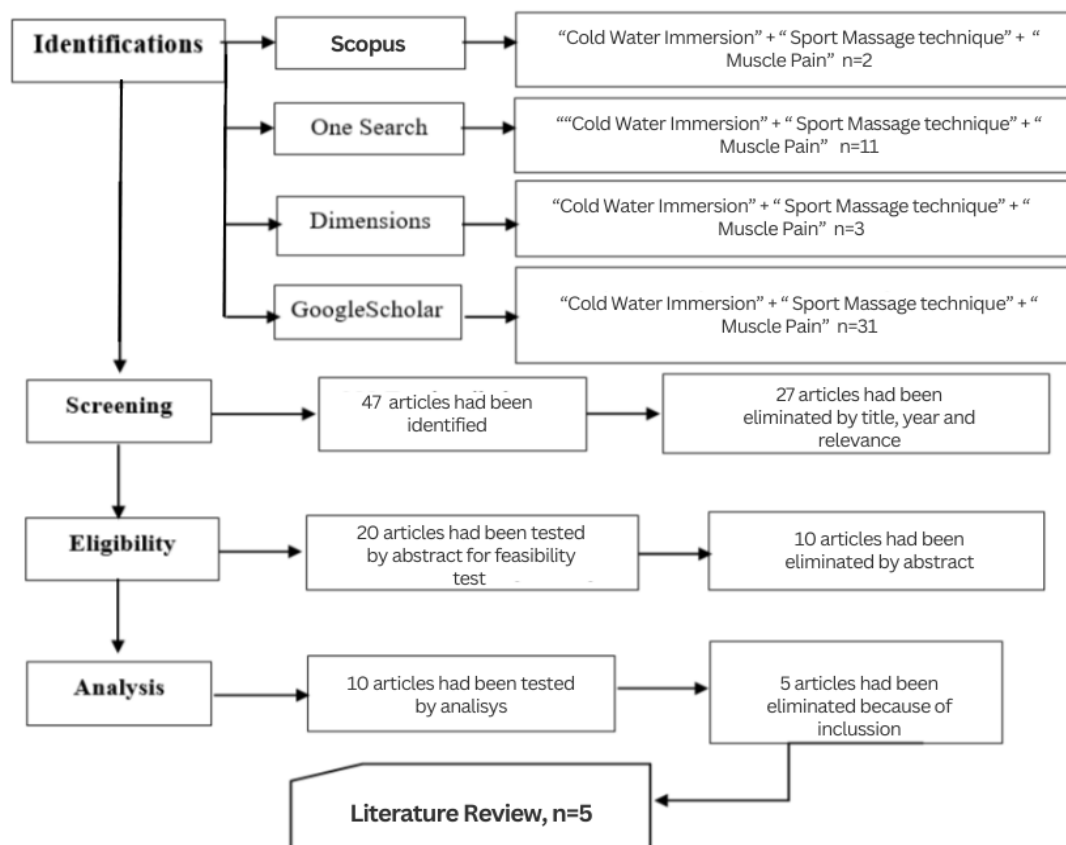


Figure 1. Flowchart of Literature Review

Table 1. List of journal literature review articles table

Source	Author's Name and Year of Publication	Publisher	Research Results
1.	(Adamczyk, Krasowska, Boguszewski, & Reaburn, 2016)	Journal of thermal biology	The results of his research are that ice massage improves recovery by stimulating blood circulation, releasing metabolic waste, stimulating the central nervous system, and reducing body heat and cardiovascular burden. Cold therapy can be used as a mechanism to increase the clearance of metabolic waste. The basic effects of cold treatments include reducing the inflammatory process, relieving pain, and relieving the symptoms of DOMS. According to the recommendations, the skin temperature should be lowered by 5–15°C to obtain an analgesic effect. Another factor that influences the effectiveness of ice massage in post-exercise recovery is that the cooling effect can produce a tissue compression mechanism, which can accelerate regeneration.

