

# The effect of deep and superficial techniques of sports massage on the indicators of muscle and inflammatory damage of young volleyball players after a session of physical activity

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## ABSTRACT

Plyometric jumping exercises increase inflammation and muscle damage in the body and disrupt the body's physiological processes. To help with this, it is important to use a variety of recovery techniques, including massage. Therefore, the present study aimed to investigate the effect of deep and superficial techniques of sports massage and indicators on muscle damage and inflammation of young volleyball players after a session of strenuous physical activity. The present study was operational and quasi-experimental. For this purpose, 24 young volleyball players (with an average age of  $19.04 \pm 2.07$  years, weight of  $75.35 \pm 12.09$  kg, body mass index of  $21.83 \pm 2.61$  and height of  $185.25 \pm 5.25$  cm) were randomly assigned to three homogenous groups: A) 8 persons in deep massage group, B) 8 persons in superficial massage group, and C) 8 persons in control group. Ten minutes after the intense physical activity protocol, the participants of the deep and superficial massage groups received a massage for 30 min. Blood samples from all the participants were taken four times, including before warming up and performing the protocol, immediately after performing the protocol, immediately after massage and 24 hours after the protocol was performed. The inflammatory indices (C reactive protein, 6 interleukin) and the muscle damage indices (creatinine kinase, lactate dehydrogenase and lactate) were then measured. The data were analyzed using SPSS20 software and statistical method of analysis of variance with repeated measurement at a significant level of  $P < 0.05$ . The results showed that in young volleyball players, after a strenuous physical activity session, deep massage techniques differed significantly from the control group in the profile of inflammatory indicators including C reactive protein, 6 interleukin and muscle damage including creatinine kinase, lactate dehydrogenase and lactate ( $P < 0.001$ ). Also, the superficial massage group was more significant than the control group in these indicators ( $P < 0.05$ ). There was no significant difference between the groups of deep and superficial massage in the indicators of inflammation and muscle damage ( $P > 0.05$ ). The findings showed that both deep and superficial massage techniques were effective in reducing inflammation and muscle damage after plyometric exercise. Therefore, to prevent injury, it is recommended to perform massage after strenuous physical activity.

**Keywords:** Massage, inflammation indicators, indicators of muscle damage, young volleyball players.

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## INTRODUCTION

Athletes are always exposed to muscle damage and fatigue caused by strenuous exercise and successive competitions, which sometimes affects the quality of

performance and the results obtained. Athletes typically experience delayed onset muscle soreness (DOMS) 7-72 hours after high-intensity or unusual activity (Connolly et

al., 2003; Ferreira-Valente et al., 2011; Lee et al., 2002; Smith et al., 1994; Suzuki et al., 1999). Muscle swelling and pain happen along with delayed onset muscle soreness (Lee et al., 2002; Paschalis et al., 2005) and lead to muscle damage and potential adverse effects on exercise (Paschalis et al., 2005). Exercises that cause muscle damage are associated with symptoms such as increased pain, swelling, weakness and limb mass, as well as a decrease in strength, output power and range of motion in the muscle (Ferreira-Valente et al., 2011; Fehrenbach et al., 2003).

Today, in all sports, especially in group sports, professional clubs are trying to provide the best opportunities to get the best possible results. Using any method that reduces and weakens the inflammatory responses and indicators of muscle damage may be beneficial during resistance training and various types of exercise that the athlete trains on the verge of fatigue and exhaustion. For example, volleyball players need to include eccentric and plyometric exercises in their daily exercise program to increase strength and improve explosive movements (Berd, 2013). However, this model of exercise causes muscle damage and delayed onset muscle soreness, and the physiological response to muscle pain caused by eccentric contraction reduces muscle strength and flexibility, increases muscle stiffness, and increases the indicators of muscle damage in the blood (Barnes et al., 2010; Best et al., 2008).

