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Effects of Self-Myofascial Release on Pain and Flexibility among Adults with Low Back Pain

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Abstract
Aims: To explores the short-term effects of a self-management myofascial approach in managing LBP. **Objective**: Firstly; To compare self-MFR and static hamstring stretching intervention on pain and flexibility. Secondly: To determine the effect of self-MFR on pain and flexibility. **Methods**: Seventy participants were randomly assigned equally into intervention and control groups. The intervention participants performed self-MFR on the plantar using a tennis ball. The control group performed static hamstring stretching. **Findings**: There was a significant difference in flexibility between both groups ($p<0.05$). There was a significant effect of self-MFR on pain ($t:6.21; p<0.05$) and flexibility ($t: -5.65\ p<0.05$) among LBP adults.

Keywords: Low back pain; Muscle flexibility; Self - myofascial release; Pain intensity

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1.0 Introduction

Low back pain (LBP) refers to pain and discomfort below the costal margin and above the inferior gluteal folds, with or without radicular pain in the lower extremities (Burton et al., 2006; Mattila et al., 2017). Based on Global Burden Disease (GBD) 2017, LBP is a chronic health issue that ranks first in the global burden of musculoskeletal disease (Wu et al. 2020). Besides, in 2017, studies reported 7.5% out of 577.0 million people worldwide suffered from LBP (Wu et al., 2020). However, this prevalence increased in 2019, ranging from up to 20% of people worldwide suffering from LBP. In 2019, studies by Chen et al. (2019) showed that there were 568.4 million cases of LBP were reported globally. However, in Malaysian public hospitals, back disorders were the 28th most frequent condition in 2014. and the 8th most frequent diagnosis in Malaysian private hospitals (Sivasampu et al., 2014). And this prevalence increased in 2018, which Malaysian public and private healthcare facilities reported LBP prevalence was among the 9th and 5th most frequent complaints among musculoskeletal disease (Hani & Liew, 2018).

Self-myofascial release (self-MFR) is a form of myofascial release (MFR) done by the self under a therapist's supervision (Remvig, Ellis & Patijn, 2008). It is based on the same theory as myofascial release, which stimulates the fascia's muscles, tendons, and mechanoreceptors while loading the soft tissues biomechanically (Remvig et al., 2008). Self-MFR is assisted mainly by lacrosse or tennis ball to release the trigger points (Celik & Mutlu, 2013; Fernandez, 2014). In addition, the self-myofascial release showed an

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improvement in pain, flexibility and disability among healthy individuals or individuals with back pain (Ajimsha et al., 2014; Balasubramaniam et al., 2014; Kwangsun et al., 2018). However, the impact of self-MFR, specifically on the plantar fascia, is limited among LBP patients. Thus, it is important to study the effect of self-MFR on plantar fascia among LBP individuals as it is beneficial for self-management and can be another option of treatment for in-home exercise that is more effective among LBP patients.

In addition, extensive previous studies reported the effect of myofascial release administered by an experienced therapist compared to self-MFR (Ajimsha et al., 2013; Bhat et al., 2021). For example, a cross-sectional study among 60 healthy participants reported that clinician-administered MFR in the suboccipital region significantly increased hamstring flexibility (Paloncy et al., 2019). The MFR and self-MFR might differ due to the different pressure, affecting the performance efficiency (Skarabot & Beardsley, 2015). Hence, it is essential to observe the effectiveness of self-MFR to develop an effective home treatment and augmented recovery among LBP individuals. Besides, it can act as a home exercise treatment among individuals who need to sit for more than 40 hours per week, reducing the prevalence of LBP in Malaysia. This study aimed to (1) compare intervention between Self- Myofascial Release (self-MFR) and static hamstring stretching on pain and flexibility among LBP individuals. 2. To determine the effect of self-MFR on pain and flexibility among LBP individuals.

2.0 Literature Review

A superficial Backline (SBL) is a single continuous line with integrated muscle tissue that acts as a single continuous line (Myers 2014). It extends and attaches to the supraorbital ridge on the anterior surface of the cranium, galea aponeurotica, erector spinae, Sacro lumbar fascia, Sacro tuberous ligament, popliteus, hamstring, gastrocnemius, Achilles tendon, and plantar fascia are all part of the SBL (Myers, 2014) The SBL's primary function is to generate the extension and hyperextension required for an individual to maintain an upright posture (Wilke, Krause & Vogt, 2019).

