

**IMPACT OF AN INTEGRATED HEALTH EDUCATION AND
EXERCISE PROGRAM IN MIDDLE-AGED ADULTS WITH
OSTEOARTHRITIS OF THE KNEE**

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NAPHAPHORN PIYAKHACHORNROT

**A THESIS SUBMITTED IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR
THE DEGREE OF MASTER OF NURSING SCIENCE
(ADULT NURSING)**

**FACULTY OF GRADUATE STUDIES
MAHIDOL UNIVERSITY**

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Thesis

Entitled

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PROGRAM IN MIDDLE-AGED ADULTS WITH OSTEOARTHRITIS
OF THE KNEE**

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IMPACT OF AN INTEGRATED HEALTH EDUCATION AND EXERCISE PROGRAM IN MIDDLE-AGED ADULTS WITH OSTEOARTHRITIS OF THE KNEE

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ABSTRACT

Knee osteoarthritis (OA) is the most common form of OA affecting middle-aged and older adults. It is the most important source of pain, discomfort, and disability. The aim of this study is to examine the impact of an integrated health education and exercise program based on self-efficacy theory on OA knowledge, self-efficacy expectations (SEE), behaviors, and health outcomes including severity of knee symptom (SEV-OA), muscle strength, joint range of motion (ROM), and body mass index (BMI), in middle-aged adults with knee OA.

Sixty-five participants (ages ranged between 38 and 59 years) with knee OA who met inclusion criteria participated in the study. They were assigned into 2 groups (group 1 and group 2). The group 1 (n = 31) and group 2 participants (n = 34) received health education and quadriceps exercise training class-based sessions followed by a facility-based exercise program for group 1 and followed by a home-based exercise program for group 2, three times a week for 12 weeks. Data collection were carried out by using a demographics questionnaire, the OA knowledge test, SEE questionnaire, health behavior questionnaire, modified WOMAC scale, back-leg dynamometer, goniometer, and weighing scales with height meter. The changes of OA knowledge, SEE, behaviors, SEV-OA, muscle strength, ROM, and BMI were assessed at baseline, 2-, 8- and 12-weeks follow-up. Data were analyzed using multivariate analyses.

Findings revealed that the participants in each group had significant improvement in OA knowledge, SEE, behaviors, SEV-OA, muscle strength, ROM, and reduction in BMI after enrollment compared with their initial status. There were no significant differences in OA knowledge, SEE, behaviors, SEV-OA, left knee flexion ROM, and BMI between group 1 and group 2, whereas experimental group 1 significantly enhanced muscle strength and right knee flexion ROM compared with experimental group 2.

Based on the findings of the study, it can be concluded that an integrated health education and exercise program based on self-efficacy theory should be suggested for patients with knee OA in order to decrease the severity and to improve joint mobility and muscle strength.

KEY WORDS: KNEE OSTEOARTHRITIS / HEALTH EDUCATION / EXERCISE / SELF-EFFICACY / MIDDLE-AGED ADULTS

126 pp.

**ผลของโปรแกรมบูรณาการข้อมูลด้านสุขภาพและการออกกำลังกายในผู้ใหญ่วัยกลางคนโรคข้อเข่าเสื่อม
(IMPACT OF AN INTEGRATED HEALTH EDUCATION AND EXERCISE PROGRAM IN
MIDDLE-AGED ADULTS WITH OSTEOARTHRITIS OF THE KNEE)**

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บทคัดย่อ

โรคข้อเข่าเสื่อมเป็นโรคที่พบได้บ่อยในกลุ่มโรคข้อเสื่อม ซึ่งส่งผลกระทบต่อผู้ใหญ่วัยกลางคนและผู้สูงอายุ และเป็นสาเหตุสำคัญที่ทำให้เกิดความปวด ความไม่สุขสบาย และความพิการตามมา การวิจัยครั้งนี้มีวัตถุประสงค์เพื่อศึกษาผลของโปรแกรมบูรณาการข้อมูลด้านสุขภาพและการออกกำลังกายซึ่งพัฒนาโดยประยุกต์ทฤษฎีความสามารถตนเอง ต่อความรู้เรื่องโรคข้อเข่าเสื่อม ความมั่นใจในความสามารถตนเอง การปฏิบัติพฤติกรรมสุขภาพ และผลลัพธ์ทางสุขภาพในผู้ใหญ่วัยกลางคนโรคข้อเข่าเสื่อม

กลุ่มตัวอย่างจำนวน 65 ราย (อายุระหว่าง 38-59 ปี อายุเฉลี่ย 50.99 ± 5.45 ปี) ที่มีคุณสมบัติตามเกณฑ์การคัดเลือก แบ่งกลุ่มตัวอย่างออกเป็น 2 กลุ่ม โดยกลุ่มทดลอง 1 ($n = 31$) ได้รับโปรแกรมการให้ข้อมูลด้านสุขภาพพร้อมกับโปรแกรมออกกำลังกายที่ศูนย์กีฬาของคณะแพทยศาสตร์โรงพยาบาลรามาธิบดี 3 ครั้ง/สัปดาห์ นาน 12 สัปดาห์ และกลุ่มทดลอง 2 ($n = 34$) ได้รับโปรแกรมการให้ข้อมูลด้านสุขภาพพร้อมกับโปรแกรมออกกำลังกายโดยการบริหารกล้ามเนื้อต้นขาด้วยตนเองที่บ้าน 3 วัน/สัปดาห์ นาน 12 สัปดาห์ เก็บรวบรวมข้อมูลโดยใช้แบบสอบถามข้อมูลทั่วไป แบบประเมินความรู้เรื่องโรคข้อเข่าเสื่อม แบบประเมินความมั่นใจในความสามารถตนเองของผู้ป่วยโรคข้อเข่าเสื่อม แบบประเมินพฤติกรรมการปฏิบัติตัว แบบประเมินความรุนแรงของโรคข้อเข่าเสื่อม ซึ่งน้ำหนัก วัดความแข็งแรงของกล้ามเนื้อต้นขา และวัดพิสัยการเคลื่อนไหวของข้อเข่า ก่อนการศึกษา และหลังการศึกษา 2, 8 และ 12 สัปดาห์ วิเคราะห์ข้อมูลด้วยสถิติ Multivariate analyses

ผลการวิจัยพบว่าภายหลังการศึกษากลุ่มตัวอย่างแต่ละกลุ่ม มีคะแนนความรู้เรื่องโรคข้อเข่าเสื่อม ความมั่นใจในความสามารถตนเอง พฤติกรรมการปฏิบัติตัว ความแข็งแรงของกล้ามเนื้อต้นขา และพิสัยการเคลื่อนไหวของข้อเข่าเพิ่มขึ้น และมีคะแนนความรุนแรงของโรคข้อเข่าเสื่อม และ BMI ลดลงอย่างมีนัยสำคัญทางสถิติ เมื่อเปรียบเทียบกับคะแนนก่อนการศึกษา และไม่พบความแตกต่างของคะแนนความรู้เรื่องโรคข้อเข่าเสื่อม ความมั่นใจในความสามารถตนเอง พฤติกรรมการปฏิบัติตัว ความรุนแรงของโรคข้อเข่าเสื่อม พิสัยการเคลื่อนไหวของข้อเข่าข้างซ้าย และ BMI ระหว่างกลุ่มศึกษา แต่พบว่ากลุ่มทดลอง 1 มีความแข็งแรงของกล้ามเนื้อต้นขา และพิสัยการเคลื่อนไหวของข้อเข่าข้างขวา มากกว่ากลุ่มทดลอง 2 อย่างมีนัยสำคัญทางสถิติ

ดังนั้น โปรแกรมบูรณาการข้อมูลด้านสุขภาพและการออกกำลังกายซึ่งพัฒนาโดยประยุกต์ทฤษฎีความสามารถตนเองดังกล่าว ควรนำไปประยุกต์ใช้กับผู้ป่วยโรคข้อเข่าเสื่อม เพื่อช่วยลดความรุนแรงของโรค เพิ่มความแข็งแรงของกล้ามเนื้อและความสามารถในการเคลื่อนไหวข้อเข่า

126 หน้า.

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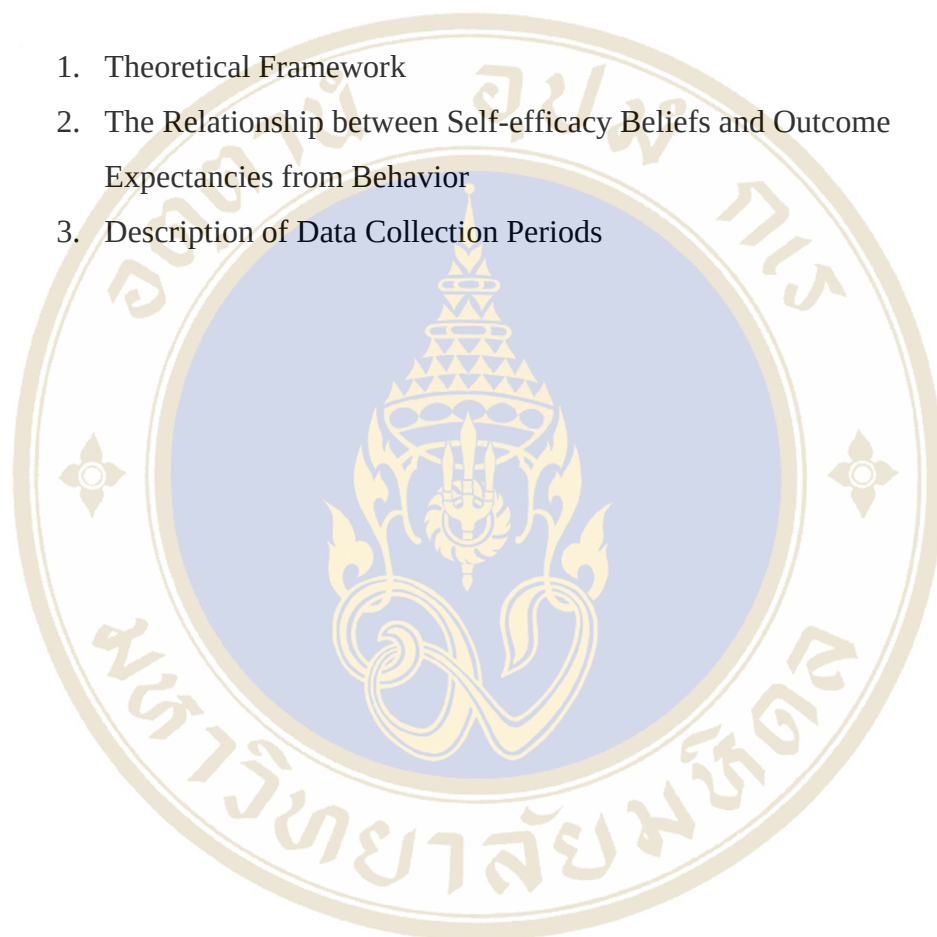
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CHAPTER I

