

Investigating the effect of traditional Iranian massage (Kermanshahi style) on the clinical symptoms of knee osteoarthritis

Sara Sadat Seyed Esfahani¹, Mohammadmahdi Omidian², Rasool Choopani¹, Kamran Mahluji³, Seyed Mohammad Riahi⁴, Mahshid Chaichi⁵, Mahmood Khodadoost^{1*}

¹ Department of Traditional Medicine, Shahid Beheshti University of Medical Sciences, Tehran, Iran. ² Department of Orthopedics, Shahid Beheshti University of Medical Sciences, Tehran, Iran. ³ Department of Traditional Medicine, Tehran University of Medical Sciences, Tehran, Iran. ⁴ Department of Epidemiology, Shahid Beheshti University of Medical Sciences, Tehran, Iran. ⁵ Department of Traditional Medicine, Shahid Beheshti University of Medical Sciences, Tehran, Iran.

Abstract

Aim: Osteoarthritis (OA) is a joint degenerative disease in which pathological changes occur not only in the joint cartilage but also in all joint structures. It seems that complementary medicine can help reduce pain and opioid consumption in these patients. The aim of this study was to evaluate the effect of Iranian massage on the symptoms of knee osteoarthritis. **Materials and Methods:** In this randomized controlled trial study, 84 patients with osteoarthritis of the knee were randomly divided in two groups. The treatment group underwent Mahlouji Kermanshahi massage therapy with chamomile oil for six weeks. Outcome measures were knee pain via visual analogue scale (VAS), Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) questionnaire, and the number of daily doses of acetaminophen consumption. Patients were evaluated after 3, 6 and then 8 weeks of treatment. **Results:** There was no statistically significant difference between the two groups in terms of gender, age and body mass index. There was a significant difference between the mean pain score, mean stiffness and mean physical activity at the baseline and the third, sixth and eighth weeks of treatment and control group. There was no significant difference between the mean of physical activity before and after the intervention in the control group. In all weeks, the average acetaminophen consumption was higher in control group than intervention group. Comparison of physical activity and pain showed that there was a significant difference between the two groups in the sixth, and eighth weeks. There was no significant difference between the two groups in term of stiffness in all weeks. These results showed the stability of the therapeutic effect (8th week) in the massage group compared to the control group based on all variables. **Conclusion:** According to the acquired data, using Mahlouji Kermanshahi massage therapy as a Persian medicine can improve the symptoms of knee OA.

Keywords: Massage, Mahlouji Kermanshahi, Persian medicine, Knee osteoarthritis, Pain

INTRODUCTION

Osteoarthritis (OA) is a joint degenerative disease in which pathological changes occur not only in the joint cartilage but also in all joint structures [1]. Knee osteoarthritis is the most common rheumatic disease that can interfere with a person's daily and personal activities, due to the pain and stiffness in the joint [2]. This disease is one of the most common causes of patients referring to musculoskeletal clinics and its prevalence increases with age, which can be due to changes in the nature of joint cartilage as well as age-related changes in neuromuscular factors. Osteoarthritis is said to affect 70% of the population over the age of 65 [3]. A recent study found that the prevalence of OA in Iran is higher than in some Asian and European countries. The prevalence of knee OA (20.5%) in men and women for all ages is higher than osteoarthritis of the hands (2.7%) and neck (2.5%) [4]. The prevalence of osteoarthritis is increasing due to aging and obesity [5]. The high prevalence of osteoarthritis, especially in adulthood and the high rate of disability associated with it, makes it an

important disability in the elderly. There is currently no definitive cure for OA. Symptomatic treatment of this disease can be divided into three main groups: pharmacological methods, non-pharmacological methods and surgery [6]. The basis of treatment in OA is pain relief minimization of

Address for correspondence: Mahmood Khodadoost, Department of Traditional Medicine, Shahid Beheshti University of Medical Sciences, Tehran, Iran.
Email: khodadost.m@gmail.com

This is an open-access article distributed under the terms of the Creative Commons Attribution-Non Commercial-Share Alike 3.0 License, which allows others to remix, tweak, and build upon the work non commercially, as long as the author is credited and the new creations are licensed under the identical terms.