Static hamstring stretching is a slight stretch of the muscles while keeping the joint in its full range of motion and is often used to increase hamstring flexibility (Deguzman et al., 2018). Sahrmann (2002) states that LBP can be reduced by controlling trunk muscles and increasing lower extremity flexibility. In addition, stretching the lumbar and leg muscles has been shown to help with LBP relief and healing (Paek et al., 2014). This is because stretching the surrounding muscles may cause capillaries to expand, resulting in increased blood flow to the muscle cells, reducing metabolites, and providing enough oxygen to ease the pain among LBP patients (Park et al., 2005; West et al., 2014). Besides, this can be due to a forced transmission from one muscle to another following the SBL connectivity (Findley et al., 2015).

3.0 Method

3.1 Participants

A purposive sampling of patients diagnosed with low back pain aged from 20 to 55 years old was selected through the walk-in from March 2022 to September 2022 at Kiro Spinecare Physiotherapy Center in Bandar Saujana Putra, Selangor. The inclusion criteria were as follows: (1) Age of 20-55 years; (2) LBP of more than 6 months diagnosed by a doctor; (3) Desk job/ job prolonged sitting more than 6-8 hours; (4) Has not received physiotherapy session; (5) Able to understand English and Malay language. In addition, participants were excluded if they met the following criteria: (1) had major injuries of the lower limb/ spine in the past six months; (2) had a neurological condition; (3) had surgical interventions in the past year; (4) pregnant; (5) hypermobile spine according to Beighton score (Beighton & Horan, 1969); (6) have major medical issues; (7) uncontrol hypertension (>140/90 mm Hg); (8) vascular problem and (9) post-menopausal women. The participants were randomly assigned into intervention and control groups using 70 small, folded squares of paper in a container, 35 labelled “A” as the intervention group and “B” as the control group. Each participant must draw a piece of paper from the container to be assigned to the intervention or control groups.The participants, either males or females, aged 19- to 24-year-old, studied full-time mode and no other chronic diseases were included in this study. They were excluded when they were aged less than 19 and above 24 years old, studied in part-time mode, worked part-time that might contribute to LBP, and known cases of any cardiovascular disease, chronic disorder (respiratory, kidney, pelvic, gastrointestinal), malignancy, or any systemic problem.The data were analyzed using IBM SPSS Statistics software Version 20 for descriptive and inferential statistics. The demographic characteristics of the participants were analyzed using descriptive analysis. The independent t-test used to compare the mean difference of the total time spent sitting between the students with LBP and without LBP while the Chi-Square test used to analyze the association between types of sitting posture and the presence of LBP.

3.2 Sample Size Calculation

Numbers of participants was obtained through calculation of software G- power 3.1.9.4., effect size f= 0.4, alfa err prob=0.05, power= 0.8, considering F test (ANOVA), total calculate sample size will be n= 64 with 10% drop out, the total sample size will be 70.

3.3 Procedures

A total of 70 eligible participants aged range 20-55 years old will be randomly assigned into two groups: (i) self-MFR (n=35) or ii) static hamstring stretching (n=35). Group randomization will be done using 70 small, folded squares of paper in a container,35 labelled ‘A’ and another 35 marked ‘B.’ Each participant will have to draw a piece of paper from the container to be assigned to either the intervention or control groups. A blind-to-group allocation researcher (second researcher) will be measured sit and reach test at baseline and post-

intervention/ control at week 6. All participants must self-administer the information about socio-demographics, medical history, and nature of the job will be gathered using a structured form. Also, the participants will rate the degree of severity of their lower back pain using the Visual Analogue Scale (VAS). The flexibility among the participants was measured using a modified sit and reach test. The average of three times the measurement of sit and reach test score was calculated in this study. Both groups received treatment twice a week for six weeks, and the reading was taken at baseline and after the 6-weeks of post-treatment.