INTRODUCTION

Background and Significance

Orthopaedic conditions are serious public health problems that affect wide range of people, from persons to family and then society. Besides, they have a tendency to increase in prevalence and incidence. The World Health Organization suspected that persons with orthopaedic conditions will increase from 400 to 570 millions by the year 2020. An estimate of 10 millions or one sixth of Thai population will be suffering from such aforementioned conditions (Boneandjointdecade, B.E. 2547).

Among others, osteoarthritis (OA) is a chronic and degenerative orthopaedic condition. This imperative health problem is commonly found in all racial groups, both male and female, middle-aged as well as older adults (Nantana Kasitanon, B.E. 2546: 11; Worawit Louthrenoo, B.E. 2546: 26). Prevalence of OA is noticeably associated with an increment of age (Felson, 2003: 9; Huang et al., 2000: 398; Nantana Kasitanon, B.E. 2546: 11; Worawit Louthrenoo, B.E. 2546: 26), and usually affects adults aged 40 years and above (Chattaya Jitraphai, B.E. 2542: 52; Titawate Tumrasvin, B.E. 2538: 367). The prevalence ranged from 1.6 to 9.4 percent of adults and from 10 to 15 percent of older adults (Felson, 2003: 9). Affected joints of OA are usually major weight-bearing joints such as hip and knee joints (ARC, 2004: 2; Mourad, 1995: 41), as well as overused joints such as fingers (Arthritis Research Campaign, ARC, 2004: 2; Stanley & Pattillo, 2005: 142), although any diarthrodial joint can be affected (Flores & Hochberg, 2003: 1).

Since knee is a major weight-bearing joint; it was found to be ‘worn and torn’ rather than any other joints (ARC, 2004: 2; Nantana Kasitanon, B.E. 2546: 15; Worawit Louthrenoo, B.E. 2546: 28-29; Mourad, 1995: 41; Thanya Subhadarbandhu, B.E. 2544: 325-326). OA of the knee is, therefore, the most common form of OA

(ARC, 2004: 2; National Institute of Arthritis and Musculoskeletal and Skin Diseases, NIAMS, 2002: 8) which affects middle-aged and also older adults (ARC, 2004: 7; Felson, 2003: 9; NIAMS, 2002: 1). The Framingham Study reported that the percentage of prevalence of knee OA was just one percent for persons aged 30 and below, 10 percent for those aged 40, and then 50 percent for persons aged 60 and above (Felson, 1990). Radiography also showed that knee OA occurred in 33 percent of persons aged 63 and above (Felson, 2003: 9). Besides, it was found approximately 70 to 85 percent of those who were 65 years old and above in another study (Lee, 1993: 31).

In the United State of America, almost a hundred percent of the elderly aged above 60 has an evidence of worn knee joint; with 80 percent has radiographic evidence of OA in leastwise one joint in the body (Lawrence et al., 1998 as cited in Nantana Kasitanon, B.E. 2546: 11-12). In addition, OA of the knee is generally found in Thai people as well. Thai lifestyle, especially those damaging sitting postures such as kneeling, squatting, and Thai traditional sitting; also eventually encourage the condition (Cooper et al., 1994 as cited in Pranee Karnjanavorawong, B.E. 2539: 13; Ngamsutikul, 2000: 82; Suparb Aree-Ue, Panwadee Putwatana & Sommai Vanavanant, B.E. 2543: 168). Although there was no statistic on OA of the knee in Thai population as a whole, there is a study on epidemiology of OA of the knee in persons who lived in urban area of Bangkok. The study was conducted on 392 people aged 60 and above who suffered from knee pain; the prevalence of knee OA ranged from 34.5 to 45.6 percent and trended to increase with an advancing age (Kuptniratsaikul, Tosayanonda, Nilganuwong, & Thamalikitkul, 2002b: 158).

Another statistical epidemiology reported by the statistics of Ramathibodi Hospital revealed that its patients with knee OA increased from 3,401 to 4,412 in 1994 and 1995 respectively in which accounted for 9.37 and 10.46 percent of overall orthopaedic outpatients for the particular year. The increment of knee OA was still observed and found that; it was increased from around 26.52 percent to 5,582 patients in 1995 and 1997 accordingly (Medical Informatics Division, B.E. 2540). As one of the top twenty listed conditions in outpatient units, there were 6,361 knee OA patients in 2000 and 8,767 in 2001 (Medical Informatics Division, B.E. 2543; 2544).

However, a prevalence of the knee OA in Ramathibodi Hospital personnel was supported by a survey on health problem conditions and risk factors conducted on 3,192 health personnel in the hospital between B.E. 2544-2546 in which reported that 33.2 percent of them or 1,061 persons suffered from joint and muscle pain (Rungtipa Buranakitjaroen, Weena Pinitwattana, & Tharathip Poomkampol, B.E. 2544). Additional information was explored by another study conducted in B.E. 2548-2549 (Wichai Ekpalakorn et al., B.E. 2549) by which revealed that 24.67 percent of 4,852 personnel experienced on the pain inside or around knee joint for the last 12 months. Although this information was not explicit in term of prevalence of the knee OA, it could be assumed that almost 1,000 middle-aged adults working in the Faculty of Medicine, Ramathibodi Hospital are living with chronic pain from OA of the knee.

OA of the knee is the most common source of pain and discomfort in which more associated with disability than OA of any other joints (Huang et al., 2000: 398; NIAMS, 2002: 8; Self, Greenwald, & Pflaster, 2000: 191). Common clinical signs of OA are joint pain, tenderness, stiffness, restriction of movement, crepitus, occasional effusion, and various degrees of local inflammation without systematic effects (Creamer, 2000: 450; Flores & Hochberg, 2003: 1; Nantana Kasitanon, B.E. 2546: 1; Worawit Louthrenoo, B.E. 2546: 25). The patients with knee OA suffer from chronic pain, and gradually increase in pain with repetitive used of joints. Pain and stiffness may cause the patient to restrict activities especially for those of daily living such as sitting, standing, or walking, and may eventually lead to de-conditioning (Brandt, 1996 as cited in Leslie, 2000: 52) as well as long-term disability. Apart from the effects on physical function, OA of the knee also induces anxiety, depression and distress (Creamer, Lethbridge-Cejku, Costa, Tobin, Herbst, & Hochberg, 1999: 3; O'Reilly & Doherty, 2003: 198). Disability leads to difficult mobility, social isolation and loss of work opportunities (O'Reilly & Doherty, 2003: 198) resulting in poor health status and low quality of life (Altizer, 1998: 480; Baker & McAlindon, 2000: 456; Ngamsutikul, 2000: 82; Suparb Aree-Ue, B.E. 2540). Furthermore, as medical service is needed (O'Reilly & Doherty, 2003: 198), expenditures including direct cost of medical services and indirect cost of related impacts such as reducing work hours or discontinuance of work do also occur (Yelin, 2003: 17). If progressive severity presents, total knee arthroplasty will be a major cost of the treatment.

According to a literature review, it reported that direct costs of OA were on an average of 1,769 to 2,427 US dollars (Yelin, 2003: 18), while indirect costs were 12,032 dollars per person in 1999 (Liang et al, 1984 as cited in Yelin, 2003: 18). In the same year, the total cost was 178.9 billion dollars for 13.03 million US populations with OA (USPGO, 2000 as cited in Yelin, 2003: 19). Moreover, the US international economics also reported that direct and indirect costs of OA were estimated at 125 thousand million dollars a year (Arthritis Foundation, 2004). This information indicated that the effects of the knee OA did not only fall on individuals but also the economy in general. Without appropriate prevention and management of the disease, the effects of the knee OA in physical, psychological, social and economic aspects will therefore lead to poor quality of life and a struggle of Thai health insurance system.

Even though OA is an incurable disease, it can be prevented and managed to slow down its progression and lessen severity of the symptoms. Previous studies suggested a number of methods for prevention and decrease symptoms of knee OA which aimed to relieve discomfort and pain, reduce stiffness and any further damages to the joint, improve function of joint, and empower self-care to the patients for health and well-being (ARC, 2004: 10; Worawit Louthrenoo, B.E. 2546: 115). Effective methods were to educate patients, provide information on the disease and how to utilize the available health care services, motivate behavioral changes for joint protection (Barlow & Lorig, 2003: 322), promote capabilities for self-care and controlling the disease (Bootsaba Oupaichit, B.E. 2537), and encourage them to practice quadriceps muscle strengthening exercises and weight reductions (Hochberg, McAlindon, & Felson, 2000; Jarunee Nantavanotayan, B.E. 2539).

