Effectiveness of an intervention program to improve knee osteoarthritis among older adults in northern Thailand

Pakorn Pusuwan 1 , Raweephun Sunanta 1 , Phanit Srisuttha 1 , Keng Chaichana 1 , Nitikorn Phoosuwan 2,3*

1 Department of Applied Thai Traditional Medicine, School of Public Health, University of Phayao, Thailand

2 Department of Public Health and Caring Sciences, Faculty of Medicine, Uppsala University, Sweden

3 Department of Community Health, Faculty of Public Health, Kasetsart University Chalermphrakiat Sakonnakhon Province Campus, Thailand

* Corresponding author:Nitikorn Phoosuwan, Faculty of Public Health, Kasetsart University Chalermphrakiat,Sakonnakhon Province Campus, Thailand

Abstract

Objective: To evaluate the Knee Osteoarthritis and Range of Motion Improvement (KORoMI) program.

Study design: This was a randomized controlled trial study.

Methods: There were 60 older adults in Thailand participated in the program (n=30 each for the experimental and control groups). The program comprised three sessions: (1) Court-Type Thai Traditional Massage (CTTM) and Hot Herbal Compression (HHC); (2) HHC and Exercise Stretching for Legs and Knees (ESLK); and (3) Herbal Knee Poultice (HKP) and ESLK.

Results: The KORoMI program reduced the severity of osteoarthritis and increased the degree of movement of the knee joint based on the range of motion (flexion).

Conclusion: The program might be used as an alternative treatment for osteoarthritis in the older adults.

Keywords: treatment, Thai, traditional medicine, osteoarthritis

Introduction

Osteoarthritis is one of the major musculoskeletal problems occurring among older adults aged 60 years and over and of the major contributors to years lived with disability among people with musculoskeletal conditions. In 2019, about 528 million people worldwide were living with osteoarthritis, of whom 73% were older than 55 years and 60% were female [1]. About 345 million people living with osteoarthritis experience it at severity levels (moderate or severe) requiring assistance in rehabilitation care before the disability progresses [2]. Osteoarthritis has become more common in Thailand and is a serious public health issue because Thailand has the second-highest percentage of elderly people among Southeast Asian nations [3]. Elderly people

aged 60 years and over are prone to osteoarthritis and there are more women than men in this age group [4].

In Phayao, a province in northern Thailand, more than 20% of the occupants are elderly people [5]. There are many different forms of care to prevent the risk and severity of symptoms from osteoarthritis. Effective treatment may reduce pain, increase the range of motion (ROM) of the knee joint, and result in normal daily activities and better quality of life for those affected [6]. Such methods of treatments are targeted at addressing osteoarthritis, including Thai traditional medicine, such as Court-Type Thai Traditional Massage, Hot Herbal compression, Herbal Knee Poultice and Exercise Stretching for Legs and Knees [7]. These forms of treatment aim to relieve muscle pain in the legs and knees, improve blood circulation, and strengthen the knees [8]. Treatments using Thai traditional medicine might be effective in reducing the probability of having osteoarthritis and increasing the range of motion (ROM) of affected knees. There have been various studies on the treatment of osteoarthritis using traditional Thai medicine, where each method has resulted in different treatment effectiveness. However, there has been no study of the effectiveness traditional Thai medicine in the form of a treatment program for osteoarthritis in older adults [9-11]. Therefore, this research aimed to evaluate a developed treatment program for osteoarthritis called the Knee Osteoarthritis and Range of Motion Improvement (KORoMI) program. The program might be used as an alternative treatment for elderly people with osteoarthritis to reduce pain and increase the ROM of the knee joint.

Methods

Objective

A randomized controlled trial study evaluated the severity of knee and ROM among elderly people in a Thai community before and after they had participated in the KORoMI program.

Study design and setting

Data were collected in Phayao province in northern Thailand. Phayao has a total of 99,116 elderly people, accounting for 21% of the total population in the province. Phayao has a mixture of residential areas, ethnicities, and cultures [5].

Knee Osteoarthritis and Range of Motion Improvement (KORoMI) program

The KORoMI program was developed by the current researchers based on reviewed literature focusing on Thai massage and exercise stretching muscles for the reduction of pain and joint stiffness [9]. and a program to relieve pain using hot herbal compression and a herbal knee poultice in the elderly with osteoarthritis [10,11]. The program consisted of three sessions: (1) Court-Type Thai Traditional Massage (CTTM) and Hot Herbal Compression (HHC); (2) HHC and Exercise Stretching for Legs and Knees (ESLK); and (3) Herbal Knee Poultice (HKP) and ESLK. The interval between sessions was two days and the follow-up time was seven days after session 3. All sessions were carried out by a licensed applied Thai traditional medical practitioner (Table 1).