3.4 Self-Myofascial Release on Plantar Fascia

The participants will be administered self-MFR to the plantar fascia using a tennis ball while seated. Before treatment, each participant is given a thorough explanation of what is expected during the self-MFR by the main researcher: foam rolling one foot at a time; each subject must use their foot to move the tennis ball to the front of the foot (forefoot) and back (heel region) following the beat of the metronome, which is set to 4 beats per direction, at a rate of 70 beats per minute for 2 minutes for each foot. The use of a metronome is to regulate the tempo and rhythm of the self MFR. Wilke et al. (2018) used a metronome to standardize the velocity of foam rolling in their studies, resulting in more dependable and accurate results. Participants will also be instructed to apply a mild, even pressure of 6/10 (considering 0- no pain and 10- maximum pain) using the VAS as a guideline throughout plantar fascia self-MFR. Incorporating the VAS in administered treatment enables uniformity pertaining to pressure applied onto the plantar fascia, also implemented in respective studies by Wilke et al. (2018).

3.5 Static Hamstring Stretching Exercises

The participants will be performing hamstring stretching, each lift and hold for 5 seconds, repeated six times, with no rest between repetitions. The explanation on how to perform the hamstring stretching will be explain by the main researcher. Each participant will be instructed to perform twice a week for six weeks. All participants, either in the intervention or control group, will be received reminders via phone call or WhatsApp weekly to improve exercise adherence. Finally, all the participant data were being analysed.

3.6 Outcome Measure

Hamstring flexibility baseline and post-intervention flexibility were assessed using a modified sit-and-reach test (SRT) with a sit-and-reach box (SRB) (Cranlea, Birmingham, UK) was used to assess. The SRT outcome measure is a valid hamstring flexibility measurement (Baltaci et al., 2002). A sit-and-reach box (SRB) has been recommended (Heyward, 2008). This study was chosen for use because of its unique ability to combine the lumbar spine and hamstring flexibility while tensioning the SBL (Mayorga et al., 2014). The cut-off points -20 to -9cm are categorized as poor for men while -15 to -8 cm for women.The average of three SRT assessments, each lasting 2 seconds (Lemmink et al., 2003), was calculated as recommended by the American College of Sports Medicine (Kaminsky & Bonzheim, 2006) and used by Baltaci et al. (2002). The average of these SRT data across both groups was taken (Baltaci et al., 2002; Gonzalez et al.,2012). Mayorga et al. (2014) conducted a meta-analysis on the validity of a sit-and-reach test as a useful tool to estimate hamstring flexibility, as there is a “moderate mean criterion-related validity for estimating hamstring extensibility.” Based on Ayala et al. (2011), the ICC of SRT is 0.92 with a coefficient of variation (CV) of 8.74%.

3.7 Statistical Analysis

Data be analyzed using SPSS software version 20.0. The data be checked for a normal distribution regarding skewness and kurtosis, univariate outliers, and missing data. A One Way Ancova be conducted to compare between groups analysis outcome measurements. The paired T-test be used to determine the short-term effect of self-MFR on the plantar fascia, on pain and flexibility. Gender, time and duration for intervention and also the measurements used to covariate in this analysis. A *p*-value of less than 0.05 be used to show that the result is statistically significant.

4.0 Results and Discussion

4.1 Demographic result

A total of 70 participants participated in this study. Table 1.0 indicates the sociodemographic and characteristics of the participants.

Table 1.0 Socio-demographic and clinical characteristics of the adults with LBP

Variables	n (%)	Mean ± SD
Age		36.19 (10.09)
Race		
Malay	68 (97.1)	
Chinese	1 (1.4)	
Indian	1 (1.4)	
Others	0 (0)	
Gender		
Female	53 (75.7)	
Male	17 (24.3)	
Job field:		
Administration	8 (11.4)	
Clinician	5 (7.1)	
Educational	6 (8.6)	

Entrepreneurship	0 (0)
Transportation	2 (2.9)
Others	49 (70)
Nature of work:	
Prolong standing	2 (2.9)
Prolong sitting	51 (72.9)
Both	17 (24.3)
Siting duration in a day:	
< 4 hours	3 (4.3)
4- 6 hours	8 (25.7)
>6 hours	49 (70)
Standing duration in a day:	
< 4 hours	32 (45.7)
4- 6 hours	33 (47.1)
>6 hours	5 (7.1)

4.2 The comparison between intervention and control group on pain and flexibility

Table 1.1 showed mean value, standard deviation (SD) and the *p*-value in the effect of self- MFR and static hamstring stretching exercise on pain and flexibility among adults with LBP. The present study showed no significant difference between self-MFR with and static hamstring stretching exercise among adults with LBP ($p > 0.05$). However, there is a significant difference in flexibility of the spine muscle between self- MFR and static hamstring stretching exercise group ($p < 0.01$) (Refer table 1.1).