Source	Author's Name and Year of Publication	Publisher	Research Results
2.	(Kusuma, Syafei, Saryono, & Qohhar, 2020)	Jurnal Keolahragaan, Universitas Negeri Yogyakarta	The results were that the CWI5°C method reduced muscle pain more quickly ($t=5.32 \pm 1.07$, $p=0.003$). It can be concluded that cold-water immersion at 5°C for 15 minutes reduces muscle inflammation.
3.	(Sa'roni & Graha, 2019)	Jurnal Medikora, Universitas Negeri Yogyakarta	The results showed that sports injury therapy massage effectively reduced heel pain and tibial muscle pain in futsal athletes at SMA Negeri 1 Ciamis. This study shows a difference in the average pain score between pain before treatment (pretest) and after treatment (posttest).
4.	(Asyiraq, Handayani, Ghozali, & Munawaroh, 2022)	Tambusai Education Journal, Universitas Pahlawan Tuanku Tambusai	The conclusion of this study shows that cold-water immersion affects healing muscle pain. However, after exercise, 1-hour cold-water immersion is better than direct 4-hour immersion.
5.	(Angelopoulos et al., 2022)	Healthcare Journal	In conclusion, the treatment intervention effectively reduced pain but may not affect other essential adaptations of DOMS. Based on the above, sports scientists should reconsider the widespread use of this intervention as a recovery strategy for athletes with DOMS.
6.	(Andersen et al., 2013)	The Journal of Strength & Conditioning Research	The results of his research are that massage significantly reduces the pain felt and increases the pain threshold. Massage stimulates skin receptors, potentially blocking the mutual sensation of pain in the spinal cord. Stretching and pressure are used in massage to activate afferent nerves and the Golgi tendon organs. Activation of the large nerve fibers can block the smaller conducting nerves that detect pain or is called the gate control theory. The massage mechanism also increases the lymphatic drainage process and removes metabolic waste products and pain mediators such as histamine and bradykin.

4. Discussion

Massage therapy interventions are frequently employed for the purpose of alleviating muscular soreness (Field, 2016) and enhancing muscle function following physical activity (Best & Crawford, 2017). Multiple lines of evidence have been employed to elucidate the mechanisms by which massage treatment influences Delayed Onset Muscle Soreness (DOMS). The modulation of parasympathetic nervous system activity was established by Weerapong, Hume, & Kolt (2015). Furthermore, it has been documented by Bakar et al. (2015) that massage therapy has the ability to enhance blood and lymphatic circulation, hence promoting the efficient elimination of biochemical indicators linked to muscle damage, such as creatine kinase (CK) and lactate dehydrogenase (LDH). The significance of the psychophysiological reaction to massage therapy in the context of pain reduction has been underscored by Wilson et al. (2021). According to Andersen et al. (2013), the initial study findings elucidated that the implementation of therapeutic massage techniques resulted in a decrease in the

subjective experience of muscle discomfort. According to Andersen et al. (2013), the authors provided an explanation that massage has a considerable effect in reducing the perception of pain and increasing the pain threshold. Massage therapy has the capacity to activate skin receptors, which may lead to the inhibition of pain feelings inside the spinal cord. The utilization of stretching and pressure techniques in massage therapy serves to stimulate afferent nerves and the Golgi tendon organs. This assertion is supported by the findings of Ningsih (2016). Sports massage refers to a therapeutic practice involving the application of manual techniques, such as hand manipulation or specialized instruments, to specific areas of the body. The primary objective of this modality is to enhance blood circulation, hence addressing exhaustion and promoting the alleviation of related symptoms.

According to a study conducted by Sa'roni & Graha (2019), previous research findings indicate that the use of therapeutic massage techniques yielded a notable reduction in pain perception, particularly in relation to muscle discomfort. The study was conducted on futsal athletes at SMA Negeri 1 Ciamis, and the procedure of data collecting was conducted during the pretest and posttest phases. According to Gasibat & Suwehli (2017), interventions encompass a range of techniques. For instance, massage involves several fundamental manipulations, such as effleurage (rubbing), petrissage (pulling), shake/vibration (shaking), tapotement (striking), and friction (grind).

The findings of two studies conducted by Kusuma et al., (2020) and (Asyiraq et al., 2022) indicate a consistent outcome, namely the efficacy of cold-water immersion interventions in the management of muscle pain injuries. In the initial investigation conducted by Kusuma et al., (2020). Kusuma et al. (2020), the intervention procedure was the utilization of water at a temperature of 5°C, with a duration of 15 minutes. This approach has been empirically demonstrated to be efficacious in addressing issues related to muscular discomfort and mitigating muscular inflammation.