Therefore, it is important to pay attention to the issue of player recovery to get better results and good performance. Various methods have been proposed for rapid recovery. Among the recovery methods, massage can help to reduce stress along with other methods, which is why massage has been used as a complementary method to help athletes become more prepared and improve their performance during exercises and competitions (Kasapis and Thompson, 2005). According to the results of several studies, post-exercise massage reduces the pain of delayed onset muscle soreness (Farr, 2002; Hilbert et al., 2003; Jakeman et al., 2010; Smith et al., 1994; Zainuddin et al., 2005) and faster recovery (Farr, 2002; Hiruma, 2005; Imtiyaz et al., 2014; Mancinelli et al., 2006).

A study conducted by Hemmings et al. (2000) to investigate the effect of massage on the recovery process of non-professional boxers shows that it accelerates the recovery process and improves performance and reduces blood lactate. A study conducted by Lane and Wenger in 2004 shows that massage accelerated the recovery process of athletes in high-intensity intermittent cycling exercises in two separate sessions 24 hours apart (Lane and Wenger, 2004). In 1989, Balke and colleagues examined the effects of two types of mechanical and manual massage on improving the athletic performance of seven healthy individuals. The results show that both types of massage increase heart-beat, blood pressure, muscle strength and

endurance, and reduce bruising and muscle fatigue (Balke et al., 1989).

Bale and James (1991) also found in their study that blood lactate and muscle soreness decreased 12 hours after massage. Due to the contradictory results of some of the above researches and the prevalence of massage use among athletes, this issue needs comprehensive studies. The intensity and type of massage can cause different physiological responses in the body of athletes in different sports. Therefore, it is necessary to investigate the effect of two types of deep massage and superficial massage from different aspects. Therefore, the present study seeks to answer the question of whether superficial and deep massage techniques are effective on the indicators of musculoskeletal and inflammatory injuries of volleyball players.

## METHODOLOGY

The present research is operational and its method is based on the nature of research based on quasi-experimental research. The statistical population of this study includes elite, young and male volleyball players in Urmia in provincial and national leagues who were selected during the call and practiced regularly for at least 5 years in volleyball academy under the supervision of experienced coaches at least 4 sessions per week. Twenty-four volleyball players, with an average age of  $19.04 \pm 2.07$  years, weight of  $75.35 \pm 12.09$  kg, body mass index of  $21.83 \pm 2.61$  and a height of  $185.25 \pm 5.25$  cm, voluntarily participated as a statistical sample and were randomly divided into three groups: deep massage, control and superficial massage. The criterion for these individuals to enter the study was the absence of any muscular or inflammatory damage. Immediately after the warming up and performing of the protocol, immediately after the protocol, immediately after the massage and 24 h after the performing the protocol, 5 cc of intravenous blood samples were taken from the elbow with a simple syringe method by an experienced physician and his assistant. The indices of creatine kinase, lactate dehydrogenase, lactate, 6interleukin and CRP were measured.

Data were analyzed using SPSS 20 software. The Shapirovic test was used to test the normality of data distribution. Anova analysis with repeated measurements was used to investigate differences within and between groups. Also, the effectiveness of each of the independent variables was determined using Eta value. The significance level was considered at the alpha level of 5%. Ethical number and research license: IR.umsu.R.E.C.1396.158

## RESULTS

The results of the Shapirovic test showed that the data

had a normal distribution and in all variables the significance level was more than five hundredths.

Table 1 shows the mean and standard deviation of IL6, CK, L.D.H, lactate and CRP variables of deep massage and superficial massage and control groups at different blood collection times.

Table 2 summarizes the most important research findings in this hypothesis. As can be seen, the effects

between the times on the CK, L.D.H and Lactate indices have been significant, meaning that the rate of all the indices differs significantly in the four blood sampling times. Also, the differences between the three groups of deep massage, superficial massage and control group have significant differences in all indicators. Therefore, there is a difference between the two massage groups in the measured indicators.

