Spor ve Performans Araştırmaları Dergisi
Journal of Sports and Performance Researches
http://dergipark.gov.tr/omuspd

Araştırma Makalesi

Geliş Tarihi/Received : 19.08.2019
Kabul Tarihi/Accepted : 07.08.2020
DOI: 10.17155/omuspd. 606247

EFFECT OF CLASSIC MASSAGE WITH PEPPERMINT OIL ON MUSCLE SORENESS AND MUSCLE STRENGTH DURING RECOVERY FROM EXERCISE*

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ABSTRACT

The aim of this study was to investigate effects of classic massage with peppermint oil or vaseline on muscle pain and muscle strength during recovery from exercise. Twenty-two healthy males between the ages of 18 to 22 years participated in this study. All participants carried out 10 set of 10 repetitions eccentric exercises of wrist flexors with elastic bands. The participants were randomly divided into two intervention groups as the peppermint oil and the vaseline massage. Ten minutes of classic massage was performed to one arm of participants after exercise and no massage was performed to contralateral arm. Muscle soreness was evaluated using pressure algometry. Grip strength was measured with JAMAR dynamometer. No significant differences were found for muscle soreness in both peppermint oil and vaseline massage arm from baseline to 24 h and 48 h ($p>.05$). There were significant differences from baseline to 24 h ($p=0.031$) and 48 h ($p=0.023$) post-exercise in peppermint oil control arm for muscle soreness. Also, there was a significant difference from baseline to 24 h ($p=0.016$) in the vaseline control arm. No significant differences were found for grip strength after exercise in all conditions ($p>.05$). There were no significant differences between peppermint oil and vaseline massage arm for both muscle soreness and grip strength ($p>.05$). The classic massages with peppermint oil and vaseline alleviated muscle soreness during recovery after exercise. But, both massage interventions did not contribute to recovery of grip strength after exercise.

Keywords: Massage, recovery, exercise, muscle soreness, muscle strength

NANE YAĞI İLE KLASİK MASAJIN EGZERSİZDEN TOPARLANMA SIRASINDA KAS AĞRISI VE KAS KUVVETİNE ETKİSİ

ÖZET

Bu çalışmanın amacı, egzersizden toparlanma sırasında nane yağı veya vazelin ile klasik masajın etkisini araştırmaktı. Bu çalışmaya 18-22 yaşları arasında 22 sağlıklı erkek katıldı. Tüm katılımcılar elastik bantlar ile 10 set 10 tekrar el bileği fleksiyon egzersizleri yaptılar. Katılımcılar rastgele nane yağı ve vazelin masajı olarak iki müdahale grubuna ayrıldı. Katılımcıların bir koluna egzersiz sonrası 10 dakika klasik masaj yapıldı ve diğer kola masaj yapılmadı. Kas ağrısı basınç algometresi kullanılarak değerlendirildi. Kavrama kuvveti JAMAR dinamometresi ile ölçüldü. Hem nane yağı hem de vazelin masaj kolunda egzersiz öncesi 24 saat ve 48 saate kadar kas ağrısı açısından anlamlı fark bulunmadı ($p> .05$). Kas ağrısı için nane yağı masajı kontrol kolunda egzersiz öncesinden egzersiz sonrası 24 saat ($p = 0.031$) ve 48 saate ($p = 0.023$) anlamlı farklılıklar vardı. Ayrıca, vazelin kontrol kolunda, egzersiz öncesinden egzersiz sonrası 24 saate ($p = 0.016$) anlamlı bir fark vardı. Her koşulda egzersiz sonrası 24 saatte ve 48 saatte kavrama gücü için anlamlı fark bulunmadı ($p> 0.05$). Hem kas ağrısı hem de kavrama kuvveti için nane yağı masaj ve vazelin masaj kolu arasında anlamlı fark yoktu ($p> 0.05$). Nane yağı ve vazelin ile klasik masaj, egzersiz sonrası toparlanma sırasında kas ağrısını hafifletti. Ancak, her iki masaj müdahalesi de egzersiz sonrası kavrama kuvveti toparlanmasına katkı sağlamadı.

