

CHAPTER 3

METHODS

1. Participants

All team members of the Thai national weightlifters who had anterior knee pain, ITB syndrome, knee ligament sprain, and/or muscle strain were recruited for the study. They were recruited from weightlifting camp in Chiang Mai. All participants read an information sheet and signed an informed consent prior to entry into the study. The ethical clearance was obtained from the Research Ethics Committee, Faculty of Associated Medical Sciences, Chiang Mai University.

Inclusion criteria

1. Had at least one of these following pathologies: anterior knee pain, ITB syndrome, knee ligament sprain, knee muscle strain with pain scale of more than score 1/10 (measured using 10 cm visual analogue scale (VAS))
2. Aged between 18-35 years

Exclusion criteria

1. Had history of knee surgery or fracture of the lower extremity
2. Attended class of less than 80% (absent more than 3 sessions)
3. Withdrawal from the study to seek for other treatments

2. Study design

A within-subject, case series design was used in the study. Participants were Thai national weightlifters with the diagnosis of at least one of the following pathologies: anterior knee pain, ITB syndrome, knee ligament sprain, knee muscle

strain. Both knees of the participants were counted if they had the symptoms and met the inclusion criteria of this study. All participants received the 8-week knee educational program with the 4-week follow up. The main focus of the study was the effects of knee educational program on changes in physical outcomes and knowledge of knee care. The protocol was approved by the Research Ethics Committee of the institute.

3. Equipments

1. Visual analogue scale (VAS)
2. Victorian Institute of Sport Assessment (VISA) scale
3. Hand-held dynamometer
4. Digital leg and back dynamometer
5. 25° decline board
6. Step platform
7. Goniometer
8. Laptop, projector, screen, laser pointer, microphone and speaker
9. Knee model
10. Trampoline
11. N-K table
12. Barbell
13. Bandage and tape
14. Ice bags and towels
15. Posters, exercise booklet and log book
16. Inform consent, evaluation forms, and questionnaires

4. **Outcome measures** (see more detail of the following measurements in Appendix

C)

1. Knowledge of knee care
2. Intensity of average knee pain VAS
3. Pain-free knee extension strength
4. Pain-free double legs and single leg strengths
5. Knee functional ability VISA scale
6. Quality of lifting questionnaire
7. Satisfaction with knee educational program

5. **Procedures**

Participants were screened based on the inclusion and exclusion criteria. They received physical examination by the licensed physiotherapists with experience in musculoskeletal field of greater than 10 years for diagnosis of anterior knee pain, ITB syndrome, knee ligament sprain, and muscle strain. Information regarding the purpose and procedures of the study were informed to the participants. They were determined the stability of signs and symptoms of knee pain with 4-week interval before starting the intervention. All participants received an 8-week period of knee educational program with the 4-week follow-up. They were encouraged to continue the training program during the follow-up period. The outcome measures including knowledge of knee care, intensity of average knee pain, pain-free knee extension strength, pain-free double legs and single leg strengths, knee functional ability, and quality of lifting were assessed at baseline, immediately after completion of the intervention (week 8th assessment) and week 12th for follow-up assessment. The

satisfaction with knee educational program was also determined at week 8th assessments (Figure 1). All assessments were avoided during the competition phase. The details of measurements were described in the Appendix C. During 8-week period of knee educational program, the frequency of attendance was recorded at each of the 16 intervention sessions (two times a week for 8 weeks). Participants who had nonattendance for more than 3 sessions were excluded from the study.

Knee educational program

Knee educational program consisted of four phases.

First phase: knowledge of knee pain

The first phase of knee educational program (week 1) consisted of a 45-minute session that was introduced two times a week.

During this phase, the individual knee problems of the participants were discussed. The anatomy and functions of the knee were also explained. Participants were instructed in detail about the common pathologies of knee pain in Thai national weightlifters, and results of research and studies of these knee pains were briefly presented. The risk factors of knee pain and healing process were also included. The knee relaxing positions and techniques were also instructed.

Second phase: pain management

The second phase of knee educational program (week 2) consisted of a 45-minute session that was introduced two times per week.

In this phase, the etiology, pathology and pain mechanism of knee pain were explained. The effects of knee pain on physical, mental and social status were also discussed. Participants were instructed in detail about the various treatment methods, including conventional physical therapy, acupuncture therapy, traditional massage,

psychological care and surgical treatment. The advantages and disadvantages of each treatment method were emphasized.

Third phase: practical application

The third phase of knee educational program (week 3-6) consisted of a 45-minute session that introduced two times a week.