**Table 1.** The mean and standard deviation of IL6, CK, L.D.H, lactate and CRP variables of deep massage and superficial massage and control groups at different blood collection times.

Var	Group	Before the protocol	After the protocol	After the massage	24 hours after massage
IL6	Deep massage	3.11 ± .92	3.29 ± .95	2.36 ± .70	1.45 ± .13
	Level massage	2.67 ± 1.42	2.87 ± 1.42	2.48 ± 1.46	3.65 ± 1.45
	Control group	3.30 ± 1.47	3.35 ± 1.68	4.13 ± 1.80	5.84 ± 1.39
CK	Deep massage	240.62 ± 54.77	277 ± 62.9	239.5 ± 68.39	12.362 ± 2.1
	Level massage	207.5 ± 56.13	226.5 ± 61.14	226.5 ± 59.25	265.5 ± 110.96
	Control group	205.5 ± 88.63	240.62 ± 117.14	285 ± 119.79	670.75 ± 127.9
L.D.H	Deep massage	280.43 ± 54.87	379.4 ± 69.81	292.06 ± 41.36	219.9 ± 37.9
	Level massage	305.41 ± 29.84	383.6 ± 91.83	343.74 ± 86.13	300.01 ± 51.98
	control group	338.01 ± 59.06	431.46 ± 97.34	600.73 ± 102.53	629.38 ± 79.02
Lactate	Deep massage	7.30 ± 1.56	7.74 ± 1.63	4.74 ± .82	3.82 ± .39
	Level massage	8.23 ± 2.40	10.23 ± 2.38	7.16 ± 1.65	5.74 ± .83
	Control group	8.87 ± 3.04	9.52 ± 2.98	11.26 ± 2.58	12.9 ± 2.72
C.R.P	Deep massage	2.96 ± .63	3.3 ± .59	2.77 ± .59	1.8 ± .27
	Level massage	2.95 ± .65	2.27 ± .64	2.82 ± .64	3.03 ± .6
	Control group	3.03 ± .49	3.35 ± .48	3.87 ± .46	4.78 ± .55

**Table 2.** Intergroup effect test in four times.

Source		Sum of squares	Df	Mean square	F	Sig	Eta
IL6	Time	5.63	3	1.88	1.83	0.164	0.164
	Group	48.74	2	24.37	4.16	0.03	0.284
CK	Time	251907	3	83969	10.57	0.001	0.531
	Group	333384	2	166692	7.44	0.004	0.415
L.D.H	Time	155491	3	51830	7.58	0.001	0.448
	Group	770529	2	385265	34.58	0.001	0.767
Lactate	Time	38.01	3	12.67	3.71	0.023	0.285
	Group	360.53	2	180.27	11.85	0.001	0.53
C.R.P	Time	1.33	3	0.444	0.985	0.414	0.095
	Group	18.72	2	9.36	9.27	0.001	0.469

## DISCUSSION

According to the results of the present study, deep massage techniques have an effect on young volleyball players after a session of strenuous physical activity in the profile of inflammatory indicators (C reactive protein and 6 interleukin) and muscle damage (creatinase kinase, lactate dehydrogenase and lactate). In other words, deep massage reduces inflammation and muscle damage in the deep massage group. Also, the differences between the blood collection times in the research indicators are significantly different, which means that the amount of all indicators in the four blood collection times is significantly different. The results are consistent with the research of Haas et al. (2013) who found out that post-workout massage increased the chemical safety of cells. However, this difference between the deep massage group and the control group differs significantly in all aspects. In fact, deep massage reduces the levels of inflammation and muscle damage. These results are similar to several studies, including Imtiyaz (2014), Smith et al. (1994), Zainuddin et al. (2005), which have shown that post-workout massage reduces creatine kinase (CK) levels and reduces inflammation and immune responses, including c-reactive proteins (CRP) and neutrophils (NC) (Zainuddin, 2005; Imtiyaz, 2014; Smith et al., 1994). Therefore, in this study, the effect of massage on reducing pain, inflammation and muscle damage has been well proven. Because the feeling of pain depends on many causes and factors; the mechanisms of pain relief using massage are also very diverse. Muscle relaxation and increased blood circulation and reduction of inflammatory indicators, removal of muscle knots and muscle damage and lactate excretion, increased secretion of endorphins and serotonin and increased sleep can be reasons for using massage before and after physical activity.