Anahtar kelimeler: Masaj, toparlanma, egzersiz, kas ağrısı, kas kuvveti

* This study was presented in Putrajaya International Conference on Sports Sciences, Fitness and Health 2017.

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INTRODUCTION

Unaccustomed exercises or exercises involving eccentric muscle activity such as downhill running, jumping and resistance training lead to damage which is known as delayed onset muscle soreness (DOMS) in skeletal muscles. This damage causes pain and tenderness within muscles at 12-48 h after exercise [1]. Muscle soreness, which frequently occurs in athletes, can result in loss of performance during training and competition [2-4]. The decrease in muscle strength is higher following eccentric activity and returns to the previous level up to 8-10 days; however, concentric and isometric muscle strength is reported to recover within 4 days. Also, reduced joint proprioception and range of motion (ROM) may lead to an increased risk of injury [1].

Previous studies including cryotherapy [5], electrotherapy [6], stretching [7], anti-inflammatory drugs [8], ultrasound [5], hyperbaric oxygen therapy [9], acupuncture [10], taping [7] and massage [11] to alleviate DOMS and to restore muscle function have reported conflicting results. Massage has been widely used in recovery of athletes from exercise and rehabilitation of patients for years. Massage increases blood circulation, decreases edema production, relieves muscle tension and stiffness, and enhances lactate removal from working muscles [12, 13]. Mancinelli et al. [14] reported that thigh massage reduced quadriceps muscle soreness and increased vertical jump height in female basketball and volleyball players. Tanaka et al. [15] found a significant difference between massage and control groups for muscle fatigue; however, these results could not be supported by electromyography. Jönhagen et al. [16] showed that thigh massage alleviated muscle soreness during recovery following eccentric quadriceps exercises. In literature, although there are many studies investigating effect of massage on recovery after sport injuries, there are limited studies about effects of various aromatic oils.

Peppermint, which grows widely in North America and Europe, has antispasmodic, painkilling, anti-inflammatory, decongestant, and antioxidant properties. Peppermint oil is used both externally and internally in the treatment of a variety of diseases, including irritable bowel syndrome, headache, and non-ulcer dyspepsia [17]. It was observed that peppermint oil decreased pain intensity in patients with headache [18]. Davies et al. [19] reported that the local application of peppermint oil had significant analgesic effect in postherpetic neuralgia. Therefore, the aim of this study was to investigate effect of classic

massage with peppermint oil on muscle pain and muscle strength during recovery from exercise.

MATERIAL and METHODS

Twenty-two healthy males between the ages of 18 to 22 years participated voluntarily in this study. The inclusion criteria were as follows: 1) participants who did not regularly perform resistance exercises on upper extremities, and 2) those without a musculoskeletal injury including upper extremities within previous six months. The exclusion criteria were: 1) participants with orthopedic disease or who had surgery on a lower extremity within previous six months, 2) those with hypersensitivity, inflammatory disease, or an open upper extremity wound. This study was approved by the ethics committee of the University. All participants were instructed to refrain from any form of physical exercise for upper extremities at least 1 week prior to as well as during the entire study period.

All participants carried out 10 sets of 10 repetitions eccentric exercises of both wrist flexors using elastic bands. Then, participants were randomly divided into two intervention groups as the peppermint oil and the vaseline massage. In each intervention group, one arm of the participants served as the control while the other arm received massage. Ten minutes of classic massage was randomly performed to one arm of participants immediately after exercise. The massage including effleurage, petrissage and friction techniques was applied over the hand and forearm by two physiotherapists to peppermint oil and vaseline groups. All participants were tested at baseline, 24 h and 48 h after exercise for muscle soreness and grip strength.

Muscle soreness was evaluated using pressure algometry over the wrist flexor muscles (Baseline, USA). Intra-tester reliability with algometry has been shown to be fair to good (r= 0.67) for the measurement of the pressure pain threshold [20]. The researcher marked the measurement point at 5 cm distal of the medial epiconyle of humerus over the line connecting median point of the wrist joint and medial epicondyle of humerus. The researcher applied a gradually increasing pressure over the marked point with algometry. Participants were instructed to report when they perceived uncomfortable sensation or pain, and the pressure at this point was recorded as kg/cm^2. The lesser unit showed the more sensitivity to pain.

