International Journal of Human Movement and Sports Sciences 11(1): 170-175, 2023 http://www.hrpub.org
DOI: 10.13189/saj.2023.110120

Massage Has the Potential to Accelerate Recovery and Decrease Muscle Soreness after Physical Exercise (Literature Review)

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Received November 6, 2022; Revised December 26, 2022; Accepted January 16, 2023

Cite This Paper in the Following Citation Styles

(a): *[1] Fatkur Rohman Kafrawi, Nurhasan, Endang Sri Wahjuni, Novadri Ayubi, Heryanto Nur Muhammad, Nining Widyah Kusnanik, Anton Komaini, "Massage Has the Potential to Accelerate Recovery and Decrease Muscle Soreness after Physical Exercise (Literature Review)," International Journal of Human Movement and Sports Sciences, Vol. 11, No. 1, pp. 170 - 175, 2023. DOI: 10.13189/saj.2023.110120.*

(b): *Fatkur Rohman Kafrawi, Nurhasan, Endang Sri Wahjuni, Novadri Ayubi, Heryanto Nur Muhammad, Nining Widyah Kusnanik, Anton Komaini (2023). Massage Has the Potential to Accelerate Recovery and Decrease Muscle Soreness after Physical Exercise (Literature Review). International Journal of Human Movement and Sports Sciences, 11(1), 170 - 175. DOI: 10.13189/saj.2023.110120.*

Abstract Physical exercise can cause fatigue, resulting in a decrease in muscle work efficiency. This study aimed to analyze the potential of massage to accelerate recovery through a literature review. This type of research is a literature review. Article searches were carried out using a comprehensive strategy in research journal databases such as Web of Science (WOS), Scopus, and Pubmed. The keywords used are massage, physical exercise, muscle pain, inflammatory response, and recovery. The inclusion criteria are journals that discuss sports massage, physical exercise, muscle pain, inflammatory response, and recovery after exercise. Furthermore, the exclusion criteria are journals published in the last 6 years from 2022. 30 articles were obtained, and 12 articles were analyzed based on the suitability of the topic, objectives, research protocol, and research results. Exercises performed at high intensity, especially with repetitive eccentric movements, will cause muscle damage, inflammation, and muscle pain. This review reports that physical intensity exercise that triggers muscle soreness has many advantages when massaged. This benefit is so beneficial in sports that the potential for the use of regular NSAIDs is reduced. In addition, massage has the potential to accelerate recovery, reduce pain intensity, and increase ROM and muscle strength after physical exercise. Therefore, we recommend that massage be used as an alternative to speed up recovery and reduce pain intensity after exercise.

Keywords Massage, Physical Exercise, Fatique, Muscle Soreness, Inflammation, Recovery

1. Introduction

Physical exercise can cause fatigue resulting in decreased efficiency of muscle work [1]. The magnitude of the body's functional changes caused by exercise is influenced by the intensity and duration of the exercise [2]. The mechanism of muscle fatigue is considered to be a complex interaction phenomenon between central and peripheral factors [3]. A study reported that central nervous system (CNS) processes that reduce nerve impulses to muscles cause a decrease in muscle strength known as central fatigue [2]. On the other hand, peripheral fatigue is mainly triggered by increased levels of lactic acid in the blood [4,5]. One study reported that lactic acid contributes

to ischemic pain in sensory neurons that innervate muscles [6]. In addition, post-exercise increase in pro-inflammatory cytokines is believed to be the cause of delayed onset muscle soreness (DOMS) and tissue disruption [7,8].

In the current case, non-steroidal anti-inflammatory drug (NSAIDs) modalities are the most popular in the management of post-exercise pain [9-12]. On the other hand, the use of NSAIDs is a wrong action because it interferes with the response of muscle growth it will have an impact on hypertrophy and muscle strength [13]. In addition, the use of NSAIDs will cause dependence [14]. In this regard, fatigue and pain caused by training sessions and competitions will interfere with athlete performance [15].

Alternative solutions need to be found to overcome these problems. One of them with the massage. Massage has been widely used when an athlete is injured in a match [16,17]. In addition, several studies have reported that massage can increase muscle strength and reduce pain during the break [1,7,18]. On the other hand, the lack of reports on this matter gives us the opportunity to discuss in depth and evaluate the available information regarding the potential of the massage through a literature review.