Table 1

Session 1 was composed of CTTM and then HHC. CTTM is a massage technique that targets several stages: (1) pressure on four-line legs, respectively, and on the femoral artery to stimulate blood flow to the toes; (2) pressure on three points around the knee (numbered 1–3 respectively); (3) massaging four points on the outer leg, focusing on the fourth point; (4) pressure under the knee fold and moving the knee joint; and (5) massaging four points on the inner leg, focusing on the third and fourth points and then moving to the knee joint (Figure 1). HHC involves compressing the legs and knees with herbs to reduce inflammation for 15 minutes after reflexology (Figure 2).

Figure 1

Figure 2

Session 2 comprised HHC and ESLK, commencing with HHC for 15 minutes. This was followed by ESLK by stretching leg and knee muscles to increase the degree of joint movement. There were two exercise postures: (1) quadriceps exercise, starting in a lying position or sitting with both legs extended, lifting the participants' toes and contracting their quadriceps and holding for 10 seconds, then switching to the other side for 10 minutes; (2) standing on tiptoe and starting by standing with the participants' feet apart and their hands on the wall, followed by the participant

bending one leg up normally with the other leg remaining on tiptoe, after which the leg and knee muscles are contracted, holding for 10 seconds, and then switching sides for 10 minutes (Figure 3).

Figure 3

Session 3 involved HKP and ESLK, respectively. HKP was poulticed using a herbal powder of *Gloriosa superba* L. and *Zingiber officinale* Roscoe around the knee for 15 minutes (Figure 4). Thereafter, ESLK was administered.

Figure 4

Participants

The participants were elderly people in one district in Phayao province that had a high percentage of elderly people.[5] The sample size was calculated using an instance program (G*power program), where effect size=0.8, β =80%, allocation ratio=1:1, and α was 0.05. After consideration for loss of follow-up, the final number of participants for each group was set at 30. Inclusion criteria were people who: 1) were aged 60–80 years; 2) had pain in one knee for more than 6 months; 3) had an Oxford knee Score (OKS) in the range 0–39; 4) had no history of knee replacement surgery; and 5) provided informed consent to participate in the study. People were excluded if they: (1) had had a fracture or injury with to a knee joint; 2) had cancer or any form of paralysis; and 3) used any non-steroidal anti-inflammatory drugs.

Procedure

Ethical approval was confirmed by the Phayao Human Ethics Committee (COA:UP-HEC 1.3/040/65), while the heads of the District Public Health Office approved the KORoMI program and the data collection. Thereafter, the researchers retrieved a list from the head of the sub-district health promotion hospital (SHPH) of elderly people in that selected sub-district who had been screened for knee osteoarthritis and had a score of 0–39 out of 48 based on the OKS [12]. The eligible participants received an invitation letter with a socio-demographic characteristics questionnaire (age, gender, marital status, level of education), and documents about the aim of the

study. In total, 60 elderly people agreed to participate in the KORoMI program and signed individual consent forms. Later, the participants were randomly assigned to be in either the experimental or control group using a block randomization method. The participants in the experimental group participated in the KORoMI program, while the participants in the control group received regular care from the SHPH (Figure 6).

Figure 6

Instruments

A questionnaire was developed for this study by the researchers. It consisted of three parts: (1) sociodemographic characteristics of the participants; (2) severity of knee osteoarthritis; and (3) knee ROM of motion evaluation. Three experts approved the content of the questionnaire using the index of item objective congruence (IOC) with a suitable acceptance score (IOC=0.5–1.0). Internal consistency of the questionnaire was tested with 30 elderly people in a province nearby Phayao (the Cronbach's alpha coefficient for the whole questionnaire was 0.95).

The sociodemographic characteristics surveyed were gender, marital status, age, religion, education, occupation, body mass index, underlying disease, smoking status, alcohol consumption, and physical activity.

The severity of knee osteoarthritis was measured using the Thai-version of the OKS [12]. The OKS consisted 12 items, with each item having a five-option scale providing a score of 0–4, where possible scores for the OKS were in the range 0–48, with a lower score indicating a higher severity of knee osteoarthritis. The instrument was before use and was deemed acceptable (Cronbach's alpha coefficient = .950).

The ROM of knee evaluation was based on a standardized method [13], applied to participants on their stomach and folding their legs to the maximum and using a goniometer to measure the degree of folding based on three repetitions and then calculating the mean degree of ROM.

Analyses

Data from the questionnaire were analyzed using different statistics. Descriptive statistics were applied to summarize the socio-demographic characteristics of the participants using frequency,

percentage, mean, SD, and range, whereas Pearson chi-square and Fisher's exact and independent sample t- tests were used to compare between the experimental and control groups. The main exposure was the KORoMI program, and the outcomes were the OKS score at T2 and ROM (flexion) at T2. The test level for significance was set at 0.05 and the 95% confidence interval was used.