How to cite this article: Seyed Esfahani, S.S., Omidian, M., Choopani, R., Mahluji, K., Riahi, S. M., Chaichi, M., Khodadoost, M. Investigating the effect of traditional Iranian massage (Kermanshahi style) on the clinical symptoms of knee osteoarthritis. Arch Pharma Pract 2020;11(S1):173-81.

decreased physical function. Non-pharmacological approaches are the main cornerstone of the treatment for this disease, and drug therapy has a supporting role [7].

NonSteroidal AntiInflammatoryDrugs (NSAIDs) is one of the most well-known drugs in the treatment of OA pain, which has important and common side effects such as stomach pain, heartburn, headaches, dizziness, liver or kidney problems, and etc. [8]. An important point in treatment is to change the load on the painful joint and improve the function of the joint protectors, so that they can distribute the load better on the joint surface. The simplest effective treatment for many patients is to avoid activities that cause pain. Studies have also shown that exercise reduces pain and improves physical function [8]. Recently, the WHO strategy has been to use traditional and complementary medicine to accelerate treatment and reduce recurrence. Massage therapy is one of the most effective and widely used alternative therapies and is often used to reduce pain [9]. Massage therapy is one of the treatment methods in Persian Medicine (PM), which has been mentioned in the original sources of PM under the title of "Dalk and Ghamz". It has been recommended for the treatment of many diseases. Persian massage requires methodology and updates in order to find its place among other methods [10]. Master Mahlouji Kermanshahi massage style has been experienced many times over the years and its effectiveness has been proved in other diseases [11]. Considering the appropriate effects of various massage styles in the treatment of knee OA, it was decided to investigate the effect of Iranian massage (Kermanshahi style) on the symptoms of knee OA.

MATERIALS AND METHODS

Trial design

This study is a randomized controlled trial conducted on 84 patients with osteoarthritis of the knee. *Compliance with ethical codes*

The study protocol was in compliance with the Helsinki Declaration (1989 revision) and has been approved by the local medical ethics committee of Shahid Beheshti Medical University (SBMU) with the reference code: IR.SBMU.RETECH.REC.1397.829. The trial protocol was registered in the Iranian Registry of Clinical Trials database under registration ID: IRCT20190121042438N1.

Inclusion criteria (participants)

Patients between the ages of 40 and 80 who have completed clinical and radiological ACR and have mild to moderate osteoarthritis (stages 2 and 3). *Exclusion criteria*

We excluded the patients who had Secondary osteoarthritis to rheumatic diseases such as rheumatoid arthritis, gout, CPPD, traumatic arthritis, infectious arthritis, history of surgery on the affected knee, BMI above 35, Severe advanced cardiovascular disease, including class 3 and 4 heart failure, proven malignancy, Liver disease (esophageal varices and

bleeding, encephalopathy, symptomatic gallstone ascites), severe renal disease (creatinine greater than 3 mg / dl), receiving intra-articular corticosteroids three months in advance, receiving oral corticosteroids 2 weeks in advance, pregnancy and lactation, and Skin disease in the knee area. *Randomization, allocation concealment, and blinding*

Patients were equally divided into massage and placebo groups based on accidentally blocked strategy patients considering the confounding variables (BMI and osteoarthritis).

Intervention and assessment

These patients responded to a VAS and WOMAC questionnaire developed by a physician other than the researcher. They were randomly assigned to two groups of massage and placebo to consider disruptive factors including BMI and the severity of osteoarthritis. The treatment group underwent the therapy of massage by a researcher in the style of Kermanshahi Mahlouji. Massage was performed once a week for 11 minutes on each leg. In addition, the patient was taught the technique of daily chamomile oil massage. In the control group, patients received liquid paraffin, and was also taught to massage their legs. Both groups were taught necessary tips to improve their lifestyle as well as daily exercise three times a day (30 times totally) to strengthen the quadriceps muscles. The study period was 6 weeks. WOMAC and VAS questionnaires were completed at the baseline, after 3 weeks and then after 6 weeks of treatment. Two weeks after cessation of treatment, patients in both groups were followed by the VAS and WOMAC questionnaires.