The objective of the subsequent investigation undertaken by Arpin, Gozali, Hastami, & Handayani, (2020) was to examine variations in intervention durations for cold-water immersion. The present study demonstrates that the application of cold-water immersion yields a beneficial impact on the perception of muscle discomfort. In addition to its efficacy, the researchers in the study observed that the cold-water immersion intervention, implemented one hour after the test, yielded superior results compared to the intervention conducted for a continuous duration of four hours without an interposed break between the pretest and posttest.

According to the study conducted by Lesmana, Padli, & Broto (2017), it was asserted that the occurrence of muscle injuries resulting in discomfort or Delayed Onset Muscle Soreness (DOMS), commonly seen by individuals following engagement in sports activities, can be effectively addressed. By engaging in active healing, namely through low-intensity physical activities like jogging or walking. The necessity for adequate circulation of nutrients, oxygen, and other substances is attributed to the wound healing process, as it ensures the continued efficient flow of blood circulation. Furthermore, Peake et al. (2017) posited that there exists a prevailing belief regarding the potential of prolonged immersion in cold-water to mitigate cellular stress-induced inflammation, hence inducing a decrease in temperature and blood flow inside skeletal muscles. CWI functions as a metabolic agent that mitigates inflammation in areas affected by skeletal muscle injury or subsequent cellular demise. Therefore, the utilization of Cold-Water Immersion (CWI) has the potential to predict and facilitate the recovery of muscle injuries that occur during physical activity.

According to a preliminary investigation carried out by Petersen & Fyfe (2021), it was observed that there was a notable enhancement in wrist flexor strength subsequent to a six-week regimen of hand grip resistance training. The observed increase in wrist flexor endurance was found to be concomitant with the implementation of intermittent cold-water immersion (ICW) for a duration of 20 minutes following each power workout. According to Moore, Bullough, Goldsmith, & Edmondson (2014), it

has been suggested that CWI can be employed as a means of facilitating the recuperation process subsequent to physical activity. The relevance or cooling effect at a specific point in time is largely influenced by the temperature and length of the cold-water immersion (CWI) treatment. Typically, it is recommended to administer Cold-water Immersion (CWI) around one hour following intense physical exercise.

Moreover, the impact of reduced temperature resulting from high-intensity exercise on the efficiency of submaximal movement under hot environmental conditions should also be considered. According to a study conducted by Joudallah, Pehlivan, Pelvan, & Çotukt (2017), the utilization of cold-water immersion (CWI) one-hour post-exercise has the potential to mitigate heightened thermoregulation and cardiovascular strain, diminish neuromuscular fatigue, and aid in the preservation of following exercise performance. Abaidia et al. (2017) have substantiated the utilization of cold-water immersion (CWI) as a prevalent therapeutic intervention among athletes across diverse sports disciplines, mostly aimed at alleviating post-exercise muscle tension. The utilization of cold-water immersion (CWI) as a diuretic or analgesic, treatment for rheumatism, and anti-inflammatory agent for athletes was prevalent in various ancient civilizations, including Egypt, Greece, and Rome. Additionally, CWI was commonly employed as a means to enhance recuperation among athletes. The enhancement and restoration of endurance is facilitated through the provision of prospective training impact for subsequent time periods.

5. Conclusion and Recommendation

Researchers have collected the results of review reviews from several research articles that water cold immersion interventions and massage therapy techniques significantly influence treatment for muscle pain injuries. For cold water immersion, it is recommended to specify the temperature and length of time so that the intervention can run effectively, namely by using water with a temperature of 5°C and carried out for 15 minutes. In addition to duration, sports activists believe that giving water cold immersion interventions will be more effective if done 1 hour after the test or indirectly. The researchers advise readers, especially sports therapists, that excellent and proven interventions are needed to solve muscle pain injuries effectively.

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The researcher would like to thank the previous researchers for their dedication to researching sports science with the specification of treating muscle pain injuries with water-cold immersion interventions and implementing sports massage techniques. This review article can educate the public about the benefits and effectiveness of these alternative interventions so that they can speed up the treatment of muscle pain injury problems.

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