Muscle tissue condition can have a profound effect on the body's ability to perform fast and powerful yet delicate movements. Muscle tissue under pressure or chronic immobility is prone to dryness and loss of flexibility and elasticity. The connection of muscle tissue with other tissues around it and even further causes the muscle tissue affected by this problem to affect the whole movement. The mechanical action of massage is ideal for curing and improving this condition.

Ghafourian et al. (2016) showed in a study that a high-intensity exercise session causes a temporary increase in some inflammatory indicators (IL6 and IL6/IL10 immediately after workout), and a lower-intensity exercise can reduce these biological indicators. In general, these results are inconsistent with the findings of the present study and the majority of valid studies on the effect of massage on reducing inflammation and muscle damage, which can be attributed to the inconsistency of these results due to differences in time and method of sampling and type of massage.

## CONCLUSION

Based on the results of the research, it is necessary to reduce the amount of muscle damage using efficient methods. Today, the use of various recovery methods, including massage, is one of the most effective ways to reduce the amount of these injuries in the body, which many medical and sports specialists prescribe massage to athletes. Massage is one of the recovery methods used, which in some researches has reduced the indicators of inflammation and muscle damage and improved performance, but in some researches, contradictory results have been obtained. However, the results of the present study showed that massage, especially deep massage compared to superficial massage, improves the body and reduces inflammatory indicators and muscle damage.

## REFERENCES

- Bale, P., and James, H. (1991). Massage, warmdown and rest as recuperative measures after short term intense exercise. *Physiotherapy and Sport*, 13: 4-7.
- Balke, B., Anthony, J., and Wyant, F. (1989). The effect of massage treatment on exercise fatigue. *Clinics in Sports Medicine*, 1: 189-196.
- Barnes, J., Trombold, J., Dhindsa, M., Lin, H., and Tanaka, H. (2010). Arterial stiffening following eccentric exercise-induced muscle damage. *Journal of Applied Physiology*, 109(4): 1102-1108.
- Best, T., Hunter, R., Wilcox, A., and Haq, F. (2008). Effectiveness of sports massage for recovery of skeletal muscle from strenuous exercise. *Clinical Journal of Sport Medicine*, 18(5): 446-460.
- Connolly, D., Sayers, S., and Mchugh, M. (2003). Treatment and prevention of delayed onset muscle soreness. *The Journal of Strength and Conditioning Research*, 17(1): 197-208.
- Farr, T., Nottle, C., Noaska, K., and Sacco, P. (2002). The effects of therapeutic massage on delayed onset muscle soreness and muscle function following downhill walking. *Journal of Science and Medicine in Sport*, 5(4): 297-306.
- Fehrenbach, E., Niess, A., Passek, F., Sorichter, S., Schwirtz, A., Berg, A., Northoff, H. (2003). Influence of different types of exercise on the expression of haem oxygenase-1 in leukocytes. *Journal of Sports Sciences*, 21: 383-389.
- Ferreira-Valente, M., Pais-Ribeiro, J., and Jensen, M. (2011). Validity of four pain intensity rating scales. *Pain*, 152(10): 2399-2404.
- Ghafourian, M., Ashtary-Larky, D., Rahim, C., Nahid, E., and Mousa, E. (2016). Inflammatory biomarkers' response to two different intensities of a single bout exercise among soccer players. *Iran Red Crescent Med J*; 18: 214-98.
- Haas, C., Butterfield, T. A., Abshire, S., Zhao, Y., Zhang, X., Jarjoura, D., and Best, T. M. (2013). Massage timing affects post exercise muscle recovery and inflammation in a rabbit model. *Medicine and Science in Sport and Exercise*, 45(6): 1105-1112.
- Hemmings, B., Smith, M., Graydon, J., and Dyson, R. (2000). Effects of massage on physiological restoration, perceived recovery, and repeated sports performance. *British Journal of Sports Medicine*, 34(2): 109-114.
- Hilbert, J., Sforzo, G., and Swensen, T. (2003). The effects of massage on delayed onset muscle soreness. *British Journal of Sports Medicine*, 37(1): 72-75.
- Hiruma, E. (2005). Effects of massage and compression treatment on delayed onset muscle soreness following maximum calf-raise exercise: 1356 board #211 3:30 pm - 5:00 pm. *Medicine and Science in Sports and Exercise*, 37(Supplement), S265-S266.
- Imtiyaz, S., Veqar, Z., and Shareef, M. (2014). To compare the effect of vibration therapy and massage in prevention of delayed onset muscle soreness (DOMS). *Journal of Clinical and Diagnostic Research*, 8(1):