Linear regression assumptions (linearity, normality, multicollinearity, and homoscedasticity) were checked for the OKS score and degree of ROM (flexion). In order to adjust for potential confounding factors, gender and BMI were used in multivariable linear regression analysis for the OKS score, while gender, BMI, and pre-test score mean for extension pre-test mean score for ROM (flexion) for the degree of ROM. OKS scores and degree of ROM at different times were compared for participants of the experimental group and the control group using an independent t-test. Assumptions for a paired-sample t-test were satisfied (continuous variables, independent observations, normal distribution shown by skewness values between -0.7 and 0.5, and no outliners defined by kurtosis values less than 2).

Results

There were 60 participants in this study (n=30 each for the experimental and control groups). All were Buddhists and most were female (73.3% in the experimental group and 66.7% in the control group). There were no significant differences in characteristics between the groups, except for the degree of ROM (flexion) (p=.003), as shown in Table 2.

Table 2.

There were no significant differences between the experimental and control groups at T0, T1, and T2 for the severity of osteoarthritis (p>.05), as shown in Figure 7.

Figure 7

The mean range of motion (flexion) differed between the experimental and control groups at T0 (p=0.003) but did not differ at T1 and T2 (p=.131 and p=.430, respectively), as shown in Figure 8.

Figure 8

After adjustment for confounders, there was no significant difference between the experimental and control groups for the OKS at T2 (β = 0.027, 95% CI -1.995-2.445, p >0.05). The experimental group demonstrated a significant improvement in the range of motion (flexion) compared to the control group (β = 0.208, 95% CI 0.090-1.014, p =0.02), as shown in Table 3.

Table 3

Discussion

This study aimed to evaluate the KORoMI program with the goal of improving the OKS and ROM among elderly people with osteoarthritis. The findings showed that OKS scores and ROM improved after participating in the program.

The population in this study were elderly people aged 60 years and over, with two-thirds being females. The current results were consistent with other studies in which about 75% of the participants with osteoarthritis were aged 55 years or older, since this age group is more likely to have osteoarthritis, more commonly in women than men [1,4].

There was no significant difference in the OKS values in the experimental and control groups at baseline (T0), after three sessions from the baseline (T1), and after seven days from T1. The KORoMI program involved a combination of various treatments (CTTM, HHC, and HKP) that might be beneficial in treating osteoarthritis, since CTTM massage can stimulate blood circulation in the skin and massage reduces pain and stiffness and improves physical function, which can be effective in relieving symptoms safely [14,15]. HHC reduces symptoms of osteoarthritis and muscle pain similar to the use of anti-inflammatory drugs and increases ROM [16,17]. HKP contains herbs having anti-inflammatory properties and can reduce the severity of knee pain [11, 18-19]. Therefore, the KORoMI program might be an alternative treatment when appropriate.

There was a difference in the ROM of the knee (flexion) at time T0 between the experimental and control groups. We used a linear regression analysis to adjust this difference. Thereafter, at T1 and T2 no significant difference was found. The ROM of the knee (flexion) is

very important in performing daily activities. Even a few degrees of extension or flexion loss can affect function and cause pain. The KORoMI program included ESLK, as a quadriceps exercise might increase movement of the knee joint, helping with reducing the disability and relieving pain, while improving patient satisfaction [20-22].

Because no difference was observed between the experimental and control groups for knee osteoarthritis and ROM (flexion), the KORoMI program could be used instead of regular treatment for the reduction of the severity of osteoarthritis and to increase the ROM of the knee. In addition, the regular treatment requires an applied Thai traditional medical practitioner every time to administer the treatment, with the duration of each session being quite long. Therefore, the KORoMI program should be an attractive short-term treatment option for osteoarthritis because it involves the practitioner once and for a shorter time.

Strengths and limitations

The study relied on Thai traditional medicine theory. The effectiveness of the KORoMI program was well demonstrated using a randomized controlled trial study. The sample calculation and quantitative data analysis carried using the G*power program. The questionnaire for quantitative data was tested for content validity and reliability.

A limitation was that the KORoMI program only included follow up on a one-week basis. Increased time for follow-up might reveal a greater change in the OKS scores and ROM of the knee.

Conclusions

The KORoMI program could reduce the severity of osteoarthritis and increase the degree of movement of the knee joint based on the range of motion (flexion). The program could be used as an alternative treatment for osteoarthritis in the elderly.

Declarations

Ethics approval and consent to participate

Ethical consideration was approved by the Ethics Committee in Thailand (COA:UP-HEC 1.3/040/65). Permission was also received from the University of Phayao Human Ethics Committee, the chief of the Phayao Provincial Public Health Office and of District Public Health

Offices. All participants received information, both oral and written, before signing a consent form. The information emphasized that they were voluntary to participate in the study and that the participants were fully entitled to withdraw their participation at any time. None of the authors was involved in any of the treatment tasks associated with the participants. Confidentiality was maintained and privacy was assured.