Acetaminophen 500 mg tablets were given to patients in both groups and they were allowed to take a maximum dose of 2 gr per day of the drug and they were asked to indicate the number of daily doses of the drug in the relevant questionnaire if they used acetaminophen daily. Mahlouji Kermanshahi massage method:

1. The knee is positioned at 160 degrees.
2. Light effleurage (gentle massage to spread the oil) on the knee and around it for 1.5 minutes.
3. Massage pressure is initially between 1 and 2 kg and will gradually increase to 15 kg.
4. Moves 7 and 8 below and above the patella for 1 minute.
5. Kneading back and forth movements with the fingertips of both hands for 1 minute from below the knee through the leg to the buckle of the gastrocnemius muscle.
6. Petrissage (deep muscle massage) above the knee by performing various maneuvers such as wringing (chelating) and muscle pickup (lifting the muscle) on the quadriceps muscle for 1.5 minutes
7. Leg muscle petrissage for 1.5 minutes
8. Kneading on the outer front surface of the leg for 1.5 minutes with the thumb
9. Foot massage for 1.5 minutes
10. Effleurage again for 1.5 minutes to finish the work
11. Fastening the knee with a camel's wool bracelet

Daily massage performed by the patient him/herself does not include items 4 and 5 massage techniques. *Safety and tolerability assessments*

According to previous studies, there are no obvious side effects in this massage. Nevertheless, possible side effects (itching, bruising, pain exacerbation, rube faction, inflation, wounds, and other side effects) was evaluated in all patients.

Data analysis method:

In this study, in the descriptive part, mean and standard deviation (if not normal from the median index for the central index and 25th and 75th percentile for the scatter index) and for absolute frequency and relative percentage were used for qualitative variables. In the analytical analysis section of the study, in order to compare independent and dependent means in the study groups, independent and paired t-tests (if violating the normative hypothesis of non-parametric equivalent) were used, respectively. Chi-square test was used to compare qualitative dependent variables in two groups.. In comparing the means of the two groups in order to take the correlation of the measurements (three repeated measurements for the dependent variable) over time and to modify the important variables, repeated measure ANOVA was used. The significance level in this study was 0.05. The software used in this analysis was SPSS 22.0 and Stata 14.0.

RESULTS

The patients' screening flowchart is shown in figure 1. According to this figure, a total of 84 people participated in the study, which were divided into two groups of 42 people. There was no statistically significant difference between the two groups in terms of gender, age, and body mass index.

The mean scores of pain, stiffness, physical activity, and acetaminophen consumption in control and intervention groups are summarized in Table 1. The two groups were compared in terms of pain, stiffness and physical activity variables in baseline and after the intervention (Tables 2, 3 and 4). This difference is also showed in Figure 2.

The results of pain score in the control group showed that there was a significant difference between the mean pain score before the intervention with the third, sixth and eighth weeks. Comparison of mean stiffness in the control group showed that there was a significant difference between the mean stiffness before the intervention and the sixth and eighth weeks. Comparison of mean physical activity in the control group also showed that there was no significant difference between the mean of physical activity before the intervention and the third, sixth and eighth weeks. The results of the intervention group showed that there was a significant difference between the mean pain score, mean stiffness and mean physical activity before the intervention and the third, sixth and eighth weeks. The results of comparing the mean scores of pain, stiffness and physical activity between the two groups in different weeks are summarized in Table 5. According to the results, there is no significant difference

between the mean score of pain, stiffness and physical activity in control group and massage recipient before the intervention.

Mean acetaminophen consumption in the third, sixth, and eighth weeks showed a statistically significant difference between the two groups (Table 6). In all weeks, this consumption was higher in control than intervention group. Comparison of physical activity showed that there was significant difference in sixth, and eighth weeks between two groups.

Stiffness comparison showed that there was no significant difference between the two groups in all weeks.

Comparison of pain showed that there was a significant difference between the two groups in all weeks.

These results showed the stability of the therapeutic effect (8th week) in the massage group compared to the control group based on all variables.

DISCUSSION

There is no definitive cure for knee OA side effects (pain, swelling, and dryness) [12, 13]. However, the use of complementary therapies is important as the most effective treatment for knee OA [14, 15]. In the meantime, massage therapy is very useful and very effective in reducing pain [16, 17]. In this study, massage therapy in the style of Mahlouji Kermanshahi was used to improve the clinical symptoms of osteoarthritis of the knee. The results of the study showed that the improvement of pain in the sixth week of the intervention was significantly evident in the massage recipient group compared to the control group (p value <0.05). Similar studies that used a variety of massage techniques, such as Swedish massage, also showed an improvement in pain scores after the massage, which was consistent with the results of our study [12, 13, 18]. However, there are some important difference between Swedish and Mahlouji Kermanshahi massages. In Swedish massage, effleurage, friction, tapotement, and vibration were used; but in Mahlouji Kermanshahi massages, Muscle strengthening, oil supplement, and pressure in massage_were used [19, 20]. Various studies have been performed on the physiological effects of massage [21].