Table 1.1 Comparison on pain and flexibility between self-myofascial release and static hamstring stretching exercise among adults with LBP

Variables	Adults with LBP								*P*- value
	Intervention group (n=35) Self- MFR				Control group (n=35) Static Hamstring Stretching Exercise				
	Pre		Post		Pre		Post		
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	
Pain (VAS)	4.69	1.69	3.00	1.57	3.94	1.55	1.59	1.39	0.84
Flexibility (SRT)	25.80	7.74	27.26	8.25	26.70	7.66	32.85	7.98	<0.01**

4.3 The short-term effects of self- myofascial release on pain and flexibility among adults with LBP

Table 1.2 presents a short- term effects of self-MFR on pain and flexibility among adults with LBP. The present study reported that there is a significant effect ($p < 0.01$) of self- MFR on pain and flexibility among adults with LBP (Refer table 1.2).

Table 1.2 Short- term effects of self-myofascial release on pain and flexibility among adults with LBP

Variables	Intervention group (n=35) Self- MFR	
	t	*P*- value
Pain (VAS)	6.22	<0.01
Flexibility (SRT)	-5.65	<0.01

The recent studies reported a significant difference ($p < 0.01$) in muscle flexibility between self-MFR and static hamstring stretching exercises among adults with LBP. Static hamstring stretching (32.85; SD=7.98) showed significant improvement in muscle flexibility compared with self-MFR on the plantar fascia (27.26; SD=8.25). This is supported by the previous study by Shamsi et al. (2020), there is a significant improvement in spine muscle flexibility after performing 3 sessions of static hamstring stretching exercises among LBP patients. Besides, Borman et al. (2011) also found a similar result; hamstring stretching for four weeks in either a sitting or standing position improved hamstring flexibility among LBP individuals. This can be due to local alterations after stretching exercises that may spread across myofascial chains to nearby structures and muscles, thus, increasing the spine's flexibility among LBP individuals (Do Carmo et al., 2013). In addition, static hamstring stretching exercise can also induce a shift in nerve tension, hence improving stretch tolerance, enhancing flexibility, and lowering pain intensity among LBP individuals (Do Carmo et al., 2013). However, a recent study results on self-MFR in contrast with the previous studies by Uryjaz et al. (2016), which reported a significant improvement in muscle flexibility of the spine among 120 participants with LBP after one session of MFR on superficial backline muscle (hamstring and plantar fascia). This is supported by the previous study by Balasubramaniam et al. (2014); Grieve et al. (2015), MFR on the hamstring, back, or plantar fascia showed a significant improvement in flexibility, pain, and disability among non-specific LBP. This could be due to different pressure applied on the MFR part (MFR vs self- MFR) and also applying to multiple areas. A previous study performing MFR on the SBL muscle by a certified physiotherapist differed from the recent studies in which participants applied pressure by themselves (self-MFR) (Uryjaz et al., 2016). In addition, in the same session, most of the previous studies applied MFR on multiple areas, such as the hamstring, back and plantar. Therefore, the difference in pressure, technique and multiple areas of the MFR part in the same session could influence the recent studies' results. Lack of experience and inappropriate pressure with tool-assisted self-MFR may have affected their performance efficiency, affecting the study result (Skarabot et al., 2015). A study by Skarabot et al. (2015) stated that the experience with self-MFR had been shown to influence flexibility. Pressure application in self-MFR is likely to affect the change in flexibility (Skarabot and Beardsley, 2015). Therefore, to compare the self-MFR among the LBP individuals, it is necessary to assess the technique and pressure applied among them first before proceeding with the measurement.