Consent for publication

Not applicable

Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

Funding

This study was supported by the Thailand Science Research and Innovation Fund and the University of Phayao (Grant No. FF66-RIM099), the Department of Public Health and Caring Sciences, Uppsala University, Sweden and Kasetsart University Chalermphrakiat Sakonnakhon Province Campus, Thailand. The funding sources had no role in the collection or analysis of the study data.

Authors' contributions

All authors contributed to the conception and design of the study. PP, RS, PS, and KC collected data. NP analyzed the data. All authors contributed to the manuscript and read and approved the final manuscript.

Acknowledgements

The authors thank the public health professionals who participated in this study. We also thank the staff and directors at Phayao Public Health Provincial and District Offices for facilitating data collection.

References

1. GBD 2019 Diseases and Injuries Collaborators. Global burden of 369 diseases and injuries in 204 countries and territories, 1990-2019: a systematic analysis for the Global Burden of Disease Study 2019. *Lancet* 2020; 396(10258): 1204–1222.

2. Cieza A, Causey K, Kamenov K, et al. Global estimates of the need for rehabilitation based on the Global Burden of Disease study 2019: a systematic analysis for the Global Burden of Disease Study 2019. *Lancet* 2020; 396(10267): 2006–2017.

3. United Nations Economic and Social Commission for Asia and the Pacific. ASEAN Ageing Data Sheet 2020, https://www.unescap.org/sites/default/d8files/knowledge-products/Final_AgeingSheet_Web.pdf (2020, accessed January 2, 2024).

4. Nathalang O, Intharanut K, Apipongrat D, et al. Association between HLA class II Polymorphism and Knee Osteoarthritis in a Thai Population. *Clinical Laboratory* 2022; 69(5): 975

5. National Statistical Office, Phayao Provincial Statistical Office. Phayao Provincial Statistical Report 2020, https://province.nso.go.th/phayao/reports-publications/ebook.html?view=book&id=8:2563&catid=4:provincial-statistical-report (2020, accessed January 2, 2024).

6. Thai Rheumatism Association. Guideline for the Treatment of Osteoarthritis of Knee, https://thairheumatology.org/phocadownload/36/Guideline_003.pdf (2010, accessed January 2, 2024).

7. Office of International Cooperation & Technical and Planning Division, Department of Thai Traditional and Alternative Medicine. *Traditional and Complementary Medicine Practice Guidelines in ASEAN: Thailand Section.* 1st ed. Bangkok: Magnate Store, 2020.

8. Ungpinitpong W. Thai traditional massage to relieve knee pain from osteoarthritis. *Journal of Medical and Physical Therapy Techniques* 2016; 18(2): 38-41

9. Boonperm N, Wamontree P, Putthumrugsa N, et al. The effects of applied thai traditional massage combined with knee exercise on knee OA patients: A case study of Ban Kracheng

community health promoting hospital, pathum thani province, Thailand. *Journal of Pharmaceutical Negative Results* 2022; 13(1): 891–897.

10. Chiranthanut N, Hanprasertpong N and Teekachunhatean S. Thai massage and Thai herbal compress versus oral ibuprofen in symptomatic treatment of osteoarthritis of the knee: a randomized controlled trial. *BioMed Research International* 2014; 2014(2): 1–13.

11. Chatawatee B, Chokpaisarn J and Yusuf M. Effectiveness of knee acupressure along with herbal knee poultice for knee osteoarthritis treatment: A pilot pre-post clinical study. *Journal of Herbal Medicine* 2022; 32: 100498.

12. Charoencholvanich K and Pongcharoen B. Oxford knee score and SF-36: translation & reliability for use with total knee arthroscopy patients in Thailand. *Journal of The Medical Association of Thailand* 2005; 88(9): 1194-1202.

13. Norkin CC and White DJ. *Measurement of Joint Motion: A Guide to Goniometry*. 4th ed. United States of America: F.A. Davis Company, 2016.

14. Viravud Y, Apichartvorakit A, Mutirangura P, et al. The anatomical study of the major signal points of the court-type Thai traditional massage on legs and their effects on blood flow and skin temperature. *Journal of Integrative Medicine* 2017; 15(2): 142-150.

15. Perlman A, Fogerite SG, Glass O, et al. Efficacy and Safety of Massage for Osteoarthritis of the Knee: a Randomized Clinical Trial. *Journal of General Internal Medicine* 2019; 34(3): 379-386.

16. Dhippayom T, Kongkaew C, Chaiyakunapruk N, et al. Clinical effects of Thai herbal compress: a systematic review and meta-analysis. *Evidence-based Complementary and Alternative Medicine* 2015; 2015: 942378.