This study aims to analyze the potential of massage to accelerate recovery and decrease muscle soreness after physical exercise.

2. Materials and Methods

This type of research is a literature review. Article searches were carried out using a comprehensive strategy in research journal databases such as Web of Science (WOS), Scopus, and Pubmed. The keywords used are massage, physical exercise, muscle pain, inflammatory response, and recovery. The inclusion criteria are journals that discuss sports massage, physical exercise, muscle pain, inflammatory response, and recovery after exercise. Furthermore, the exclusion criteria are journals published in the last 6 years from 2022. 30 articles were obtained, and 12 articles were analyzed based on the suitability of the topic, objectives, research protocol, and research results.

3. Results

The results of the research in this literature review are presented in Table 1.

Table 1. Review of research results on the effect of massage on recovery and pain intensity

Author	Sample Characteristics	Study Design	Intervention	Results
(Chen et al., 2019) [19]	Twenty-six 14-year-old soccer players participated in this study. Subjects were divided into 2 groups, namely the group with massage intervention on the feet and the control group without massage	A Random Controlled Trial	The massage intervention was given for 15 minutes in the supine position after performing repeated running ability tests	Massage can increase parasympathetic activity so that it has the potential to speed up recovery after repeated sprint exercises
(Shalfawi, Enoksen and Myklebust, 2019) [20]	Four men and four women with an average age of 18 years participated in the study	A random crossover	The intervention was given with a multi-bar roller massager on the quadriceps muscle for 10 minutes before and 15 minutes after cycling until fatigue	Blood lactate levels were higher during fatigue and decreased after multi-bar massage. In addition, there is a tendency to have a positive effect on muscle strength but there is no significant difference in VO2Max
(Chwała et al., 2021) [1]	Eighty-four healthy men aged 20-25 years were involved in this study and then randomly divided the group into four groups. Two groups performed isometric exercises (1 control group with passive rest and 1 group received massage intervention) and 2 groups performed auxotonic exercises (1 control group with passive rest and 1 group received massage intervention)	Eksperimental	The intervention was given in the form of a vibration massage 20 minutes after the subject did isometric and auksotonic exercises using a leg press with submaximal intensity	A significant difference in maximal strength was seen in the isometric exercise group that was given vibration massage. The effects of a massage done right have the potential to speed up recovery after a workout

Table 1. Continued

(Piotrowska et al., 2021) [21]	Twelve 21-year-old untrained men participated in the study. Furthermore, the subjects were randomly divided into 2 groups, namely the control group and the treatment group	Eksperimental	Vibration massage intervention was given for 60 minutes after the subject performed a cycle ergometer exercise for 180 minutes	The administration of vibration massage intervention was significantly able to reduce creatine kinase levels as a marker of muscle damage compared to the control group
(White et al., 2020) [22]	A total of 9 healthy men aged 23 years participated in the study	Eksperimental	Subjects completed massage therapy and control conditions (on 2 different trial days, separated by 1 week). The intervention was given after the subject did moderate to high-intensity exercise in the form of intermittent sprint training	Massage therapy seems to be able to reduce the inflammatory response after high-intensity exercise so it has the potential to speed up recovery
(Bender et al., 2019) [23]	A total of seventy eight runners aged 18 to 60 years were included in this study. Subjects were divided into 2 groups, namely treatment which was given massage, and the control group was given false joint mobilization	Eksperimental	Massage intervention was carried out for 10 minutes after the subject did a 10 km running activity	Massage done after physical exercise can reduce pain intensity
(Cheatham, Stull and Kolber, 2018) [24]	A total of 45 adults participated in the study. Subjects were divided into 3 groups, namely the group with roller massage, the group with non-roller pidgin, and the control group	A Randomized Controlled Trial	The massage intervention was carried out for 2 minutes and the control group did not massage	Roller massage was able to reduce pain intensity and increase the Range of Motion compared to the non-roller group and the control group
(Nunes et al., 2016) [25]	Seventy-four triathlon athletes between the ages of 37 and 39 who completed an event and experienced pain in the anterior thigh participated in the study	A Randomized Trial	After the competition, the subjects in the experimental group were given a quadriceps massage intervention for 7 minutes and the control group rested in a sitting position	Massage therapy is effective for reducing pain and accelerating recovery after long-distance triathlon training activities
(Hoffman et al., 2016) [26]	Seventy-three ultramarathon athletes participated in the study. Subjects were divided into 3 groups, namely the massage group (n=25), the pneumatic compress group (n=24), and the control group (n=24)	A Randomized Trial	After the competition, subjects were randomly assigned to an intervention of massage for 20 minutes, pneumatic compresses, and supine rest	There was a significant decrease in muscle pain intensity in the massage and pneumatic compress group compared to the control group