Besides, the present study revealed that self-MFR showed better improvement in pain compared with static hamstring stretching exercise; however, there is no significant difference in pain between both groups. The present study agrees with the previous study by Bhat et al. (2021); there is an improvement in MFR in pain among LBP patients. This is because MFR is a manual therapy that stimulates mechanoreceptors in the soft tissues, which may enhance the activation pattern of para-spinal muscles, resulting in increased pain-free ROM (Bhat et al., 2021). For the mechanoreceptor mechanism, as the pressure increase during MFR or self-MFR, the mechanical receptor will stimulate the nervous system thus, reducing the muscle tone thus, reducing pain (Schleip, 2003). In addition, MFR treatment improves soft tissue mobility and dysfunction among individuals with LBP, thus, reducing the pain among LBP patients (Beardsley et al., 2015; Maitland et al., 2000. Another study by Standley and Meltzer (2008) highlighted that the release of adhesions improved the physiological nature of the myofascial system in the form of higher metabolism, which encouraged circulation (increased metabolic reaction, fibroblastic activation, the healing process). As a result, increased myofascial viscoelasticity, inhibition of acetylcholine and cell transmitter, decreased interleukin and parasympathetic activation and decreased pain levels (Werenki, 2011; Standley & Meltzer, 2008). Thus, this could explain why the self-MFR decreased in pain compared to static hamstring stretching exercises, even though the difference is insignificant.

Recent studies reported there is a significant short-term effect ($p< 0.01$) of self-MFR on pain and muscle flexibility of the spine among LBP individuals. The present study result agrees with the previous studies that there is a significant effect on pain score after MFR among LBP individuals (Ozsoy et al., 2019; Muhammad Sawwali et al., 2019). This could be due to collagen rearrangement returning the fascial tissue to its standard length during the MFR technique (Schleip, 2003). During MFR, the internal fluids are redistributed, restrictive intermolecular crosslinks are broken, and collagenous tissue is elongated, increasing the flexibility of SBL (Harrison et al., 1994). MFR technique also aids in vascular and lymphatic circulation improvement, thus reducing pain intensity (Harrison et al., 2000). In addition, MFR treatment improves soft tissue mobility and dysfunction among individuals with LBP, thus, reducing the pain among LBP patients (Beardsley et al., 2015; Maitland et al., 2000). Concerning a parameter, applying pressure in the MFR technique leads to decreased tension in tight muscles, reducing the level of pain (Hoy et al., 2014). This can be explained by the study from MacDonald et al. (2013), the small undulations apply direct and sweeping pressure to the soft tissue during self-MFR, causing the fascia to warm and break away fibrous adhesions between fascial layers, restoring soft-tissue flexibility, thus, reducing the pain. An RCT among 66 participants with plantar heel pain showed that MFR treatment has a better effect on sham ultrasound therapy regarding reducing plantar heel pain and functional disability (Ajimsha et al., 2014). The authors stated that the efficacy of MFR on plantar heel pain might be caused by a reduction in plantar fascia tension or a decrease in gastrocnemii and soleus muscle tightness leading to restricted ankle dorsiflexion (Ajimsha et al., 2014). Thus, MFR may suppress the degenerative process of the plantar fascia by assisting the healing process and allowing the fascial architecture to return to normal (Ajimsha et al., 2014).

In addition, a study by Balasubramaniam et al. (2014) highlighted individuals with LBP showed an increase in lumbar flexibility after one session of MFR. MFR helps correct abnormal body alignment, regain lost motion, and improve flexibility by breaking down tissue resistance, healing tissue injuries, and retraining the appropriate body posture function (Balasubramaniam et al., 2014). A previous study by Ozsoy et al. (2019) among 45 elderlies with non-specific LBP showed that MFR combined with core stability exercise highlighted an improvement in lower body flexibility after 6 weeks compared with core stability exercise alone (Ozsoy et al., 2019). Therefore, this could explain why self-MFR showed a significant effect on pain and flexibility among LBP individual

5.0 Conclusion

We conclude that a self-MFR on plantar fascia showed a significant short-term effect on pain and flexibility. We also reported significant differences in flexibility between both groups among adults with LBP. The limitation of this current study is: firstly, the study only assesses the short-term effects of self-MFR. Secondly, there is no assessment of how the participants performed the self-MFR before the measurement was taken after the 6- weeks of post-treatment. Future research should assess the long-term effect of self-MFR to significantly imply the treatment as a home-exercise programme among LBP patients and acts as prevention management among individuals with a sedentary lifestyle. Besides, pre-education and assessment on how participants perform the self-MFR should be prioritized to get a significant result in the future.