17. Boonruab J, Damjuti W, Niempoog S, et al. Effectiveness of hot herbal compress versus topical diclofenac in treating patients with myofascial pain syndrome. *Journal of Traditional and Complementary Medicine* 2018; 9(2): 163-167.

18. Charoennavarat K. Effects of knee osteoarthritis and treatment with the herbal poultice. *Journal of Thai Traditional & Alternative Medicine* 2021; 19(3): 724-736.

19. Chamchan D and Banchonhattakit P. Effectiveness of herbal poultices for relieving knee pain in patients with osteoarthritis: A Systematic Review. *Singburi Hospital Journal* 2022; 31(2): 14-28.

20. Benner RW, Shelbourne KD, Bauman SN, et al. Knee Osteoarthritis: Alternative Range of Motion Treatment. *The Orthopedic Clinics of North America* 2019; 50(4): 425-432.

21. Kan HS, Chan PK, Chiu KY, et al. Non-surgical treatment of knee osteoarthritis. *Hong Kong Medical Journal* 2019; 25(2): 127-133.

22. Nigam A, Satpute KH and Hall TM. Long term efficacy of mobilisation with movement on pain and functional status in patients with knee osteoarthritis: a randomised clinical trial. *Clinical Rehabilitation* 2021; 35(1): 80-89.

Table 1. Implementation of Knee Osteoarthritis and Range of Motion Improvement program in relation to three sessions involving Court-Type Thai Traditional Massage (CTTM), Hot Herbal Compression (HHC), Herbal Knee Poultice (HKP), and Exercise Stretching for Legs and Knees (ESLK)

Session	Contents	Time management
1st time: CTTM and HHC	CTTM: Massage along lines and massage points on the body for use in treating disease, according to Thai traditional medicine theory. HHC: Apply a hot herbal compress to the knee joint to relax muscles and reduce pain.	CTTM 45 minutes and then HHC 15 minutes
2nd time: HHC with ESLK	HHC: as above. ESLK: increase movement of the knee joint based on quadriceps exercise. 1) Bobbing toes up and down 10 minutes each toe. 2) Standing on tiptoe 10 minutes each leg.	HHC 15 minutes and then ESLK 20 minutes
3rd time: HKP with ESLK	HKP: The use of HKP to reduce inflammation in the knee joint. ESLK: as above.	HKP 15 minutes and then ESLK 20 minutes

Table 2. Characteristics of study participants (n = 60)

Characteristic	Experimental group (n=30)	Control group (n=30)	p-value
Age (years)			
Mean (SD)	68.83 (5.66)	68.33 (5.80)	0.737[a]
Range	60–86	61–82	
Gender, n (%)			
Male	8 (26.7)	10 (33.3)	0.317[b]
Female	22 (73.3)	20 (66.7)	
Marital status, n (%)			
Married	18 (60.0)	16 (53.3)	0.271[b]
Not married (widowed/divorced)	12 (40.0)	14 (46.7)	
Education level, n (%)			
No education	3 (10.0)	2 (6.7)	0.99[c]
Primary School	27 (90.0)	28 (93.3)	
Occupation, n (%)			
Agriculturist	8 (26.7)	10 (33.3)	0.790[b]
Employment (daily/self/government)	9 (30.0)	7 (23.3)	
No employment	13 (43.3)	13 (43.3)	
Body mass index (kg/m^2)			
Normal weight	16 (53.3)	20 (66.7)	0.292[b]
Overweight/obese	14 (46.7)	10 (33.3)	
Waist circumference (cm)			0.432
Normal (male <90cm, female <80cm)	11 (36.7)	14 (46.7)	
Abnormal (male ≥90cm, female ≥80cm)	19 (63.3)	16 (53.3)	
Having underlying disease(s)			
Yes (hypertension/diabetes/heart/kidney)	19 (63.3)	22 (73.3)	0.405[b]
No	11 (31.7)	8 (26.7)	
Regular exercise, n (%)			
Less than 90 min/week	21 (70.0)	13 (43.3)	0.075[b]
91–150 min/week	6 (20.0)	8 (26.7)	

More than 150 min/week	3 (10.0)	9 (30.0)	
Smoking, n (%)			
Never	22 (73.3)	21 (70.0)	0.837[b]
Current/Ex-smoker	8 (26.7)	9 (30.0)	
Alcohol, n (%)			
Never	15 (50.0)	16 (53.3)	0.785[b]
Quit alcohol	9 (30.0)	10 (33.3)	
Currently consuming alcohol	6 (20.0)	4 (13.3)	
Oxford knee score			
Pre-test score mean (SD)	23.27 (7.16)	24.33 (7.12)	0.565[a]
Range of motion (degree)			
Pre-test score mean for extension (SD)[d]	0 (0.00)	0 (0.00)	
Pre-test score mean for flexion (SD)	100.28 (16.94)	113.16 (15.253)	0.003[a*]

[a]based on independent T-test; [b]based on Chi-square test; [c]based on Fischer's exact test; [d]not calculated; BMI, Body mass index; SD, Standard deviation; *statistical significance at 0.05 level.