This phase is mainly a practical application. The participants were practiced the rehabilitation exercises. The rehabilitation program consisted of stretching and eccentric exercise programs using the Curwin-Stanish protocol.

Stretching program

The static stretching of the calf and thigh muscles consisted of 3-5 repetitions with 20-30 seconds sustained stretching for each muscle group that were performed by the participants themselves at the begin and the end of each training session.

Eccentric exercise program

Eccentric exercise program was based on the principle of the Curwin-Stanish method (8). This exercise program was started with static stretching of the calf and thigh muscles, after that, participants performed eccentric exercises, which consisted of squat, forward lunge, and step down exercises. The same static stretch exercises as in warm-up phase were repeated again at the end of the exercise session. The participants were also applied with the ice bag over the affected area of knee for 20 minutes after session.

Participants were asked to perform the exercise program daily, with 3 sets of 15 repetitions. A duration of 15–30 seconds of rest between repetitions and 1–2 minutes of rest between sets was instructed. All exercises were performed with minimal pain or discomfort. Participants were instructed to progress exercise level

when they can complete their exercise with minimal discomfort ($< 1/10$ VAS). The progression was performed by changing the exercise position and/or adding the external load such as barbell (Appendix K). Participants received an exercise instruction booklet with detail instructions for every training session (i.e., type of exercise, number of repetitions and set). They were required to complete a daily log book during the intervention period. This log book was used to monitor compliance, pain during the training session, additional activities and treatments.

In this phase, the postural correction in lifting was also instructed and practised.

Fourth phase: sport specific-training

The fourth phase of knee educational program (week 7-8) consisted of a 45-minute session that was introduced two times a week.

In this phase, the proprioceptive and plyometric exercises were added to the eccentric exercise program. For the plyometric exercises, participants were instructed to perform this kind of exercise 2 days per week. All exercises were performed with minimal pain or discomfort. A duration of 30 seconds was provided as resting interval between repetitions and 2 minutes of rest between sets was also instructed (Appendix K). For the proprioceptive exercises, participants were instructed to stand on a trampoline on 1 leg for 1 minute. To increase the exercise demand, participants were instructed to draw circles in the air with the free contralateral leg. Furthermore, participants were asked to progress level of this exercise by closing eyes during exercise or throwing and catching the ball. The proprioceptive exercise was performed daily.

The individual problems (e.g., excessive foot pronation and supination) were corrected by the physiotherapist.

During the third and fourth phases, the participants were followed at all intervention sessions to ensure proper execution of the program and exercise, and allow the physiotherapist to progress the exercise level as necessary.

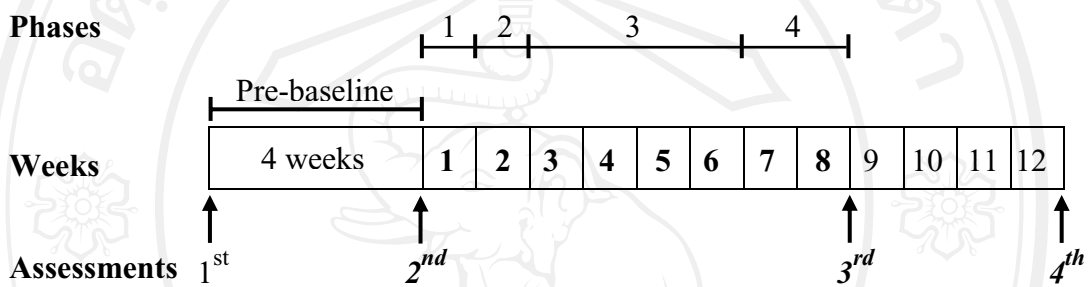


Figure 1 The intervention program and the measurements during the study.

6. Statistical analysis

Data were analyzed using the statistical software package. Changes in outcome measures during 4-week interval before starting the intervention (pre-baseline compared with baseline assessments) were tested for stability of the athletes' symptoms using the non-parametric Wilcoxon signed-ranks test. The significant level was set at an alpha of 5%. The Friedman test was used to evaluate the changes in all outcome measures among the 3 periods of the study (0 week, 8 weeks, and 12 weeks). If there was a significant difference ($p < 0.05$) among the 3 periods, the *post-hoc* Wilcoxon signed-rank test with Bonferroni correction method for adjustment of familywise error rate were used to identify which 2 periods were significantly different. Therefore, the new adjustment was determined at the p -value of less than

0.0167. This more stringent level of significance ($p < 0.0167$) was used to protect against inflating Type 1 error rate.