Patient education had an influence on how the patients shall follow the instructions in disease control, while exercise program in participants with OA of the knee particularly quadriceps muscle strengthening exercises incited pain reduction, improvement of physical function (Chadin Samorrapoom, B.E. 2543; Chirawan Tanwattana et al., B.E. 2545; de Jong, Hopman-Rock, Tak, & Klazinga, 2004: 316-321; Harnirattisai & Johnson, 2005; Huang, Lin, Yang & Lee, 2003: 398-405; Hughes, Seymour, Campbell, Pollak, Huber, & Sharma, 2004; McCarthy, Mills, Pullen, Roberts, Silman, & Oldham, 2004: 880; Messier et al., 2000: 1062; Mounghthong, 2000; O'Reilly, Muir, & Doherty, 1999; Ravaud et al., 2004; Rawiworrakul, 2006;

Schilke, Johnson, Housh, & O'Dell, 1996; Suomi & Collier, 2003: 1589-1593;), enhancement of muscle strength (Chadin Samorrapoom, B.E. 2543; Huang, Lin, Yang & Lee, 2003; Kuptniratsaikul, Tosayanonda, Nilganuwong, & Thamalikitkul, 2002a; Messier et al., 2000: 1062; Mikesky, Mazzuca, Brandt, Perkins, Damush, & Lane, 2006; O'Reilly, Muir, & Doherty, 1999; Rawiworrakul, 2006; Schilke et al., 1996), and increase in abilities to perform activities of daily living (Chadin Samorrapoom, B.E. 2543). In spite of an effectiveness of the methods mentioned, there was evidence of discontinuity in following health care instructions. The efficacy of a muscle exercise program to improve functional performance of the knee in patients with OA was compared to an intervention group in which those with muscle exercise twice a week for a period of 8 weeks, with a control group over the 12-month study periods. The intervention group showed a significant improvement in quadriceps strength and walking distance especially during the first two month; however, there was a tendency for the progress to slow down by the 6th and 12th month after an enrollment (Kuptniratsaikul et al., 2002a). These results displayed noncompliance to perform exercise. Since health practice behaviors, especially exercise behavior, are usually challenging to change and required to be consistent in order to obtain rather favorable effects (Kuptniratsaikul et al., 2002a; O'Reilly, Muir, & Doherty, 1999; Rawiworrakul, 2006). The intervention strategy to increase adherence is needed. Self-efficacy is believed to be importance in the adoption of exercise (O'Reilly & Doherty, 2001; 563). Many studies revealed the effectiveness of a health education and exercise program using self-efficacy theory as a basis among the patients with OA of the knee. The results indicated that enhancing self-efficacy interventions could increase OA knowledge, improve exercise behavior and physical activities, and reduce knee pain and discomfort related to OA of the knee (Boon-im, 2002; de Jong et al., 2004: 316-321; Jarunee Nantavanotayan, B.E. 2539; Kaysorn Sumpaonthong, B.E. 2536; Ketsuda Maneekrajangsaeng, B.E. 2544; Mounghthong, 2000; Rawiworrakul, 2006; Thongsamrit, 1998).

One point that should be noted from the aforementioned literature reviews is that the health education and exercise program of knee OA in most previous studies was actually focused on the older adults while middle-aged adults were disregarded. Concerning the appropriate management and prevention knee OA in middle-aged

adults is important to slow down the progression of the severity of knee symptoms in later life. Moreover, most of the studies compared the intervention group that received health education, home-based and/or hospital-based, and exercise program with the control group that received standard treatment. However, there was no published study that compared home-based exercise program with hospital-based exercise program through focusing on providing facilities. Each program differs in terms of advantage and appropriateness to implement. Regarding to middle-aged or work-aged adults with OA of the knee, some patients may appreciate to exercise at home where they can easily practice in terms of spending time at their convenience, while the others are well-situated to exercise at facilitate place in the hospital where there are various exercise equipments that meet their needs.

Faculty of Medicine, Ramathibodi Hospital is a health promoting hospital where has placed a policy to encourage health practice behavior among personnel. It has set up a Sport Center for the staffs aiming to encourage them to be health leaders who play important parts in the faculty's strategic plan as to support and encourage people towards good health and well-being. From the researcher point of view, the hospital setup is ideal for studying the impact of an integrated health education and exercise program in personnel with OA of the knee. The program is expected to promote behavioral changes, enhance self-efficacy expectation (SEE) for continuing good health practice behavior especially quadriceps muscle strengthening exercise. Consequently, the program may be a guideline for prevention, relief and management of OA of the knee for patients in general.

Theoretical Framework

Self-efficacy theory proposed by Albert Bandura was used as a theoretical framework. Based on the theory (Bandura, 1997), self-efficacy is a dynamic cognitive process in which an individual evaluates his or her competency to perform a given behavior. The self-efficacy theory suggested that behavior is initiated, performed and maintained as a function of efficacy beliefs (efficacy expectations) and outcome expectations. Efficacy beliefs are expectations on individuals' capability to engage in or master the courses of action, while outcome expectations are expectations on

outcomes that result from individuals' engagement in behavior (Bandura, 1997: 21-23). Perceived self-efficacy is a part of self-reflective capability in the cognitive process (Bandura, 1986: 21) constructed on the basis of four sources including enactive mastery experience, vicarious experiences, verbal persuasion, and emotional arousal or physiological and affective states (Bandura, 1977: 81-82; 1986: 399-409; 1997: 80-113).

Enactive mastery experience that can be enhanced through direct performance accomplishments is the most influential source of self-efficacy as they provide the most authentic evidence of whether one can master whatever it takes in order to succeed. The effects of actual experience on self-efficacy are modified by individuals' interpretations of their performance and desired outcome.

Vicarious experience is an alteration of self-efficacy through transmission of competencies and comparison with attainments of others. Other individuals' performance is a primary source of information on skills and abilities. Having persons observe effective role models can be helpful to attain their self-efficacy and promote behavior.

Verbal persuasion is a belief in others' appraisal as valid assessment of their own abilities which may impact the level of self-efficacy. Persons who get persuasive verbalization are more likely to mobilize greater effort and increased perceived self-efficacy.

Emotional arousal can influence persons who individually judge their capability, strength, and vulnerability to dysfunction. Individuals make inferences about their abilities from emotional arousals and other physiologic cues experience while enacting a behavior or expecting its enactment. Positive interpretations of arousals such as excitement and satisfaction augment individuals' sense of self-efficacy; whereas negative interpretations like pain, fatigue, discomfort, anxiety, and stress reduce it.

The literature review indicated that many studies applied the self-efficacy theory as a theoretical framework in developing health education and exercise program for patients with OA of the knee (Boon-im, 2002; de Jong et al., 2004: 316-321; Jarunee Nantavanotayan, B.E. 2539; Kaysorn Sumpaonthong, B.E. 2536; Ketsuda Maneeekrajangsaeng, B.E. 2544; Mounghong, 2000; Rawiworrakul, 2006;

Thongsamrit, 1998). The results indicated that enhancing self-efficacy interventions could thus increase exercise behavior and physical activities, and decrease knee pain and discomfort related to OA of the knee. Hence, an integrated health education and exercise program will be developed by proposing the patients with OA of the knee to enhance self-efficacy expectation (SEE) through four sources: 1) promoting enactive mastery experiences by providing the general information regarding OA of the knee and training on exercise; 2) offering vicarious experiences from role models who has succeeded in exercising; 3) presenting verbal persuasions through motivating and encouraging patients to engage in exercise; and 4) evaluating emotion and physical performance after exercise, providing a group or individual discussion, setting goals forwards, and reporting individual physical performance assessment. Additionally, health education is designed to help participants improve their knowledge, and change their exercise behaviors, health status, or health care utilization (Barlow & Lorig, 2003: 322). It was integrated as a theoretical framework that is shown in Figure 1.

Patients who participate in the program will be expected to improve their OA knowledge, enhance SEE, improve health behavior namely working on quadriceps muscle exercise, avoidance of knee joint pressure and efficacy of weight control, and reach the beneficial health outcomes including decrease in severity of knee symptoms (SEV-OA), augmentation muscle strength and joint range of motion (ROM), and maintain or decrease of body mass index (BMI).