Table 3. Linear regression analyses for comparisons of Oxford Knee score and degree of range of motion between experimental and control groups at T2

	Crude analysis coefficient B (95% CI)	p-value	Adjusted analysis coefficient B (95% CI)	p-value
Oxford knee score				
Experimental group	-.044 (-2.53, 1.81)	.737	.027 (-1.995, 2.445)	.84
Gender	-	-	0.070 (-1.708, 2.980)	.589
Body mass index	-	-	-.260 (-.574, .009)	.057
Degree of range of motion (flexion)				
Experimental group	-.104 (-9.69, 4.81)	.430	.208 (.090, 1.014)	.02*
Gender	-	-	0.040 (-3.464, 5.804)	.615
Body mass index	-	-	-.105 (-.235, .968)	.227

CI, Confidence interval; *statistically significant at 0.05 level.

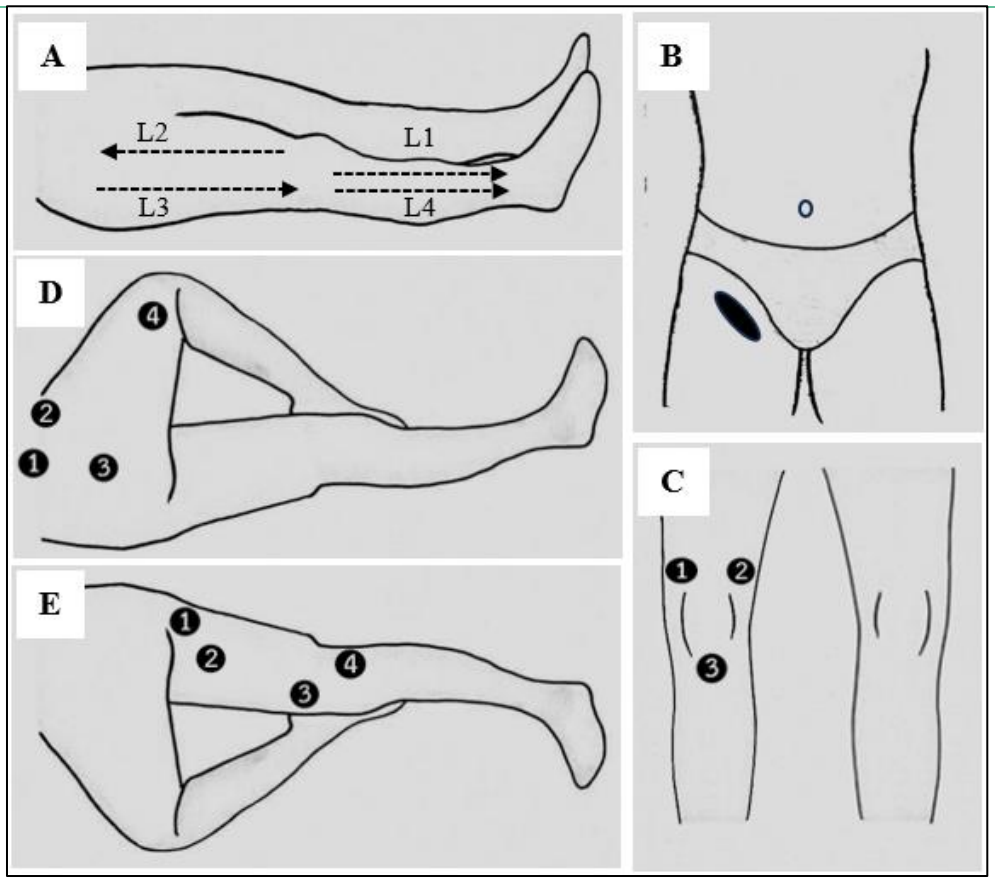


Figure 1. (A) Lines on legs L1–L4. (B) femoral artery point. (C) three points around knee. (D) four points on outer leg. (E) four points on inner leg.

Figure 2. Hot Herbal Compression: (A) on leg. (B) on knee joints

Figure 3. Exercise Stretching for Legs and Knees: (A) quadriceps exercise. (B) standing on tiptoe.