The proposed mechanism for the effect of massage on the improvement of patients' pain scores is that by performing gentle and light massage, mechanical receptors with low thresholds that adapt slowly or rapidly are activated in the peripheral system, leading to the activation of A-beta nerve fibers. In the presence of pain, this stimulation in the thick nerve fibers reduces the transmission of pain impulses in the lamina of the posterior branch of the spinal nerve [22, 23]. If the massage is more intense, there is a possibility of activating high-threshold mechanical receptors, which activate the A-gamma fibers. The use of pressure in massage due to the basis of traditional Iranian medicine, strengthens the muscle [20].

This stimulation is transmitted from the spinothalamic tract to the periaqueductal gray nucleus in the midbrain and activates inhibitory control, thereby reducing pain sensation and perception [24]. On the other hand, sensation and perception of pain is strongly associated with anxiety, stress response and sleep disorder that are activated by higher centers [25-27]. A research shows that massage reduces the activity of the adrenal glands and lowers adrenaline levels [28]. It has also been shown that reducing the activity of sympathetic nerves could show the anti-stress effect of massage [29, 30].

In our study, the old style of KMS massage was used, which has been taught for about 10 years in the faculties of Persian Medicine and has been implemented in the health centers of traditional medicine. This type of treatment has been used in PM for a long time with different methods and names [11]. Iranian traditional massage was to reduce body moisture, back and joint pain relief, and etc. [31]. In our study, significant effect of this type of massage on the reduction of knee pain was indicated. The results of similar studies such as Bahr *et al.* (AromaTouch Hand Technique with Deep Blue oils), Nomikos *et al.* (deep friction massage with olive oil), and Perlman *et al.* (whole-body Swedish massage), have shown that massage with the oil application improves blood circulation and lymphatic flow, causing nutrients and fresh oxygen to reach these tissues, leading to the release of toxins and the healing of the organ, as well as the release of endorphins (or pain relievers) and increased secretion of serotonin and release of the hormone cortisol which leads to stress reduction [24, 32-34]. There were limitation in this study:

- The duration of study was six weeks and follow-up was two weeks. Therefore, this period is long and requires frequent reminders for the patient to continue treatment and follow-up.
- Some patients did not have enough support in fill out a daily checklist during the study
- There was a long massage time for each patient in the clinic (at least half an hour for each patient).