- 133-136.
- Jakeman, J., Byrne, C., and Eston, R. (2010).** Efficacy of lower limb compression and combined treatment manual massage and lower limb compression on symptoms of exercise-induced muscle damage in women. *Journal of Strength and Conditioning Research*, 24(11): 3157-3165.
- Kasapis, C., and Thompson, P. (2005).** The effects of physical activity on serum creatine protein and inflammatory markers: A systematic review. *Journal of the American College of Cardiology*, 45(10): 1563-1569.
- Lane, K. N., and Wenger, H. A. (2004).** Effect of selected recovery conditions on performance of repeated bouts of intermittent cycling separated by 24 h. *Journal of Strength and Conditioning Research*, 18(4): 855-860.
- Lee, J., Goldfarb, A., Rescino, M., Hegde, S., Patrick, S., and Apperson, K. (2002).** Eccentric exercise effect on blood oxidative-stress markers and delayed onset of muscle soreness. *Medicine and Science in Sports and Exercise*, 34(3): 443-448.
- Mancinelli, C., Davis, D., Aboulhosn, L., Brady, M., Eisenhofer, J., and Foutty, S. (2006).** The effects of massage on delayed onset muscle soreness and physical performance in female collegiate athletes. *Physical Therapy in Sport*, 7: 5-13.
- Paschalis, V., Koutedakis, Y., Jamurtas, A., Mougios, V., and Baltzopoulos, V. (2005).** Equal volumes of high and low intensity of eccentric exercise in relation to muscle damage and performance. *The Journal of Strength and Conditioning Research*, 19(1): 188-188.
- Smith, L., Keating, M., Holbert, D., Spratt, D., McCammon, M., Smith, S., and Israel, R. (1994).** The effects of athletic massage on delayed onset muscle soreness, creatine kinase, and neutrophil count: A preliminary report. *Journal of Orthopaedic and Sports Physical Therapy*, 19(2): 93-99.
- Suzuki, K., Totsuka, M., Nakaji, S., Yamada, M., Kudoh, S., Liu, Q., Sugawara, K., Yamaya, K., and Sato, K. (1999).** Endurance exercise causes interaction among stress hormones, cytokines, neutrophil dynamics, and muscle damage. *Journal of Applied Physiology*, 87(4): 1360-1367.
- Zainuddin, Z., Newton, M., Sacco, P., and Nosaka, K. (2005).** Effects of massage on delayed-onset muscle soreness, swelling, and recovery of muscle function. *Journal of Athletic Training*, 40(3): 174-180.

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**Citation:** Nematpour, P., Sajedi, H., Milan, R. S., and Gursoy, R. (2020). The effect of deep and superficial techniques of sports massage on the indicators of muscle and inflammatory damage of young volleyball players after a session of physical activity. *African Educational Research Journal*, 8(1): S152-S156.

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