7. Reliability study of measurements

Before the formal data collection, a reliability study of the measurements was conducted. Ten healthy participants were recruited to attend the knee extension strength test, and double legs and single leg strength tests. Each test was composed of two trial sessions with 1 day apart to allow establishment of the test-retest reliability of the tests. For each test, participants were carefully familiarized with the testing procedure before the test. Intra-tester reliability of each test was determined using the intra-class correlation coefficients (ICC_(3,3)).

8. Location

The study was conducted at the weightlifting camp in Chiang Mai.

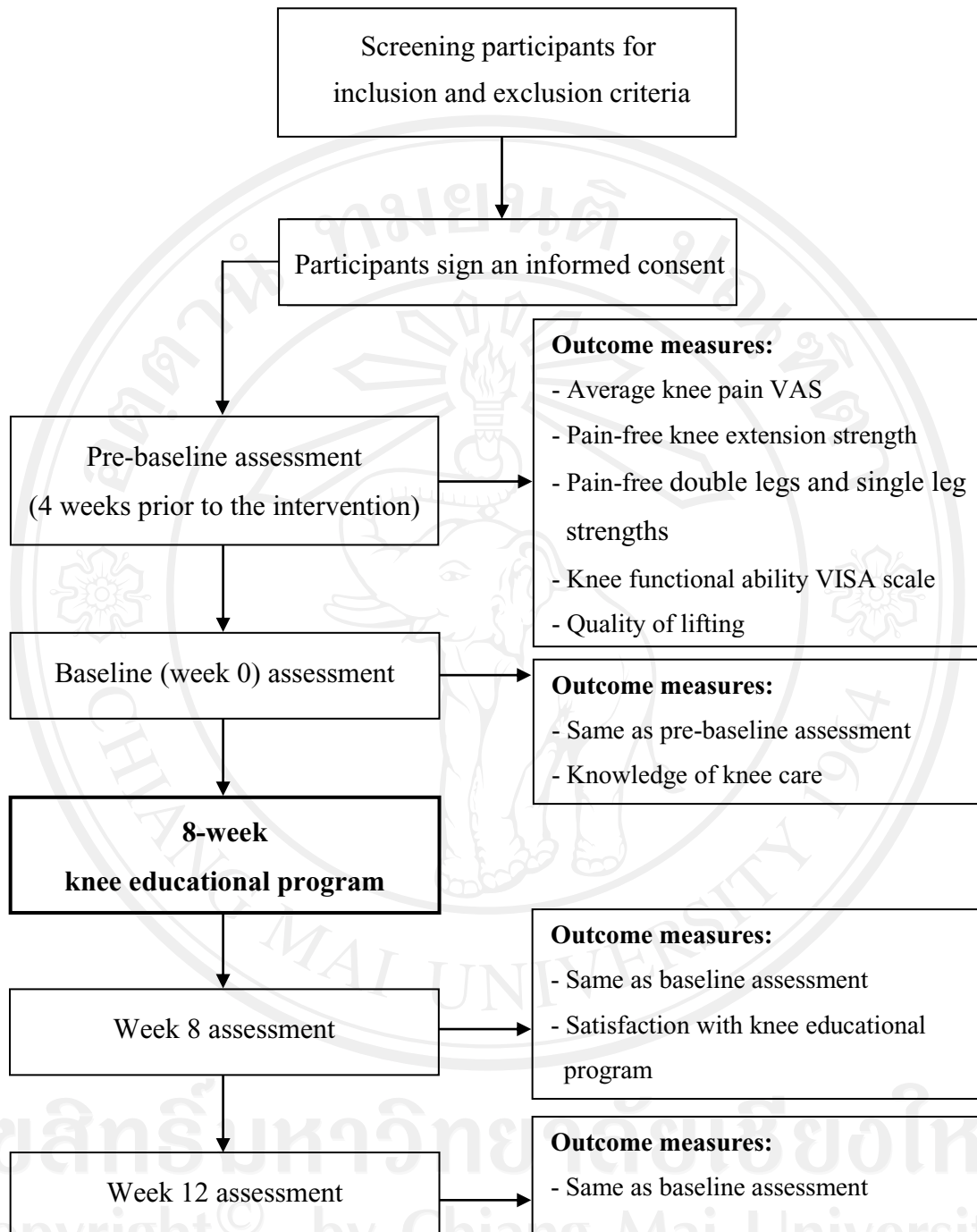


Figure 2 Procedure diagram