Grip strength was measured with JAMAR dynamometer (Baseline, USA). While the participants were sitting in an armless chair, the upper extremity was positioned with wrist and forearm in the neutral position, 90° elbow flexion and shoulder at 0° abduction. Participants were asked to squeeze the handle of the dynamometer with maximum strength with both hands. Participants were verbally encouraged to squeeze the dynamometer with their maximum effort. Three trials were carried out with 60 seconds rest and the average of all three grips was recorded [21,22].

Data were analyzed using SPSS (Version 16.0, SPSS Inc, Chicago, IL). Demographic characteristics are shown in Table 1. Normality of the dependent variables was checked using the Kolmogorov Smirnov test. A 4x3 (condition x time) mixed ANOVA was assessed at each measurement time (baseline, 24 h and 48 h after exercise) for four conditions. Bonferroni correction was applied for multiple comparisons. Independent sample t-tests were used to compare differences between the intervention groups. All results are shown as the mean ± SD. Significance was set at $p<0.05$.

RESULTS

Table 1. Demographic characteristics of participants

	Vaseline (n=11) Mean ± SD	**Peppermint Oil (n=11) Mean ± SD**
Age (yrs)	21.09±1.13	20.00±1.00
Height (cm)	175.81±6.30	177.18±5.72
Weight (kg)	70.27±10.13	76.90±12.58

No significant differences were found for muscle soreness in both peppermint oil and vaseline massage arm from baseline to 24 h and 48 h ($p>.05$) (Table 1).

Table 2. Muscle soreness and grip strength scores of conditions

Measurements	**Conditions**	**Baseline Mean ± SD**	**24 h Mean ± SD**	**48 h Mean ± SD**
Muscle soreness (Kg/cm^2)	Vaseline	9.33±2.05	8.87±1.76	9.30±1.79
	Vaseline Control	9.81±1.24	8.29±1.42[a]	8.88±1.55
	Peppermint Oil	9.13±2.07	8.12±1.53	8.25±1.47
	Peppermint Oil Control	9.68±2.43	7.30±0.87[a]	7.64±0.77[a]
Grip strength	Vaseline	47.45±8.04	44.72±7.73	47.00±6.26

(kg)	Vaseline Control	44.09±7.24	44.09±7.00	45.27±6.11
	Peppermint Oil	44.27±6.84	43.63±7.10	45.00±7.38
	Peppermint Oil Control	44.81±7.05	43.90±9.14	44.54±8.85

[a] Different from baseline

There were significant differences from baseline to 24 h (p=0.031) and 48 h (p=0.023) post-exercise in peppermint oil control arm for muscle soreness. Also, there was a significant difference from baseline to 24 h (p=0.016) in the vaseline control arm. No significant differences were found for grip strength at 24 h and 48 h after exercise in all conditions (p>.05) (Table 2).

Table 3. Changes in muscle soreness and grip strength of intervention groups

Measurements		**Peppermint Oil Mean ± SD**	**Vaseline Mean ± SD**	**p**
Muscle soreness (kg/cm^2)	Baseline-24 h	1.00±0.18	0.46±0.15	0.466
	Baseline-48 h	0.88±0.22	0.02±0.01	0.274
Grip strength (kg)	Baseline-24 h	0.63±0.41	2.72±0.35	0.219
	Baseline-48 h	0.72±0.23	0.45±0.32	0.341

There were no significant differences between peppermint oil arm and vaseline massage arm for both muscle soreness and grip strength (p>.05) (Table 3).

DISCUSSION

The results of this study showed that classic massage with peppermint oil and vaseline alleviated muscle soreness during recovery after exercise. However, both massage interventions did not contribute to recovery of grip strength after exercise. In this study, elastic band exercises were used to produce muscle soreness. All participants had no experience in resistance exercises of the wrist flexor muscles. Gadruni et al. [23] found that muscle soreness and inflammatory markers indicative of muscle damage significantly increased 24h after the elastic-band exercise protocol in sedentary individuals. To our knowledge, the classic massage with peppermint oil and vaseline may have attenuated muscle soreness in the present study because massage supports blood and lymph circulation, and eliminates lactate accumulation by inflammation or fatigue following exercise [24]. In most studies, the visual analogue scale (VAS) has been used to assess muscle soreness. Although VAS is an easy method, it has a poor intra-rater reliability and inter-rater reliability [25]. In the present study, pressure algometry was used to more