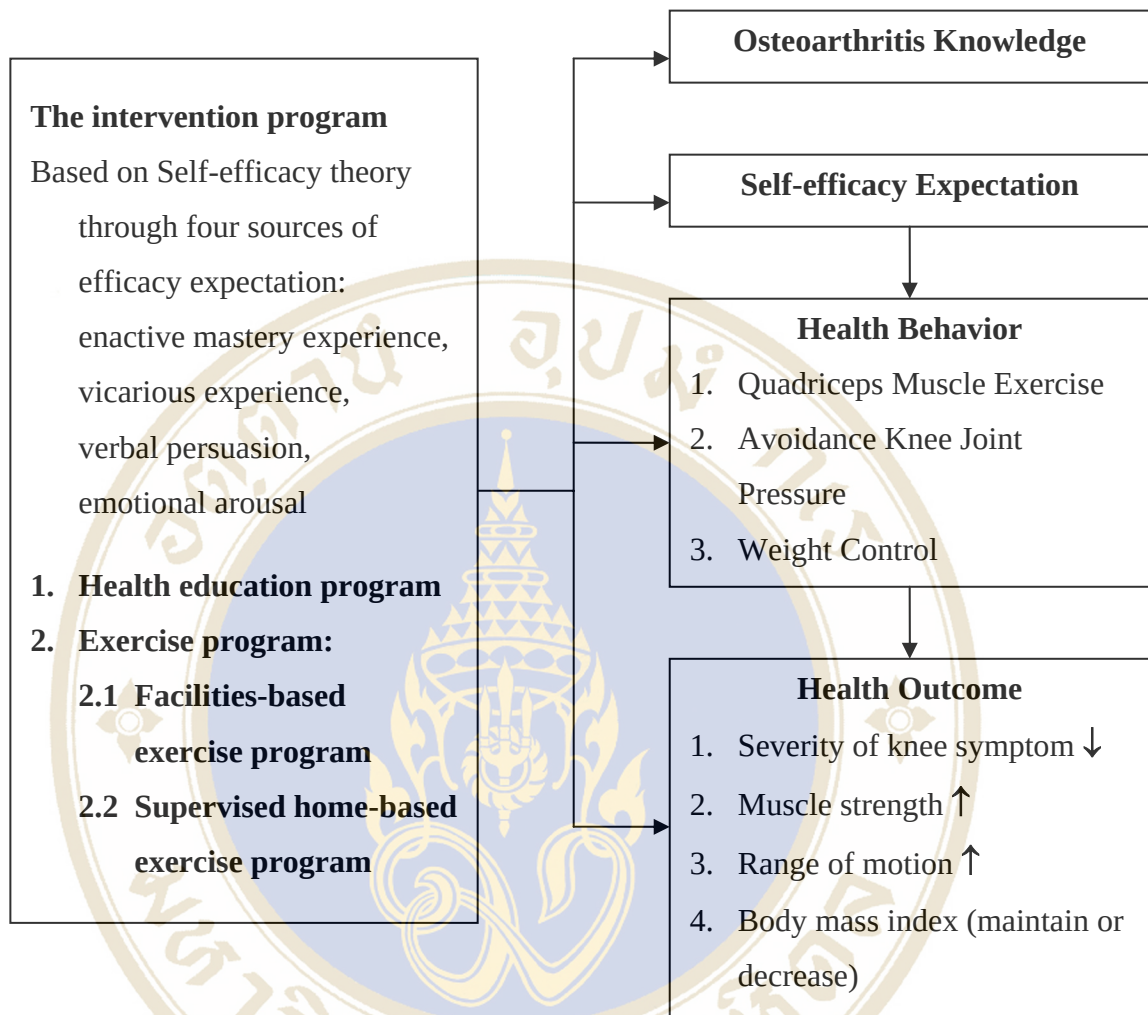


Figure 1. Theoretical Framework

Research Questions

1. Do the middle-aged adults with osteoarthritis of the knee who participated in an integrated health education and exercise program have more knowledge on osteoarthritis than before entering the program?

2. Do the middle-aged adults with osteoarthritis of the knee who participated in an integrated health education and exercise program have higher self-efficacy expectation than before entering the program?

3. Do the middle-aged adults with osteoarthritis of the knee who participated in an integrated health education and exercise program have higher behavior scores than before entering the program?

4. Do the middle-aged adults with osteoarthritis of the knee who participated in an integrated health education and exercise program have better health outcomes than before entering the program?

5. Is there any different in osteoarthritis knowledge, self-efficacy expectation, behavior, and health outcomes between the middle-aged adults with osteoarthritis of the knee who participated in the experimental group 1 (facilities-based exercise program) and those who participated in the group 2 (supervised home-based exercise program)?

Research Objectives

The objectives of this study were to:

1. Compare the differences of OA knowledge mean scores in the middle-aged adults with osteoarthritis of the knee who participated in an integrated health education and exercise program at the baseline, the 2nd, 8th, and 12th week after enrollment.
2. Compare the differences of SEE mean scores in the middle-aged adults with osteoarthritis of the knee who participated in an integrated health education and exercise program at the baseline, the 2nd, 8th, and 12th week after enrollment.
3. Compare the differences of behavior mean scores in the middle-aged adults with osteoarthritis of the knee who participated in an integrated health education and exercise program at the baseline, the 8th and 12th week after enrollment.
4. Compare the differences of health outcomes in the middle-aged adults with osteoarthritis of the knee who participated in an integrated health education and exercise program at the baseline, the 8th and 12th week after enrollment.
5. Compare the differences of OA knowledge, SEE, behavior and health outcomes between the middle-aged adults with osteoarthritis of the knee who participated in the experimental group 1 (facilities-based exercise program) and those who participated in group 2 (supervised home-based exercise program) at the baseline, the 2nd, 8th, and 12th week after enrollment.

Hypotheses

1. The middle-aged adults with osteoarthritis of the knee who participated in an integrated health education and exercise program have more osteoarthritis knowledge than before entering the program.
2. The middle-aged adults with osteoarthritis of the knee who participated in an integrated health education and exercise program have higher self-efficacy expectation than before entering the program.
3. The middle-aged adults with osteoarthritis of the knee who participated in an integrated health education and exercise program have higher behavior scores than before entering the program.
4. The middle-aged adults with osteoarthritis of the knee who participated in an integrated health education and exercise program have better health outcomes than before entering the program.
5. There is no difference between osteoarthritis knowledge, self-efficacy expectation, behavior, and health outcomes among the middle-aged adults with osteoarthritis of the knee who participated in the experimental group 1 (facilities-based exercise program) and those who participated in the group 2 (supervised home-based exercise program).

Scope of Research

This study is a quasi-experimental study, two comparison group pretest-posttest design, which conducted as to determine the impact of an integrated health education and exercise program among personnel of the Faculty of Medicine, Ramathibodi Hospital, and patients visiting at the orthopaedics outpatient department of the Faculty of Medicine, Ramathibodi Hospital who ages ranged from 38 to 59 years old, and suffered with OA of the knee during January to May 2007.

Expected Advantage of the Research

OA of the knee is a serious public health problem affecting not only on the individuals, but also their families, societies and nation, and trends to increase in prevalence and incidence. Participants who participate in the integrated health education and exercise program is expected to reduce knee pain, decrease severity of knee symptoms, improve physical functions, enhance muscle strength, increase abilities to perform activities of daily living, and maintain work actions with consequent financial concerns of the participants. Accordingly, the program will lead to better health status and quality of life. Additionally, the program may be used as a guideline for application in other aged groups of patients with OA of the knee and patients with other chronic disease.

Definition of Terms

Health education program is any set of planned educational activities designed to help patients to change their behaviors, and is developed by the researcher based on Bandura's self-efficacy theory. The topics of education consist of general information regarding OA of the knee including definition, causes and risk factors, signs and symptoms, diagnosis, treatments, and preventions and management of OA of the knee focusing on lifestyle behavioral changes, weight control strategies, and quadriceps muscle exercises for muscle strength and joint ROM enhancements to relieve OA knee symptoms and improve health outcomes.

Exercise programs consist of two exercise programs namely the facilities-based exercise program and supervised home-based exercise program developed on the basis of self-efficacy theory. The programs are conducted by the researcher through four strategies: a) enactive mastery experiences, b) vicarious experiences, c) verbal persuasion, and d) emotional arousal.

1. Facilities-based exercise program is a program designed for experimental group 1. The program consists of isotonic and isokinetic quadriceps muscle strengthening exercise. After health education program is provided, the patients will then be given a facilities-based exercise program trained by the researcher. They will treadle a cross trainer up and down repeatedly, and will perform a 30 minutes exercise

on cross trainer at the Sport Center of Faculty of Medicine, Ramathibodi Hospital, 3 times a week during 12 weeks after enrollment.

2. Supervised home-based exercise program is a program designed for an experimental group 2. The program consists of isotonic and isometric quadriceps muscle strengthening exercise. After health education program is provided, the patients will then be given a supervised home-based exercise program and trained to work on quadriceps muscle exercise by the researcher. They will perform 10 cycles of exercise per session, three times a day, and three days a week during 12 weeks period at home or work place by themselves.

Isometric exercise is a form of exercise involving the static contraction of a muscle without any visible movement in the angle of the joint, and the length of the muscle does not change.

Isotonic exercise is a form of exercise involving the static contraction of a muscle with changing in the joint angle, and the length of muscle changes, shortens or lengthens.

Isokinetic exercise is a form of exercise that performed with a specialized device which provides variable resistance to a movement, so that no matter how much effort is exerted, the movement takes place at a constant speed or constant angular velocity over a joint's full range of motion.

OA Knowledge is the knowledge on general information as regards to OA of the knee including causes and risk factors, signs and symptoms, impacts and managements. It is evaluated by 'the OA knowledge test' that is translated and modified from 'test your arthritis knowledge' (American Academy of Orthopaedic Surgeons, 2003) by the researcher. The possible total scores ranged from 0 to 10. The higher scores indicate the better knowledgeable on knee OA.

Self-efficacy expectation (SEE) is the sense of patients' confidence to perform good health behavior of quadriceps muscle exercise, avoidance of knee joint pressure and efficacy of weight control. It is evaluated by 'self-efficacy expectation questionnaire' developed by Jarunee Nantavanotayan (B.E. 2539). The possible total scores ranged from 0 to 30. The higher scores indicate the better the patients' self-efficacy expectation.

Health behaviors are behaviors related to OA health practice including maintenance optimal weight, joint protection and quadriceps exercise. It is evaluated by 'health behavior questionnaire' developed by Jarunee Nantavanotayan (B.E. 2539). The possible total scores ranged from 0 to 33. The high scores indicate that the participants performed suitable health behaviors related to reduce knee OA symptoms.