REFERENCES

- Chen D, Shen J, Zhao W, Wang T, Han L, Hamilton JL, *et al.* Osteoarthritis: toward a comprehensive understanding of pathological mechanism. *Bone Res.* 2017;5:16044-.
- Lespasio MJ, Piuze NS, Husni ME, Muschler GF, Guarino A, Mont MA. *Knee Osteoarthritis: A Primer.* *Perm J.* 2017;21:16-183.
- Heidari B. Knee osteoarthritis prevalence, risk factors, pathogenesis and features: Part I. *Caspian J Intern Med.* 2011;2(2):205-12.
- Jamshidi A-R, Tehrani Banihashemi A, Roknsharifi S, Akhlaghi M, Salimzadeh A, Davatchi F. Estimating the prevalence and disease characteristics of rheumatoid arthritis in Tehran: A WHO -ILAR COPCORD Study (from Iran COPCORD study, Urban Study stage 1). *Med J Islam Repub Iran.* 2014;28:93-.
- Shane Anderson A, Loeser RF. Why is osteoarthritis an age-related disease? *Best Pract Res Clin Rheumatol.* 2010;24(1):15-26.
- Miller RD. Some recent advances in the symptomatic treatment of osteoarthritis. *Calif Med.* 1950;72(5):373-6.
- Sofat N, Kuttapitiya A. Future directions for the management of pain in osteoarthritis. *Int J Clin Rheumatol.* 2014;9(2):197-276.
- Bjordal J. NSAIDs in osteoarthritis: irreplaceable or troublesome guidelines? *Br J Sports Med.* 2006;40(4):285-6.
- Menard MB. Immediate Effect of Therapeutic Massage on Pain Sensation and Unpleasantness: A Consecutive Case Series. *Glob Adv Health Med.* 2015;4(5):56-60.
- Khoramizadeh M, Hashem-Dabaghian F, Mohammadikenari H. Dalk and Ghamz: An Iranian Traditional Massage Technique. *Complementary medicine research.* 2019:1-2.
- Hashemi M, Jafarian AA, Tofighi S, Mahluji K, Halabchi F. Studying the Effectiveness of One Type of Iranian Traditional Massage on Lumbar Radiculopathy. *Iran J Med Sci.* 2016;41(3 Suppl):S11-S.
- Bhatia D, Bejarano T, Novo M. Current interventions in the management of knee osteoarthritis. *J Pharm Bioallied Sci.* 2013;5(1):30-8.
- Heidari B. Knee osteoarthritis diagnosis, treatment and associated factors of progression: part II. *Caspian J Intern Med.* 2011;2(3):249-55.
- Nik Shafii NAH, Yaacob LH, Ishak A, Kadir AA. Traditional and Complementary Medicine Use in Knee Osteoarthritis and its Associated Factors Among Patients in Northeast Peninsular Malaysia. *Oman Med J.* 2018;33(2):148-53.
- Shengelia R, Parker SJ, Ballin M, George T, Reid MC. Complementary therapies for osteoarthritis: are they effective? *Pain Manag Nurs.* 2013;14(4):e274-e88.
- Ali A, Rosenberger L, Weiss TR, Milak C, Perlman AI. Massage therapy and quality of life in osteoarthritis of the knee: A qualitative study. *Pain Medicine.* 2017;18(6):1168-75.
- Perlman AI, Ali A, Njike VY, Hom D, Davidi A, Gould-Fogerite S, *et al.* Massage therapy for osteoarthritis of the knee: a randomized dose-finding trial. *PLoS One.* 2012;7(2):e30248-e.
- Atkins DV, Eichler DA. The effects of self-massage on osteoarthritis of the knee: a randomized, controlled trial. *Int J Ther Massage Bodywork.* 2013;6(1):4-14.
- Gholami-Motlagh F, Jouzi M, Soleymani B. Comparing the effects of two Swedish massage techniques on the vital signs and anxiety of healthy women. *Iran J Nurs Midwifery Res.* 2016;21(4):402-9.
- Tabari NM, Yousefi SS, Heydarirad G, Soraki MK, Habibipour P. Exercise From the Perspective of Iranian Traditional Medicine. *J Evid Based Complementary Altern Med.* 2017;22(2):344-6.
- Atkins DV, Eichler DA. The effects of self-massage on osteoarthritis of the knee: a randomized, controlled trial. *Int J Ther Massage Bodywork.* 2013;6(1):4.
- Waters-Banker C, Dupont-Versteegden EE, Kitzman PH, Butterfield TA. Investigating the mechanisms of massage efficacy: the role of mechanical immunomodulation. *Journal of athletic training.* 2014;49(2):266-73.
- Kumar S, Beaton K, Hughes T. The effectiveness of massage therapy for the treatment of nonspecific low back pain: a systematic review of systematic reviews. *International journal of general medicine.* 2013;6:733.
- Tasker R. Identification of pain processing systems by electrical stimulation of the brain. *Human neurobiology.* 1982;1(4):261-72.
- Woo AK. Depression and Anxiety in Pain. *Rev Pain.* 2010;4(1):8-12.
- Sribastav SS, Peiheng H, Jun L, Zemin L, Fuxin W, Jianru W, *et al.* Interplay among pain intensity, sleep disturbance and emotion in patients with non-specific low back pain. *PeerJ.* 2017;5:e3282-e.
- de Heer EW, Gerrits MMJG, Beekman ATF, Dekker J, van Marwijk HWJ, de Waal MWM, *et al.* The association of depression and anxiety with pain: a study from NESDA. *PLoS One.* 2014;9(10):e106907-e.
- Rapaport MH, Schettler P, Breese C. A preliminary study of the effects of a single session of Swedish massage on hypothalamic-pituitary-adrenal and immune function in normal individuals. *J Altern Complement Med.* 2010;16(10):1079-88.
- Rapaport MH, Schettler P, Breese C. A preliminary study of the effects of repeated massage on hypothalamic-pituitary-adrenal and immune function in healthy individuals: a study of mechanisms of action and dosage. *J Altern Complement Med.* 2012;18(8):789-97.
- Lee Y-H, Park BNR, Kim SH. The effects of heat and massage application on autonomic nervous system. *Yonsei medical journal.* 2011;52(6):982-9.
- Khoramizadeh M, Hashem-Dabaghian F, Mohammadikenari H. Dalk and Ghamz: An Iranian Traditional Massage Technique. *Complementary medicine research.* 2019;26(4):280-1.
- Bahr T, Allred K, Martinez D, Rodriguez D, Winterton P. Effects of a massage-like essential oil application procedure using Copaiba and

Deep Blue oils in individuals with hand arthritis. *Complementary therapies in clinical practice*. 2018;33:170-6.