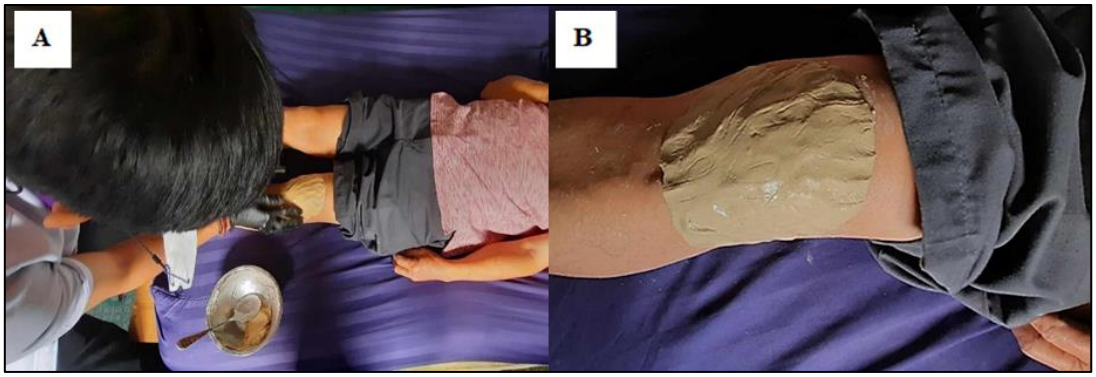
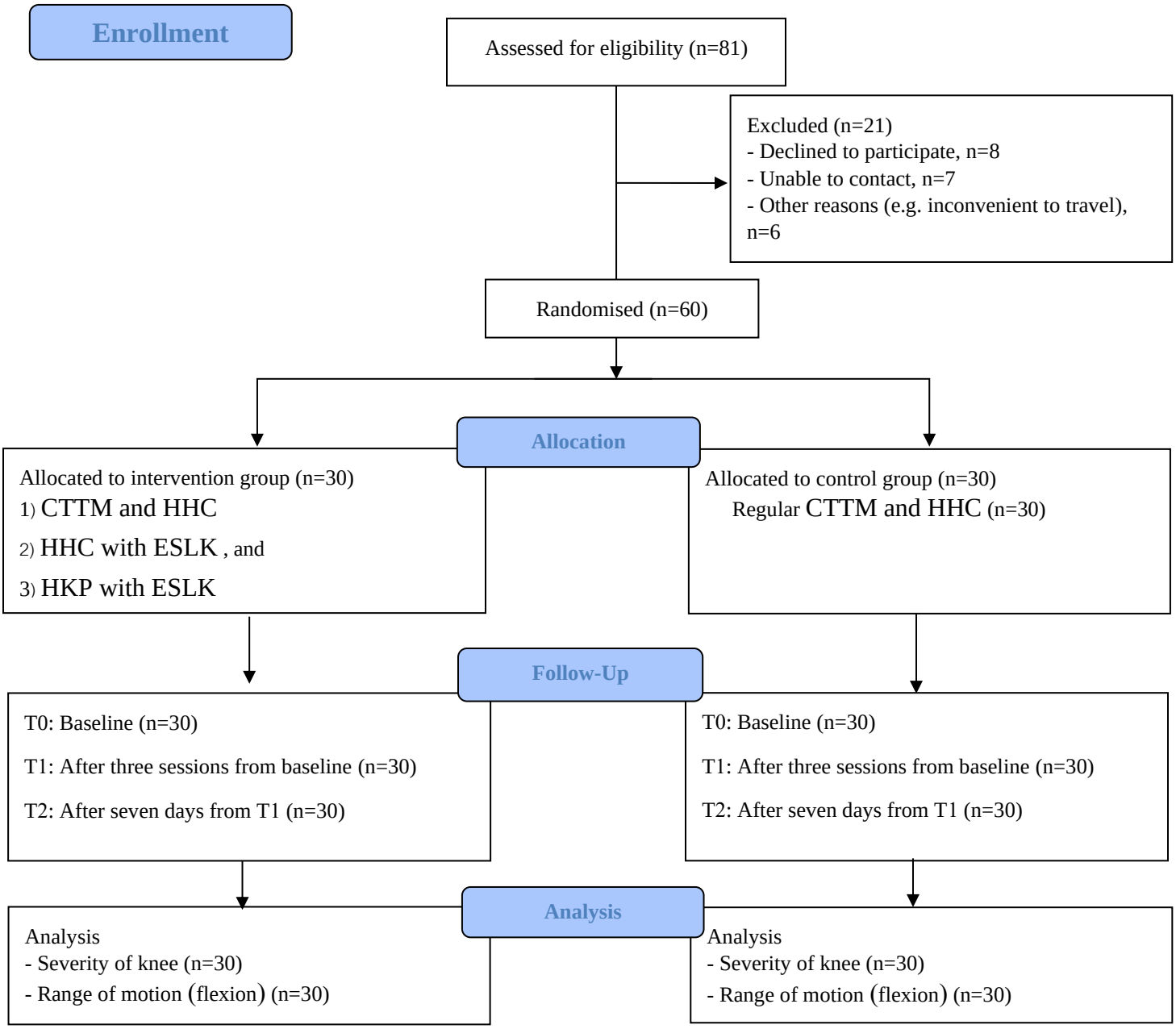


Figure 4. Herbal Knee Poultice: (A) applied on knee area. (B) applied herbal mask on knee

Figure 5. Court-Type Thai Traditional Massage: (A) pressure on femoral artery to stimulate blood flow to toes. (B) pressure on three points around knee.