Health outcomes are consequence of health practice related to OA of the knee including severity of knee symptom, muscle strength, range of motion and body mass index.

1. Severity of knee symptom (SEV-OA) is the degree of OA knee symptoms including pain, stiffness and physical function. It is assessed by 'modified WOMAC scale' (Sek Aksaranugraha, 2000). The possible total scores are ranged from 0 to 240. The higher scores refer to the more severity of OA knee symptoms.

2. Muscle strength is the highest force of the quadriceps muscle group to perform an extended knee at once. It is assessed by 'back-leg dynamometer' (Ministry of Tourism and Sports, B.E. 2548; Nitikul Chairat, B.E. 2542: 23). The high scores indicate good muscle strength of the patients.

3. Range of motion (ROM) is the degree of full flexion of right and left knee. It is assessed by 'goniometer'. A normal value of knee extension and flexion ranged from 0 to 140 degrees (Pornchai Mulpruek, B.E. 2547: 51; Sattaya Rojanasthien & Samphan Phadungkiat, B.E. 2536: 73). If the participants could extend the knee larger than 0 degree or has knee flexion less than 140 degrees, they would be determined as abnormal ROM.

4. Body mass index (BMI) is true parameter calculated by expressing body weight (kg) divided by height (m^2) of the patients at the date of data collection. Body weight and height are assessed by 'weighing scale with height meter (SECA)' of the Supreme Products Companied Limited.

CHAPTER II

LITERATURE REVIEW

The study's literature concerning impact of an integrated health education and exercise program on middle-aged adults with osteoarthritis of the knee is reviewed by integration of the theoretical and empirical literature in following topics:

- General information regarding osteoarthritis of the knee
- Impact of osteoarthritis of the knee
- Preventions and managements of osteoarthritis of the knee
- Self-efficacy theory

General Information Regarding Osteoarthritis of the Knee

Definition and overview of OA

Osteoarthritis (OA) is the most common form of arthritis (Dingley, 1999: 253; Felson, 2003: 9; National Institute of Arthritis and Musculoskeletal and Skin Diseases, NIAMS, 2002: 1), chronic disease in degenerative changes, which affects the joints in the body characterized by destruction of articular cartilage and overgrowth of surrounding bone (Arthritis Research Campaign, ARC, 2004: 2; Creamer, 2000: 450). 'Osteo' means bone, and 'arthritis' means joint damage and swelling. The other terms employed interchangeably to OA includes degenerative joint disease, hypertrophic arthritis, senescent arthritis, osteoarthrosis, and arthrosis (ARC, 2004: 2; Flores & Hochberg, 2003: 1; Stanley & Pattillo, 2005: 142). However, the subcommittee on Osteoarthritis of the American College of Rheumatology, the Diagnostic and Therapeutic Criteria Committee, proposed the definition of OA as "a heterogeneous group of conditions that lead to joint symptoms and signs which are associated with defective integrity of articular cartilage, in addition to related changes in the underlying bone and at the joint margins" (Altman et al., 1986: 1039). Affected joints of OA are major weight-bearing joints such as hip or knee joints (ARC, 2004: 2;

Mourad, 1995: 41), or overused joints such as fingers (ARC, 2004: 2; Stanley & Pattillo, 2005: 142) although any diarthrodial joint can be affected (Flores & Hochberg, 2003: 1).

OA of the knee is the most common form of OA (ARC, 2004: 2; NIAMS, 2002: 8), which affects the knees in middle-aged and older adults (ARC, 2004: 7; Felson, 2003: 9; NIAMS, 2002: 1). In addition, OA of the knee is the most common source of pain and discomfort, and is more associated with disability than OA of any other joints (Huang et al., 2000: 398; NIAMS, 2002: 8; Self, Greenwald, & Pflaster, 2000: 191). OA processes not only affect the articular cartilage, but also all joint tissues specifically subchondral bone, ligaments, capsule, synovial membrane, and periarticular muscle. The OA disease manifests morphologic, biochemical, molecular, and biomechanical changes in cells and matrix, which bring about softening, fibrillation, fissures, ulceration, and loss of articular cartilage, including sclerosis and aberration of subchondral bone, marginal osteophytes, and subchondral bone cysts, as well as full-thickness joint surface. (Flores & Hochberg, 2003: 1; Sudhee Sudasna & Vajara Rujiwetpongstorn, B.E. 2539: 400-405). The clinical symptom of OA is characterized by joint pain, tenderness, stiffness, restriction of movement, crepitus, occasional effusion, and various degrees of local inflammation without systematic effects (Creamer, 2000: 450; Flores & Hochberg, 2003: 1; Nantana Kasitanon, B.E. 2546: 1; Worawit Louthrenoo, B.E. 2546: 25).

Pathophysiology

OA was developed as a result of structural, biochemical, and metabolic changes. The primary defect of OA is a loss of articular cartilage. The major constituents of cartilage are water, proteoglycans, and collagens. The proteoglycans contain a protein core with glycosaminoglycan side chains, predominantly chondroitin sulfate and keratin sulfate. The proteoglycan form aggregates with hyaluronic acid (another glycosaminoglycan) and links proteins that conduce to cartilage stability and strength. A joint develops OA when either normal cartilage and subchondral bone of the joint gets excessive loads or insufficient cartilage but bone gets appropriate loads, which contribute to breakdowns of all joint tissue (Cote, 2001: 496).

The pathogenesis of OA involves a dual process of catabolism and repair. In normal cartilage, there is a continuous remodeling process. Matrix molecules, proteoglycans and collagens, are usually degraded by autolytic enzymes and are replaced by chondrocytes. In OA cartilage, this process is altered in way that causes an overall loss of the matrix molecules despite the attempts to repair. Additionally the new synthesized matrix molecules are mechanically insufficient to normal cartilage; therefore, it is more prone to injury and further damage (Cote, 2001: 496).

The destructive process of OA may result from local tissue trauma causing chondrocyte injury which releases proteolytic enzyme such as neutral proteases, acid cathepsins, collagenase, and metalloproteases. These enzymes degrade matrix molecules and produce smaller non-aggregating molecules, which leads to thinner, mechanically inferior cartilage. The rate of enzyme release and the subsequent rate of matrix molecule destruction are significantly more rapid in OA than normal cartilage (Noble, 1996 as cited in Cote, 2001: 497).

In addition, there is a loss of tensile strength as changes in the cartilage matrix composition lead to greater forces being transmitted to chondrocytes and subchondral bone. As a result, chondrocytes sustain greater injury and induce enzyme releasing. On the other hand, subchondral bone sustains microfractures, causing stiffening and loss of compressibility. Degenerative changes cause the normally smooth, white, translucent cartilage to become yellow and opaque, with rough surfaces and areas of softening. As the layers of cartilage become thinner, bony surfaces grow closer together (Stanley & Patillo, 2005: 142). Some of breakdown products from cartilage and proteoglycans can stimulate a secondary inflammatory response of polymorphonuclear leukocytes, synovial cells, and macrophages. The whole process is in a continuous destructive cycle (Cote, 2001: 496-497). Thus, the joint surfaces become denuded of cartilage and subchondral bone, increase in density and become sclerotic (Stanley & Patillo, 2005: 142).

Classification of osteoarthritis

OA is classified into two classes; primary or idiopathic, and secondary OA. Primary OA is an unknown previous event or disease which related to the OA. Genetics and hormones may contribute to the symptom. Secondary OA is caused by

associated medical conditions or diseases such as post-traumatic lesions, continuous overuse of the joint, inflammatory joint disease, infection, metabolic processes that weaken the cartilage, and congenital diseases (Altman et al., 1986: 1040; 1991a: 41-42; 1991b: 10).

Risk factors related to osteoarthritis of the knee

OA, although, is a disorder of unknown etiology that primarily affects the articular cartilage and subchondral bone (Flores & Hochberg, 2003: 1), a combination of factors seem to increase the risk of OA in the knee joint including ageing, female sex, obesity, family history of OA, repetitive physical tasks in athletics and certain occupations, trauma to the joint (ARC, 2004: 6-7; Dingley, 1999: 253; Ebersole, Hess, Touhy, & Jett, 2005: 385; NIAMS, 2002: 2) and elsewhere.

Age seems to be an important associated factor. Prevalence of OA is noticeably associated with increased age (Felson, 2003: 9; Huang et al., 2000: 398; Nantana Kasitanon, B.E. 2546: 11; Worawit Louthrenoo, B.E. 2546: 26), and usually affects adults over 40 years of age (Chattaya Jitpraphai, B.E. 2542: 52; Titawate Tumrasvin, B.E. 2538: 367). Its prevalence ranges from 1.6-9.4 percent of adults to 10-15 percent of older adults in different studies. In Framingham Study, radiographic knee OA occurred in 33 percent of persons aged 63 and older (Felson, 2003: 9), and was found in 70-85 percent of those aged 65 and over (Lee, 1993: 31). The prevalence of knee OA in Thailand studies consistently ranges from 34.5-45.6 percent of elderly people aged 60 and older (Kuptniratsaikul, Tosayanonda, Nilganuwong, & Thamalikitkul, 2002b: 158). In the United State, almost a hundred in percentage of elders aged above 60 have radiographic evidence of knee joint disease, and 80 percentages of those have radiographic evidence of OA in at least one joint (Lawrence et al., 1998 as cited in Nantana Kasitanon, B.E. 2546: 11-12). In a study of 5,284 volunteers with neither knee nor hip OA, three follow-ups conducted every 4-5 years, 12.8 years on the average length of follow-up, reported that the risk of OA increased as the subjects get older (Hootman, Macera, Helmick, & Blair, 2003: 636).