33. Nomikos NN, Nomikos GN, Kores DS. The use of deep friction massage with olive oil as a means of prevention and treatment of sports injuries in ancient times. *Arch Med Sci*. 2010;6(5):642-5.
34. Perlman A, Fogerite SG, Glass O, Bechard E, Ali A, Njike VY, et al. Efficacy and safety of massage for osteoarthritis of the knee: a randomized clinical trial. *Journal of general internal medicine*. 2019;34(3):379-86.

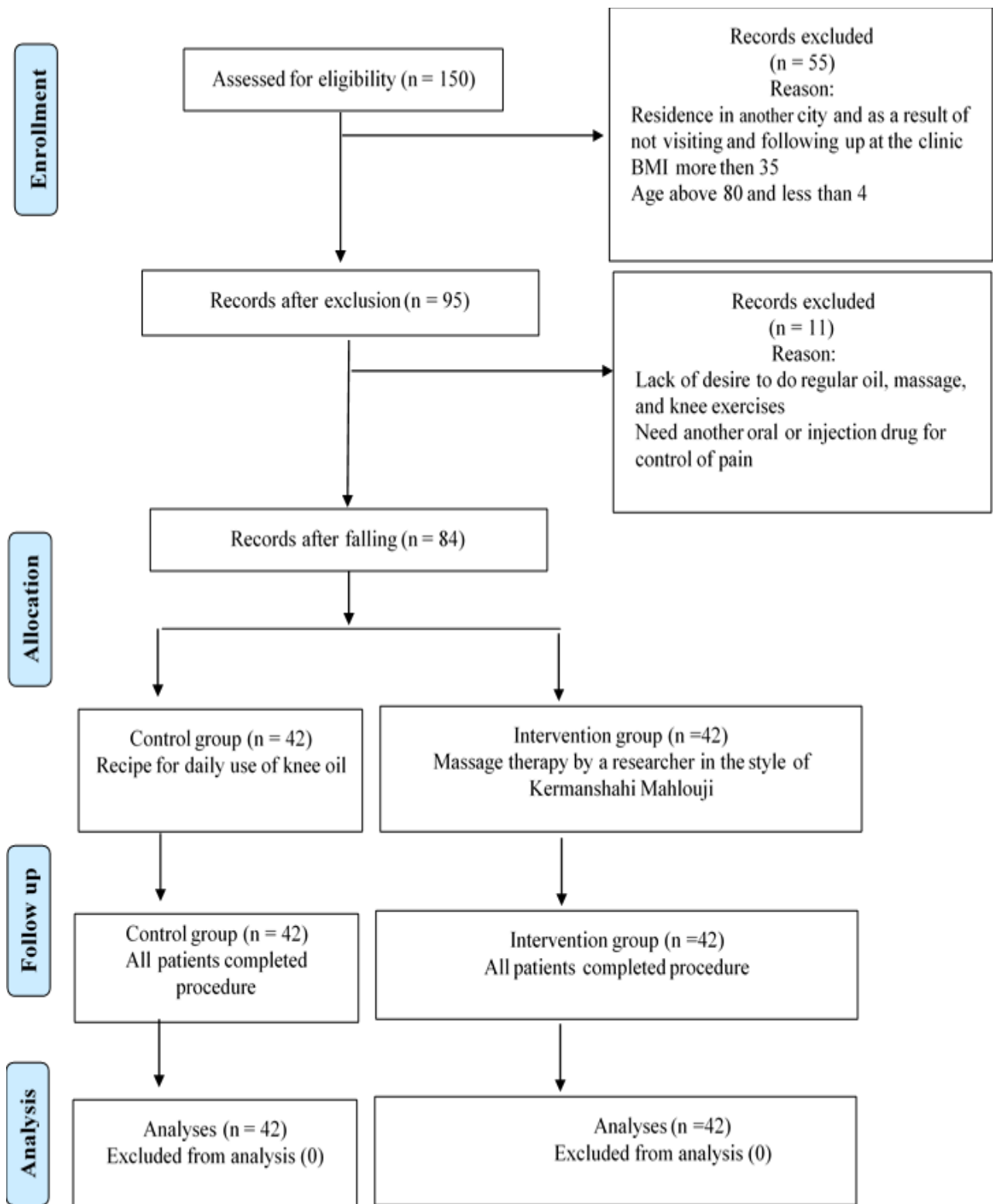


Figure 1. CONSORT Flowchart of the patients' screening, enrollment, allocation, follow-up, and analysis.