Table 1. Continued

(Xing et al., 2021) [27]	Thirty-two male rats aged 608 weeks weighing 180-200 grams were used as research subjects. Subjects were divided into 4 groups, namely the normal group, model, fake massage, and massage	Eksperimental	Massage and fake massage were performed 1 week after model formation. The intervention was carried out for 10 minutes and was carried out once a day for a week. The sham massage group received no massage, but the right gastrocnemius muscle was lightly clamped for 10 minutes. The normal and model groups did not receive any intervention	The results of this study reported that massage facilitates adaptive changes in the somatosensory cortex that lead to repair of peripheral nerve injury recovery
(Hunt et al., 2019) [28]	Thirty male rats were selected and then divided into 2 groups, namely the treatment group with massage and the control group without massage	Eksperimental	The rats were anesthetized then the right gastrocnemius muscle received a cyclic compressive load for 30 minutes as a mimetic massage. After being treated, the mice were placed in their cages and allowed to recover. After 24 hours post-treatment, the mice were euthanized and then the muscles were surgically removed and frozen	Massage can increase muscle stem cells so that it has the potential to repair injured muscles

4. Discussion

The main purpose of this literature review is to analyze the potential of massage to accelerate recovery and reduce pain intensity after physical exercise. Exercises performed at high intensity, especially with repetitive eccentric movements, will cause muscle damage, inflammation, and muscle pain [29–32]. These symptoms will be felt for 4 to 7 days and usually, the pain reaches its peak 24 hours after exercise [33,34].

The results of this literature review show that there is evidence that massage has been used as an alternative to speed up recovery and reduce pain intensity. We investigated the mechanism of massage effects starting from muscle cells in experimental animals who reported that massage was able to increase muscle stem cells and potentially repair injured muscles. [28]. In addition, massage is able to facilitate adaptive changes in the somatosensory cortex that lead to injury recovery and peripheral nerve repair [27]. In this regard, massage basically facilitates the integration of information by reversing the activity of the somatosensory cortex to restore sensory function. Furthermore, we observed that massage has been shown to lower blood lactic acid levels [20]. We believe in a theory reporting that lactate contributes to ischemic pain in sensory neurons that innervate muscles [6]. In addition, we found evidence that massage has the potential to decrease the inflammatory response and muscle damage [21,22]. In this regard, other studies have also reported the effectiveness of massage to reduce pain intensity [23–26]. Reducing pain intensity will potentially restore muscle work efficiency, increase ROM and muscle strength [20,24]. Some of the results of this literature report that massage is effective for 10, 20, 30 and 60 minutes [21,26–28].

The findings of this literature review imply that high-intensity physical exercisethat triggers muscle soreness has many advantages when given massage. This benefit is so beneficial in sports that the potential for the use of regular NSAIDs is reduced. In addition, a short exercise massage has the potential to accelerate recovery, reduce pain intensity, increase ROM and muscle strength after physical exercise. We recognize that this literature review leaves unanswered questions. This includes the effect of repeated massages that are carried out regularly and the most effective duration for doing massages because the results of the literature vary in duration.

5. Conclusions

Exercises performed at high intensity, especially with repetitive eccentric movements, will cause muscle damage, inflammation, and muscle pain. This review reports that physical intensity exercise that triggers muscle soreness has many advantages when massaged. This benefit is so

beneficial in sports that the potential for use of regular NSAIDs is reduced. In addition, massage has the potential to accelerate recovery, reduce pain intensity, increase ROM and muscle strength after physical exercise. Therefore, we recommend that massage be used as an alternative to speed up recovery and decrease post-exercise pain intensity.

Declarations

Conflict of Interest

The authors declare that they have no conflict of interest.

Authors' Contributions

All authors contributed equally in the research and preparation of the paper.

Funding

This research uses private funds.

Acknowledgments

The author would like to thank LPPM Universitas Negeri Surabaya and Universitas Negeri Padang.

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