Gender is another factor related to OA. A higher prevalence, and more often reveals generalized distribution, in women than men. Before the age of 50, prevalence in men is higher than women but after age of 50 the prevalence is contrary (Felson,

2003: 9). It is twice as frequent in women as in men (ARC, 2004: 6; Mourad, 1995: 41). These patterns of gender- and age-related prevalence are compatible with a role of post-menopausal hormone deficiency in higher risk of OA (Felson, 2003: 9), but there is no strong evidence (ARC, 2004: 6).

Obesity may contribute to added stress on joint cartilage (Mourad, 1995: 41). Mechanically, during the stance phase of gait, the knee joint is 3-7 times loaded of body weight, and 0.5 kilograms increased body weight augments 1-1.5 times stress on the joint.

Moreover, a longitudinal study of 5,284 participants with neither knee nor hip OA reported that the risk of OA increased as participants get higher BMI (Hootman et al., 2003: 636). In a hospital-based case-control study of the risk factors associated with OA of the knee in persons aged 45 years or more who were registered at an orthopaedic clinic in Maharaj Nakhon Ratchasima Hospital, of those study sample, the body mass index (BMI) of 25.0 to 29.9 kg/m² and 30 kg/m² or greater increased the risk by 2.27 times (95% CI = 1.41 to 3.63) and 6.75 times (95% CI = 2.71 to 19.80), respectively. Likewise, population-based studies of OA have consistently revealed that obese persons have higher risks of knee OA than non-obese control subjects (Huang et al., 2000: 398). In contrast, subjects who lose weight are less probable to progress radiographs or to develop symptoms (Felson et al., 1997 as cited in Creamer, 2000: 452). Therefore, obesity or overweight increases risks for OA of the knee (Hootman et al., 2003; Nantana Kasitanon, B.E. 2546: 15; Worawit Louthrenoo, B.E. 2546: 28-29), and also increases the chances of OA getting worse once it has developed (ARC, 2004: 7).

There are evidences supported that certain physical activities at work and during participation in sports also increase the risk of knee OA (Cote, 2001: 496). Occupational overuse of the knee joints is also a risk factor of OA, especially in occupations related either to sitting postures such as kneeling, squatting, sitting on the haunches and Thai traditional sitting for longer than 30 minutes, or to ascending stairs more than 10 steps a day (Cooper et al., 1994 as cited in Pranee Karnjanavorawong, B.E. 2539: 13). The previous study (Ngamsutikul, 2000: 82) indicated that sitting postures such as kneeling, squatting, and Thai traditional sitting for longer than 6 hours/week increased the risk by 20.90 times (95% CI = 10.70 to 40.80), 16.62 times

(95% CI = 9.36 to 29.48) and 4.86 times (95% CI = 2.77 to 8.54), respectively. Accordingly, physical activities, such as heavy weight lifting or certain sports particularly excessive running, and football playing, contribute to added stress on joint cartilage (ARC, 2004: 7; Thanya Subhadarbandhu, B.E. 2544: 325-26).

Genetic predisposition is a very crucial risk factor (ARC, 2004: 6; Ebersole et al., 2005: 385). Genes may affect collagen, one of the main building blocks of cartilages, or that the way the bone reacts and repairs itself, or even the inflammatory process (ARC, 2004: 6). OA of the knee is more common in certain racial groups than others, for instance, OA in Afro-Caribbean people are more common than white people (ARC, 2004: 7).

Besides risk factors noted above, a literature review concluded that knee OA is associated with higher BMD (Stewart & Black, 2000: 466). Furthermore, the other risk factors such as post-traumatic lesions, inflammatory joint disease, infection, metabolic processes that weaken the cartilage, muscle weakness, postmenopausal estrogen deficiency, and congenital diseases should be focused on their effect on OA of the knee (Altman et al., 1986: 1040; Altman, 1991a: 41-42; Altman, 1991b: 10; Ebersole et al., 2005: 385; Leslie, 2000: 52).

Clinical features and diagnosis

OA, as mentioned before, is clinically characterized by joint pain, tenderness, stiffness, restriction of movement, crepitus, occasional effusion, and various degrees of local inflammation without systematic effects (Creamer, 2000: 450; Flores & Hochberg, 2003: 1; Nantana Kasitanon, B.E. B.E. 2546: 1; Worawit Louthrenoo, B.E. 2546: 25).

Pain is a predominant symptom of OA that usually asymmetrical varies in severity, location, precipitating and relieving factors, and responses to intra-articular analgesic (Creamer, 2000: 450). Since pain is an individual experience, its extent must be individually determined (Mourad, 1995: 41). Patients with OA of the knee have various intensity of pain in or around the knee joint. In early stage of the disease, patients may complain about knee pain or ache after physical work or exercise (ARC, 2004: 8; NIAMS, 2002: 7). The characteristic of pain is often described as a deep, dull ache associated with use and weight-bearing, that can be relieved by rest. However, if

the pain persists, it will lead to limitation of mobility (Cote, 2001: 497; Dingley, 1999: 255; Leslie, 2000: 52).

Morning stiffness is another symptom. It is transient, normally lasts less than 30 minutes. It is usually experience in OA patients with prolonged period of rest or inactivity (ARC, 2004: 8; Cote, 2001: 497; Dingley, 1999: 255; Ebersole et al., 2005: 385).

Crepitus, tenderness, and limited range of knee motion are commonly found when doing physical examination. These symptoms are signs of advanced OA resulting from severe cartilage loss, osteophyte remodeling, and bone erosion. Clinically detectable instability is regarded as a late sign that may accompany severe deforming. Synovitis of the knee often accompanies with warmth, synovial thickening, joint effusion and stress pain. As the disease progresses, muscle wasting and weakness occur but they are difficult signs to assess (O'Reilly & Doherty, 2003: 198-199).

Radiological features are helpful in establishing diagnosis of knee OA excluding other causes of knee pain, and monitor disease progression (Leslie, 2000: 52). Characteristic finding from radiological study reveals asymmetric joint-space narrowing, subchondral sclerosis, subchondral cyst formation, and osteophytes (Watt & Doherty, 2003: 211).

The criterion of osteoarthritis of the knee

In 1981, the subcommittee on Osteoarthritis of the American College of Rheumatology, the Diagnostic and Therapeutic Criteria Committee, American College of Rheumatology, developed the classification criteria for OA (Altman et al., 1986: 1039-1049), but the criteria were more difficult to apply in clinical setting (Altman, 1991a: 43). Thus, they are modified to become a simplistic checklist for clinical task. The summarized signs and symptoms of OA for identification of patients with symptomatic OA of the knee are described in Table 1 (Altman, 1991a: 43; 1991b: 11; 1995: 43).

Table 1. ACR Classification Criteria for Osteoarthritis of the Knee

Clinical	Clinical, Laboratory and Radiographic
1. Knee pain for most days of previous month 2. Crepitus on active joint motion 3. Morning stiffness of the knee 30 minutes or lesser 4. Age 38 years or older 5. Bony enlargement of the knee	1. Knee pain for most days of previous month 2. Radiographic osteophytes at the joint margins 3. Synovial fluid of OA (at least 2: clear, viscous, WBC < 2,000 cells/mL) 4. Age 40 years or older 5. Morning stiffness of the knee 30 minutes or lesser 6. Crepitus on active joint motion
Minimum criteria for classification of OA:	Minimum criteria for classification of OA:
- 1, 2, 3, 4; or 1, 2, 3, 5; or 1, 5	- 1, 2; or 1, 3, 5, 6; or 1, 4, 5, 6
89% sensitive; 88% specific	94% sensitive; 88% specific

Impact of Osteoarthritis of the Knee

There are physical, psychological, social, and economics aspects of the impacts of OA of the knee. Clinically, patients with OA have had gradual chronic pain which intensity correlates with repetitive use of joints. Pain and stiffness may cause the patient to restrict activities of daily living such as sitting, standing, or walking which will lead to deconditioning (Brandt, 1996 as cited in Leslie, 2000: 52) and long-term disability. As the disease progresses, arising joint deformity and instability (O'Reilly & Doherty, 2003: 198-199) lead to gait disturbance and finally handicap, which makes patients suffer for the rest of their lives (Surasak Nilganuwong, B.E. 2548: 725). The condition not only effects physical function but also causes psychosocial impairment namely anxiety, depression and distress (O'Reilly & Doherty, 2003: 198). Results of disability may include poor mobility, difficulty in activities of daily living, social isolation, and loss of work opportunities which leads to financial concerns (O'Reilly & Doherty, 2003: 198) and therefore influence health status and quality of life (Altizer, 1998: 480; Suparb Aree-Ue, B.E. 2540).

Anxiety and depression are commonly focused in patients with OA. The intensity effects pain perception and level of disability (O'Reilly & Doherty, 2003: 198). In a study of 374 community volunteers aged 40 and older, women reporting knee pain had significantly higher anxiety scores than those without knee pain (Creamer, Lethbridge-Cejku, Costa, Tobin, Herbst, & Hochberg, 1999: 3). Bony swelling and deformity may be a source of distress in some patients (O'Reilly & Doherty, 2003: 198). Additionally, disability may include poor mobility, difficulty in activities of daily living, social isolation, and loss of work opportunities with consequent financial concerns (O'Reilly & Doherty, 2003: 198). The adverse outcomes in knee OA can have devastating effects on the quality of life of those suffering from the disease (Baker & McAlindon, 2000: 456). A hospital-based case-control study of quality of life of patients with OA of the knee conducted on 210 patients with OA of the knee and 210 patients with other orthopaedic conditions was reported (Ngamsutikul, 2000: 82). After controlling for age and gender, the study indicated that the quality of life of the patients with OA of the knee assessed by WHOQOL-BREF was 28.2% (95% CI = 31.4 to 24.9), which was lower than patients with other orthopaedic conditions. Additionally, the findings showed that the quality of life in the physical and psychological domains of patients with severe and moderate symptom were 47.8% (95% CI = 73.8 to 21.7) and 25.6% (95% CI = 50.4 to 0.8), respectively, which was lower than those with mild symptom.