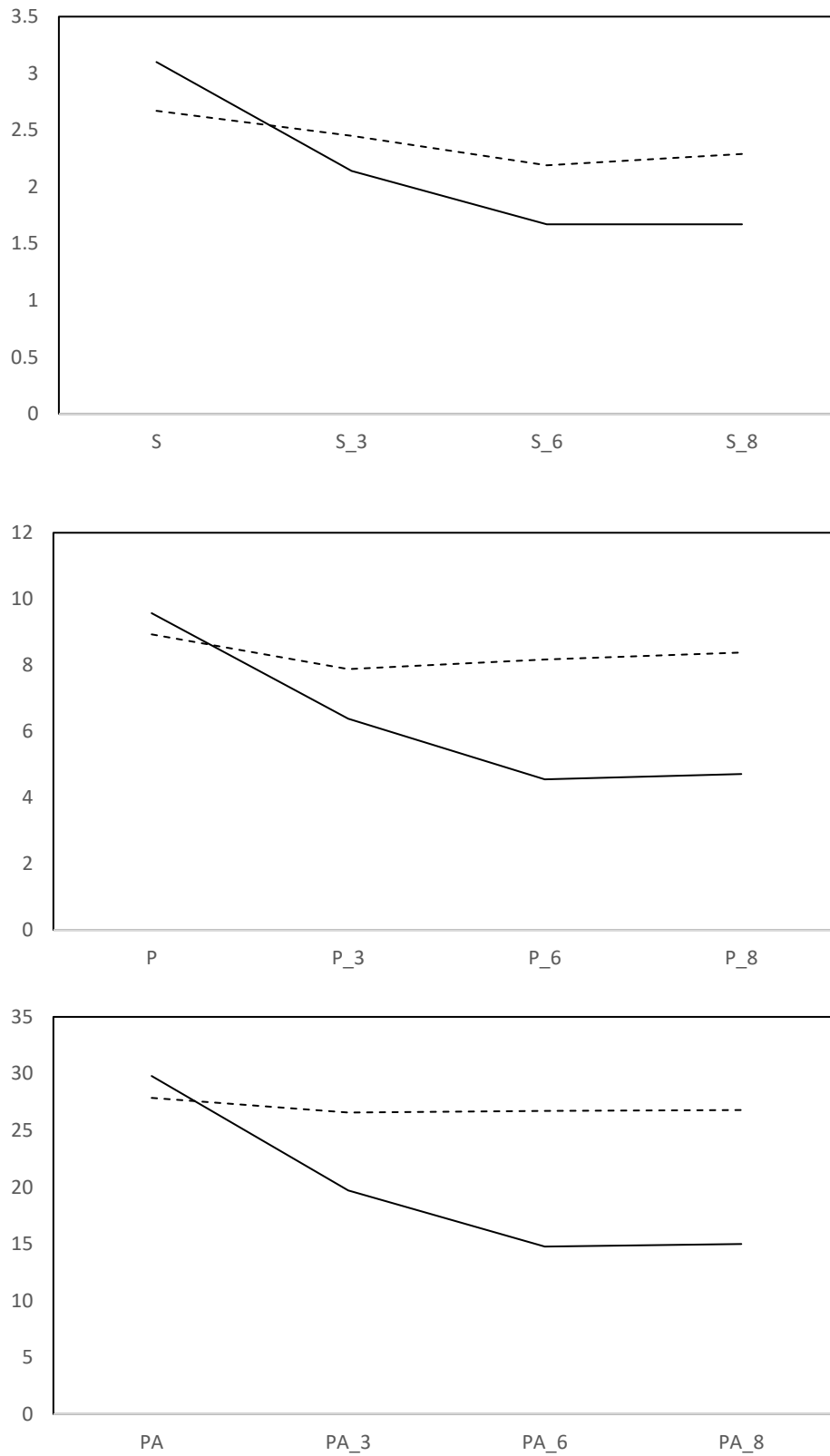


Figure 2. Comparison of pain, stiffness, and physical activity in the baseline, third, sixth, and eighth weeks in each group. Dotted line: control group, continuous line: intervention group.