Enrollment
Assessed for eligibility (n=81)
Excluded (n=21)
- Declined to participate, n=8
- Unable to contact, n=7
- Other reasons (e.g. inconvenient to travel), n=6
Randomised (n=60)
Allocation
Allocated to intervention group (n=30)
1) CTTM and HHC
2) HHC with ESLK , and
3) HKP with ESLK
Allocated to control group (n=30)
Regular CTTM and HHC (n=30)
Follow-Up
T0: Baseline (n=30)
T1: After three sessions from baseline (n=30)
T2: After seven days from T1 (n=30)
T0: Baseline (n=30)
T1: After three sessions from baseline (n=30)
T2: After seven days from T1 (n=30)
Analysis
Analysis
- Severity of knee (n=30)
- Range of motion (flexion) (n=30)
Analysis
- Severity of knee (n=30)
- Range of motion (flexion) (n=30)

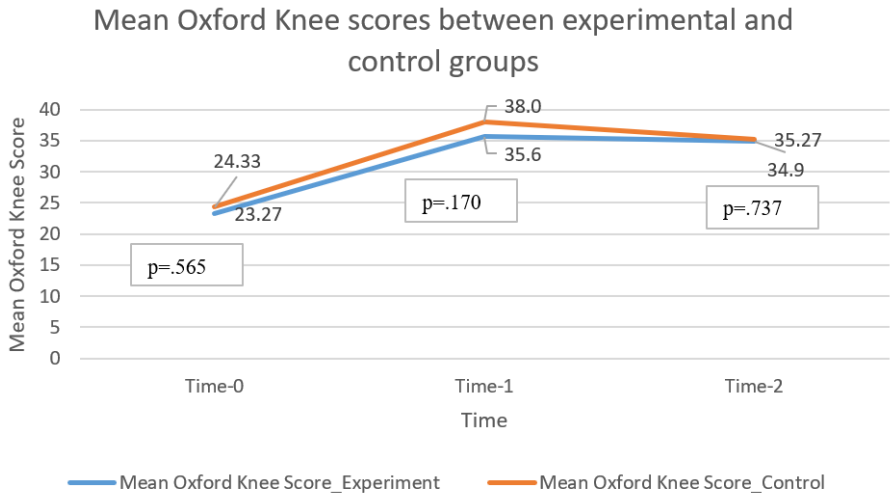


Figure 7. Severity of osteoarthritis comparison between experimental and control groups at each time point.

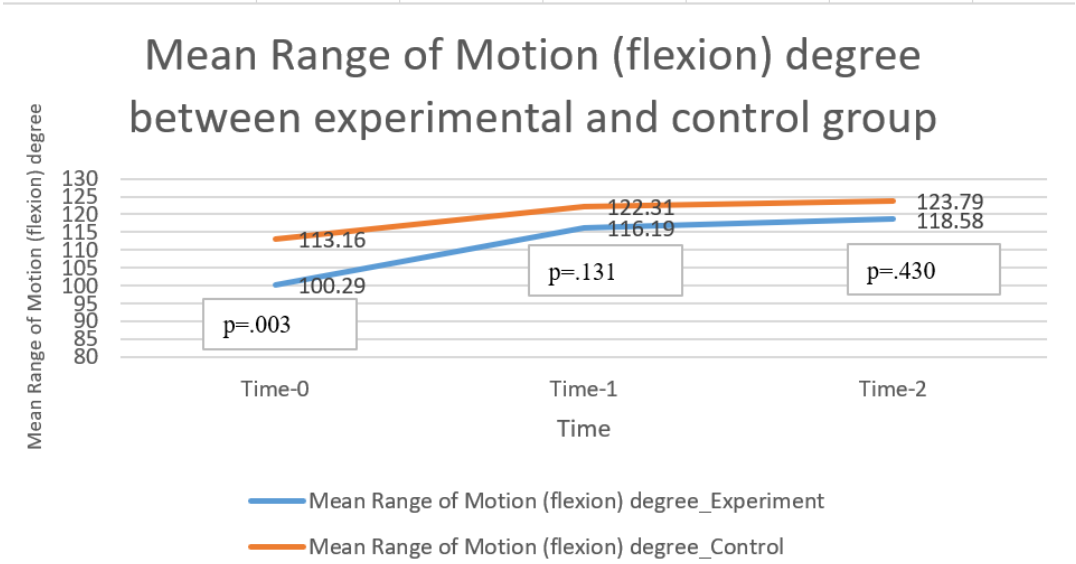


Figure 8. Range of motion comparison between experimental and control groups at each time point.