OA is an untreatable disease, while pain is a common reason for seeking medical advice (O'Reilly & Doherty, 2003: 198) that leads to cost of illness. The cost of illness involves direct expenditure for medical services and indirect cost from the impact of disease measured by lost wages due to reduce work attempt or discontinuance of work activities (Yelin, 2003: 17). A study reported that direct cost of OA averages between \$1,699 and 2,433, while indirect costs are \$12,032 (Lane et al, 1997 as cited in Yelin, 2003: 19). In 1999, there were 13.03 million US populations with OA, and the total costs of OA were \$178.9 billion (USPGO, 2000 as cited in Yelin, 2003: 19). In case of progressive severity OA, total knee arthroplasty is a major cost of treatment. For example, a study conducted to estimate the cost of treatment for total knee arthroplasty in 39 patients with OA revealed that the patients had an average length of stay of 6.59 days with an average treatment cost of 84,419.18 baht/case. This

was composed of routine service cost of 4,776.90 baht/case and medical care cost of 79,642.28 baht/case. The highest cost was spent on medical supply and prosthesis with average cost of 57,200.35 baht/case. The next most substantial costs were the operation and medication cost of 9,701.66 and 6,590.33 baht/case, respectively (Verathaworn, 2004).

Therefore, inappropriate prevention and management of the disease may have physical, psychosocial and economics effects which lead to poor quality of life of patients with OA. However, OA is incurable, even though there are many strategies to prevent, slow down progress and decrease severity of OA knee symptoms.

Preventions and Managements of Osteoarthritis of the Knee

The purpose of managements for patients with knee OA is to relieve discomfort and pain, reduce stiffness and any further damage to the joint, to improve function of joint, and to empower self taking care for health and well-being of the patient (ARC, 2004: 10; Worawit Louthrenoo, B.E. 2546: 115). Although there is no curative therapy to hold back the 'wear and tear' process of OA, it can be prevented the disease and managed to slow down progression and decrease severity of OA knee symptoms. The optional strategies include patient education, non- and pharmacological treatment, and surgery (Altizer, 1998: 492-496; Chattaya Jitpraphai, B.E. 2542: 53; Visal Kantaratanakul, B.E. 2543: 251-252; Worawit Louthrenoo, B.E. 2546: 116-118).

Patient education

Patient education involves any set of planned educational activities designed to help patients change behaviors, health status, or health care utilization (Barlow & Lorig, 2003: 322) so that they can take care of themselves. In fact, the topics of education consist of general information regarding OA of the knee, how OA of the knee develops, what causes and risk factors are, diagnosis, treatment, and management of OA of the knee especially weight control, quadriceps exercise and joint protection. If the patients are continuously compliance, the disease symptoms will decrease, and patients will suffer less from the disease.

OA of the knee is more common in persons who perform heavy physical activity. Improper behaviors especially activities of daily living such as sitting, standing, or walking, gradually increase the risk to develop the disease. Some studies indicated that lifestyle behavioral changes for joint protection incited less pain, improvement of physical function, and increase in abilities to perform activities of daily living (Barlow & Lorig, 2003: 322; Jarunee Nantavanotayan, B.E. 2539; Rawiworrakul, 2006). Hence, some recommends for changing lifestyle of at-risk to protect and reduce joint stress as follows: (Apichana Kovindha, B.E. 2546: 210-211; ARC, 2004: 16-17):

1. Maintain muscle and joint competency by resting a little after modest exercise.
2. Avoid knee joint pressure such as kneeling, squatting, and Thai traditional sitting.
3. Do not keep the leg bent in the same position for long periods. Get up and stretch the joints from time to time.
4. Continue doing activity, but avoid activities that cause severe pain of the knee afterward.
5. Use the ambulatory aids to decrease stress on weakened joints and bones as necessary.
6. Wear comfortable shoes with shock-absorbing insoles as much as possible.
7. Go upstairs and downstairs as less as possible.
8. Use a hand-rail for support when climbing stairs. Go upstairs step by step with painless leg first and go downstairs with affected leg first, followed by another leg.
9. Use arm-rests of chairs to support when getting up.

Patient education is an effective way of reducing pain in OA, and a number of programs have been developed (Creamer, 2000: 452). A supportive educative nursing system was developed to evaluate the effect of the program on patient knowledge, capabilities for self-care, and controlling the disease in 66 community-dwelling elderly people with OA of the knee (Bootsaba Oupaichit, B.E. 2537). The experimental group received an additional supportive educative nursing system program with twice time home visit in 8 weeks, while the control group received usual nursing care. The results

showed that both groups had increased level of knowledge, capabilities for self-care and controlling the disease, and the experimental group had higher score of those than the control group. Additionally, the experimental group had positive correlation among knowledge, capabilities for self-care, and controlling the disease.

A similar study of Rawiworrakul (1999) was conducted to evaluate the effect of supportive educative nursing system on patient knowledge, discomfort from OA of the knee, and capabilities for self-care operation of 42 patients aged 50 years and over after a total knee replacement. Subjects were admitted to Siriraj hospital during May and July 1999 and Lerd-Sin hospital during June and July 1999. Both groups received usual nursing care, but the experimental group received additional supportive educative nursing system program and a hand-book provided by the investigator. The results revealed that the experimental group had more knowledge and capabilities for self-care operation after their total knee replacement. The experimental group also had less discomfort from OA of the knee than the control group, but the difference was not significant. Another two studies also showed that patient education affects self-care behaviors and controlling of the disease (Somsong Thammaraksa & Pikul Kamonsurachat, B.E. 2542; Theeranan Singchalerms, B.E. 2542). Thus, patient education was proposed to help patients with OA of the knee developing their abilities and capabilities for self taking care resulting in symptom relief and functional improvement.

Nonpharmacological treatment

The nonpharmacological treatment of OA is imperative. There are various evidences of interventions for OA managements such as quadriceps exercise, aerobic exercise, weight reduction, footwear modification, ambulatory assistive devices, and thermal modalities (Creamer, 2000: 450; Mazzuca, Page, Meldrum, Brandt, & Petty-Saphon, 2004: 716).

1. Exercises either quadriceps or aerobic exercise are important in OA management (NIAMS, 2002: 23). Proper exercise promotes mobility, flexibility, muscle strength, and endurance (Stanley & Pattillo, 2005: 145). Moreover, simple active exercises to strengthen the quadriceps can decrease joint cartilage deterioration.

With OA of the knee, patients trend to avoid physical activity because of the fear that the activity will lead to an increase in pain. Although avoiding physical activity can reduce pain, low activity levels will further result in deterioration of physical condition, especially in muscle weakness. In case of muscle weakness, joints become less stable and less able to carry a load, resulting in increased disability. Consequently, patients avoid activity even more that causes a downward spiral toward increasing physical disability that adversely affects the quality of life of these patients (Apichana Kovindha, B.E. 2546: 203-204). However, several studies showed the benefit of exercise, quadriceps exercise on decreasing severity of knee OA. Suomi and Collier (2003: 1589-1593) ascertained the effectiveness of the National Arthritis Foundation (NAF) aquatic and on-land exercise programs on functional fitness and perceived ability to perform activities of daily living (ADL) in 30 older adults with arthritis. The subjects were randomly assigned into either 3 groups of aquatic exercise, on-land exercise, or control group equally. Classes for both exercise intervention programs were conducted in 45-minute training, twice weekly sessions for 8 weeks. The study revealed that aquatic and on-land exercise subjects showed significant improvements on functional fitness, ADL, and hand-held isometric strength tests after intervention. No significant changes were found in any of these measures for the control group.

A correlation study of 120 patients attending Siriraj Hospital and Ratchaburi Hospital, proposed to determine factors affecting the rehabilitation of quadriceps muscle in patients with OA of knee (Orapin Swangwatanasade, B.E. 2540). The results revealed that there were negative correlations between severity and muscle strength ($r = -.381, p < .001$), between self-care behavior and muscle strength ($r = -.209, p < .05$), between severity and degree of flexion ($r = -.296, p < .001$), between severity and degree of extension ($r = -.376, p < .001$), and between motivation and pain ($r = -.292, p < .001$). There were positive correlations between muscle strength and perceived benefits, perceived barrier, motivation and time of exercise ($r = .267, p < .01$; $r = .249, p < .01$; $r = .349, p < .001$; $r = .231, p < .01$, respectively), and between severity and pain ($r = .690, p < .001$). Additionally, the result of the stepwise multiple regression analysis showed that severity, motivation and self-care behavior level explained 31 percent of variances of muscle strength; the severity level explained

8.8 percent of the variances of the degree of flexion and 14.2 percent of the variances of the degree of extension; and the severity and the motivation level explained 50.1 percent of the variances of pain in the OA patients. The results of this study indicated that the severity of OA was associated with muscle strength, range of motion and pain. Therefore, to improve muscle strength and range of motion, and to reduce in knee pain may decrease the severity of OA.