Table 1. Mean scores of pain, stiffness, physical activity, and acetaminophen consumption in control and intervention groups.

control	pain	stiffness	Physical Activity	Acetaminophen consumption
Baseline	8.93	2.67	27.86	5.6190
Third week	7.88	2.45	26.57	5.4286
Sixth week	8.17	2.19	26.71	5.6905
Eighth week	8.38	2.29	26.79	5.5952
Intervention	pain	stiffness	Physical Activity	Acetaminophen consumption
Baseline	9.57	3.10	29.79	8.1905
Third week	6.38	2.14	19.71	3.6429
Sixth week	4.55	1.67	14.76	2.6429
Eighth week	4.71	1.67	14.98	2.5476

Table 2. Comparison of pain in the baseline, third, sixth, and eighth weeks in each group.

Paired Samples Test	Group	Paired Differences	
		Mean (SD)	P value
Baseline/ Third week	Control	1.048 (2.650)	0.014
	Intervention	3.190 (2.319)	0.000
Baseline/ Sixth week	Control	.762 (2.861)	0.092
	Intervention	5.024 (2.901)	0.000
Baseline/ Eighth week	Control	.548 (2.471)	0.159
	Intervention	4.857 (3.017)	0.000

Table 3. Comparison of stiffness in the baseline, third, sixth, and eighth weeks in each group.

Paired Samples Test	Group	Paired Differences	
		Mean (SD)	P value
Baseline/ Third week	Control	.214 (.813)	0.095
	Intervention	.952 (1.058)	0.000
Baseline/ Sixth week	Control	.476 (1.065)	0.006
	Intervention	1.429 (1.595)	0.000
Baseline/ Eighth week	Control	.381 (1.011)	0.019
	Intervention	1.429 (1.684)	0.000

Table 4. Comparison of physical activity in the baseline, third, sixth, and eighth weeks in each group.

Paired Samples Test	Group	Paired Differences	
		Mean (SD)	P value
Baseline/ Third week	Control	1.286 (4.860)	0.094
	Intervention	10.071 (6.968)	0.000
Baseline/ Sixth week	Control	1.143 (5.471)	0.183
	Intervention	15.024 (8.345)	0.000
Baseline/ Eighth week	Control	1.071 (3.966)	0.087
	Intervention	14.81 (8.503)	0.000

Table 5. Comparison of pain, stiffness, and physical activity in the baseline, third, sixth, and eighth weeks between two groups.

Variable		Control group Mean±SD	Intervention group Mean±SD	P value
Pain	Baseline	8.9286 (4.31895)	9.5714 (4.28920)	0.853
	Third week	7.88 (4.895)	6.38 (3.533)	0.049
	Sixth week	8.1667 (5.06502)	4.5476 (3.38722)	0.002
	Eighth week	8.38 (4.978)	4.71 (3.480)	0.008
Stiffness	Baseline	2.6667 (2.31292)	3.0952 (2.27188)	0.908
	Third week	2.45 (2.178)	2.14 (1.882)	0.278
	Sixth week	2.1905 (2.24410)	1.6667 (1.86974)	0.424
	Eighth week	2.29 (2.234)	1.67 (1.843)	0.282
Physical activity	Baseline	27.8571 (15.40600)	29.7857 (13.94683)	0.502
	Third week	26.57 (15.185)	19.71 (10.607)	0.061
	Sixth week	26.7143 (15.80257)	14.7619 (10.33065)	0.026
	Eighth week	26.79 (15.640)	14.98 (10.459)	0.014

Table 6. Comparison of acetaminophen consumption in the baseline, third, sixth, and eighth weeks between two groups.

Week	Group	Mean (SD)	P value
Baseline	Control	5.62 (8.690)	0.193
	Intervention	8.19 (10.232)	
Third week	Control	5.4286 (8.73497)	0.003
	Intervention	3.6429 (5.88848)	
Sixth week	Control	5.62 (8.690)	0.000
	Intervention	8.19 (10.232)	
Eighth week	Control	5.5952 (9.09854)	0.000
	Intervention	2.5476 (5.46475)	