objectively determine the change of muscle soreness. Similar to our findings, Zainuddin et al. [26] showed that massage was effective in attenuation of DOMS compared to control arm. Ten healthy participants performed eccentric biceps curls to induce DOMS. The authors evaluated the effects of a 10-min massage including effleurage, petrissage and friction techniques 3 h post-exercise. The massage did not help recovery of the elbow flexor strength and elbow flexion ROM. Farr et al. [27] reported that massage significantly decreased muscle soreness compared to the control leg 48 h after downhill walking, while it did not improve muscle strength. Muscle soreness was generated with a 40-min downhill treadmill walk protocol in healthy male subjects. The effleurage and petrissage techniques were applied to major leg muscles 2 h post-exercise. However, the researchers did not observe significant recovery in the vertical jump and leg strength. Hilbert et al. [28] observed that the massage at 2 h after eccentric hamstring exercises decreased muscle soreness and did not improve hamstring torque and ROM of knee joint at 48 h after exercise. On the other hand, the following studies revealed that massage improved both soreness and muscular performance. Han et al. [29] showed that massage significantly decreased pain and contributed to gait performance following gastrocnemius exercises in healthy college students. The authors produced muscle soreness by exercise with going up and down 20 repetitions in 5-story building. Massage significantly increased gait parameters such as stride velocity, step length, stride length. Mancinelli et al. [14] investigated the effect of massage on DOMS in quadriceps muscle in female basketball and volleyball players. The researchers found that massage increased vertical jump height and reduced perceived soreness. Willems et al. [11] examined muscle soreness over quadriceps femoris muscle following downhill treadmill walking in active female subjects. The 25 min massage improved vertical jump performance and reduced soreness in the massaged leg. To our knowledge, it is possible that there are conflicting results on muscle soreness, muscle strength and athletic performance such as sprinting, jumping. It is difficult to compare the data from the various studies due to methodological differences such as exercise intensity and duration, type of exercise, duration of massage application, and target muscles.

In the present study, the insignificant result in grip strength may be explained by fatigue in a limited number of muscles following wrist flexion exercises. In this study, concentric and eccentric wrist flexion exercises were performed to create muscle soreness.

However, the effect of peppermint oil or vaseline massage on muscle soreness was tested by grip strength. Muscles functioning in grip strength are divided into two groups as intrinsic (located within the hand) and extrinsic (located within the forearm). There are only two extrinsic muscles that play a role in both wrist flexion and hand grip function. These are the flexor digitorum superficialis and the flexor digitorum profundus muscles [30, 31].

Most researchers observed effect of massage in recovery from various exercise protocols. The present study focused on comparison of the effects of massage with peppermint oil and vaseline. Our findings indicated that the peppermint oil massage and vaseline massage were not superior to each other for both muscle soreness and grip strength in recovery from exercise. It has been documented that the topical application of peppermint oil is effective in reducing pain intensity in patients with tension headache [10, 11]. Gobel et al. [32] reported that peppermint oil led to a significant increase of the skin blood flow of the forehead after topical application of peppermint oil, measured by laser doppler. Also, it has been suggested that topical application of peppermint oil creates a long-lasting cooling effect on the skin, caused by a steric alteration of the calcium channels of the cold-receptors [33]. It has been suggested that massage benefits individuals via biomechanical, physiological, neurological and psychological mechanisms [13]. Therefore, the results of our study may not be completely explained by the properties of the oil or cream used for massage.

In conclusion, classic massage with both peppermint oil and vaseline alleviated muscle soreness in recovery from elastic band exercises of wrist flexors. However, both massage interventions did not contribute to recovery of grip strength. These results may be beneficial for both clinical and sporting settings. The limitation of this study is that the blood concentrations of muscle damage indicators and inflammatory markers induced by DOMS were not measured. Further research including other muscle groups and blood markers of muscle soreness is required to determine effects of the peppermint oil massage on recovery of post-exercise.

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