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Paper Contribution to Related Field of Study

This paper contributes to Physiotherapy, Public Health, Health, and Wellbeing

References

Ajimsha, M. S., Al-Mudahka, N. R., & Al-Madzhar, J. A. (2015). Effectiveness of myofascial release: systematic review of randomized controlled trials. Journal of bodywork and movement therapies, 19(1), 102-112.

Balasubramaniam A, Ghandi V, Sambandamoorthy A. 2013. Role of myofascial release therapy on pain and lumbar range of motion in mechanical back pain: an exploratory investigation of desk job workers. Ibnosina Journal of Medicine and Biomedical Sciences 6(2):75_80.

Beardsley, C., Stirn, I., 2015. Comparing the effects of self-myofascial release with static stretching on ankle range-of-motion in adolescent athletes. Int. J. Sports Phys. Ther. 10 (2), 203e212.

Bhat, V., Patel, V. D., Eapen, C., Shenoy, M., & Milanese, S. (2021). Myofascial release versus Mulligan sustained natural apophyseal glides' immediate and short-term effects on pain, function, and mobility in non-specific low back pain. PeerJ, 9, e10706.

Borman, N.P., Trudelle-Jackson, E., Smith, S.S., 2011. Effect of stretch positions on Hamstring muscle length, lumbar flexion range of motion,and lumbar curvature in healthy adults. Physiother. Theory Pract. 27, 146e154.

Do Carmo Carvalhais, V. O., de Melo Ocarino, J., Araújo, V. L., Souza, T. R., Silva, P. L. P., & Fonseca, S. T. (2013). Myofascial force transmission between the latissimus dorsi and gluteus maximus muscles: an in vivo experiment. Journal of biomechanics, 46(5), 1003-1007.

Do, K., Kim, J., & Yim, J. (2018). Acute effect of self-myofascial release using a foam roller on the plantar fascia on hamstring and lumbar spine superficial back line flexibility. Physical therapy rehabilitation science, 7(1), 35-40.

Grieve, R., Goodwin, F., Alfaki, M., Bourton, A. J., Jeffries, C., & Scott, H. (2015). The immediate effect of bilateral self-myofascial release on the plantar surface of the feet on hamstring and lumbar spine flexibility: a pilot randomized controlled trial. Journal of bodywork and movement therapies, 19(3), 544-552.

Hoy D, March L, Brooks P, Blyth F, Woolf A, Bain C, Williams G, Smith E, Vos T, Barendregt J, Murray C, Burstein R, Buchbinder R. 2014. The global burden of low back pain: estimates from the Global Burden of Disease 2010 study. Annals of the Rheumatic Diseases 73(6):968_974

Joshi, D. G., Balthillaya, G., & Prabhu, A. (2018). Effect of remote myofascial release on hamstring flexibility in asymptomatic individuals–A randomized clinical trial. Journal of bodywork and movement therapies, 22(3), 832837.

Myers, T., 2014. Anatomy Trains: Myofascial Meridians for Manual and Movement Therapists, third ed. Churchill Livingstone Elsevier, United States of America.

Nascimento P, Costa LOP, Araujo AC, Poitras S, Bilodeau M. Effectiveness of interventions for non-specific low back pain in older adults. A systematic review andmeta-analysis. Physiotherapy.2019;105(2):147–162. doi: 10.1016/j.physio.2018.11.004

Ozsoy, G., Ilcin, N., Ozsoy, I., Gurpinar, B., Buyukturan, O., Buyukturan, B., ... & Sas, S. (2019). The effects of myofascial release technique combined with core stabilization exercise in elderly with non-specific low back pain: A randomized controlled, single-blind study. Clinical interventions in aging, 14, 1729.