Aerobic exercise is frequently prescribed to patients with OA of the knee. Wished-for advantages including increased muscle strength, increased weight loss, improved mobility, and enhanced general well-being (Creamer, 2000: 451). A systematic review of randomized clinical trial of the effectiveness of exercise therapy in patients with knee OA was concluded that there was evidence of small to moderate beneficial effect of exercise on pain as well as disability and walking performance, and a medium to great beneficial effect of global well-being (van Baar, Assendelft, Dekker, Oostendorp, & Bijlsma, 1999). However, the benefit of exercise was supported by a study conducted on 439 community-dwelling subjects aged over 60 years, with knee or hip OA. Results indicated that a graded aerobic exercise (aerobic walking, three times a week) reduced pain levels by about 12% (Ettinger et al., 1997 as cited in Creamer, 2000: 452).

In addition to aerobic exercises, specific quadriceps exercises are often suggested. Quadriceps strengthening exercises and stretching or flexibility exercises are key elements of an exercise program for patients with knee OA. Lower extremity muscle strength may protect knees from getting OA, and may prevent disease progression for patients with OA (Felson & Zhang, 1998 as cited in Leslie, 2000: 53). In the early stages, strengthening may be done by isometric exercise in which the muscles contract whereas the joint stays in same position (Birchfield, 2001: 128). Isometric exercises is a form of exercise involving the static contraction of a muscle without any visible movement in the angle of the joint, and the length of the muscle does not change (Wikipedia, 2008a). The exercise helps patients to improve their stability and provides a more even distribution of weight to prevent further injury (Cote, 2001: 499). In a community-based study of 191 subjects with knee pain aged 40-80, the subjects were randomized to exercise and control (no intervention) group. The exercise group performed strengthening exercise 20-minutes daily for six months.

The results showed that an exercise intervention group reduced WOMAC pain scores for 22.5% and physical function scores for 17.4%, while the control group had a decrease of 6.2% WOMAC pain scores and unchanging physical function scores. However, both groups also reduced in the VAS scores (O'Reilly et al., 1999: 15). Likewise, results from another study indicated that isometric resistance exercises reduced pain by approximately 8% (Ettinger et al., 1997 as cited in Creamer, 2000: 452).

Additionally, isotonic exercise is a form of exercise involving the static contraction of a muscle with changing in the joint angle, and the length of muscle changes, shortens or lengthens (Wikipedia, 2008b). A study conducted on 42 patients with OA of the knee (Chadin Samorrapoom, B.E. 2543) compared the exercise with or without weight bearing. The subjects in group 1 received progressive resistive exercise for 2 weeks in a hospital and 2 weeks at home, whereas those in group 2 received isotonic exercise (no resistance) for 4 weeks at home. Findings from the both groups indicated a reduction in pain and physical function improvement in the first weeks, as well as muscle strength enhancement in the second week after participation. The results also revealed non-significant differences between groups for muscle strength, pain and physical function when compared weekly. Consistently study (Chirawan Tanwattana et al., B.E. 2545) was found in a study conducted to compare modified progressive resistive exercise of quadriceps muscle with isometric quadriceps exercise for 4 weeks. The study significantly resulted in pain reduction and physical function improvement in the first weeks after the intervention in both groups, but no significant of these variables was found between groups.

Isokinetic exercise is a form of exercise that performed with a specialized device which provides variable resistance to a movement, so that no matter how much effort is exerted, the movement takes place at a constant speed or constant angular velocity over a joint's full range of motion (Chow, 2001; The free dictionary, 2008). This type of exercise is also suggested for improving joint stability or walking endurance (Huang, Lin, Yang, & Lee, 2003: 398). In a study of 20 patients with OA of the knee (Schilke, Johnson, Housh, & O'Dell, 1996), the subjects in experimental group received isokinetic muscle-strength training program, whilst those in control group received no intervention. The experimental group performed six sets of five

maximal contractions three times weekly for 8 weeks on a Cybex II dynamometer at 90 degree per second. This study resulted in significantly reduction of pain and stiffness, and also improvement of mobility, muscle strength and range of motion in the experimental group. There were no significant differences in walking time and health status between groups or within group. A reduction in pain of participants engaging in the exercise program was consistent with a study of Maurer and colleagues (Maurer et al., 1999 as cited in Creamer, 2000: 452).

However, different muscle strengthen exercises are beneficial for patients with knee OA in different ways. A study of 132 patients with bilateral knee OA was designed (Huang et al., 2003: 398-405) to compare the effect of different muscle strengthening exercises on improving muscle strength and functional status, which was evaluated by visual analogue scale, ambulation speed, and Lequesne index. The subjects were randomly divided into 4 groups by 33 of those in each group. The subjects in group 1 received isokinetic muscle-strengthening exercise, group 2 received isotonic muscle-strengthening exercise, group 3 received isometric muscle-strengthening exercise, and group 4 acted as control. Subjects in all groups received 20 minutes of hot pack and passive range of motion exercise for 5 minutes before treatment, then subjects in group 1, 2, and 3 exercised 3 times weekly for 8 weeks. After completing the treatment, subjects in group 1 and 2 received a home exercise program consisting of 15 minutes of stationary-bike exercise, whereas subjects in group 3 performed 5 seconds of isometric contraction of muscles in full knee extension with 30 repetitions daily until follow-up one year. The results revealed that the subjects in each treatment group had significant improvement in pain reduction, disability reduction, and walking speed after treatment and follow-ups when compared with initial assessment. Isokinetic exercise led to the greatest increase of walking speed and decrease of disability after treatment and at follow-up, while isotonic exercise had the greatest effect on pain reduction after treatment. However, fewer participants discontinued the treatment because of exercise knee pain. The conclusion from this study is that isotonic exercise should be suggested for initial strengthening in patients with OA knee pain, while isokinetic exercise should be recommended for improving joint stability or walking endurance at a later time (Huang et al., 2003: 398).

Moreover, modes of exercise program can effect outcome measurements. McCarthy and colleagues (McCarthy, Mills, Pullen, Roberts, Silman, & Oldham, 2004: 880) compared the relative effectiveness of providing a home-based exercise program versus home-based exercise supplemented with an 8-week class-based exercise program in reducing pain and improving function in 214 patients with knee OA. The subjects were randomly allocated to either home or home supplemented with class-based exercise program (45-minute twice weekly for 8 weeks). Results showed that subjects in home supplemented with class-based exercise group demonstrated significantly greater improvement in locomotor function and decrease in walking pain than the home-based group at 12 months follow-up. A related study conducted on 392 community-dwelling elderly with knee OA aged 60 years and older to evaluate adherence of exercise behavior. Group exercise was prepared twice a week, 8 week durations, for the experimental group only. The results of the study revealed that the experimental group showed significant tendency to increase in quadriceps muscle strength and improve in walking distance especially in the first two months, while there were not observed in the control group. However, there was a tendency to decline in quadriceps muscle strength and walking distance by the 6th and 12th month after enrollment in both groups. This reminded health care providers concerning on encouraging the patients to keep continuing of exercise (Kuptniratsaikul, Tosayanonda, Nilganuwong, & Thamalikitkul, 2002a: 33).

A benefit of exercise combined with health education program on patients with knee OA was also reported. de Jong and colleagues (de Jong, Hopman-Rock, Tak, & Klazinga, 2004: 316-321) conducted an implementation study of evidence-based exercise and health education program on older adults with OA of the knee. The program consists of six weekly sessions of two hours, with health education in early hour and supervised exercise program by a physiotherapist in the second hour. The participants received a course book, including a home-based exercise program. The results found that 157 participants who completed the program obtained positive effects on OA knowledge, pain and self-efficacy. However, no effect was found for mobility.

In conclusion, exercise, particularly quadriceps muscle strengthening exercise, is one of the effective therapies for reducing joint pain and improving

function in patients with OA of the knee. Proper exercise promotes mobility, flexibility, muscle strength, and endurance, in contrast, excessive or inappropriate exercise may worsen OA symptoms. Consequently patients should maintain a proper balance between rest and exercise. Many studies have established that various modes of exercises are correlated with symptom relief and functional improvement of patients with diverse levels of severity of knee OA. However, data available is insufficient to help providing guidelines on the optimal exercise type or dosage exists. Additionally, all studies had quite few participants for generalizability to population, and almost all the participants were older adults. However, some studies showed that adherence to exercise was questionable; a developed program to promote adherence to exercise intervention should be set up.

2. Weight reduction is a useful treatment for obese and overweight patients with OA of the knee (Muir & Webber, 2003: 372). The fact is that many people with OA of the knee are obese. Studies have shown that people who lose weight are less likely to develop knee symptoms in the future than those who do not (ARC, 2004: 12). Weight reduction plays crucial role in decreasing stress on the joint by minimizing joint destruction and pain. Patients who are overweight should have clear understanding of the importance of weight reduction and maintain optimal weight within ideal body weight. In order to assess level of obesity, body mass index (BMI) is used to examine such a condition. BMI was examined by using formula as follows (Muir & Webber, 2003: 371):

$$\text{Body mass index (kg/m}^2\text{)} = \frac{\text{Body weight (kg)}}{\text{Height (m}^2\text{)}}$$

BMI range:

< 18.5	kilogram/meter ² is underweight,
18.5-24.9	kilogram/meter ² is normal,
25-29.9	kilogram/meter ² is overweight,
30-39.9	kilogram/meter ² is obesity, and
≥ 40	kilogram/meter ² is morbid obesity.

As known, being overweight not only effects knee joint, but also weakens general health, and increases the risk of heart disease, strokes, and diabetes. The patients are recommended to eat a balanced, healthy diet and keep their weight as close as possible to the ideal range for height and age (ARC, 2004: 12). Several methods, therefore, were used to lose weight in obesity including dietary change, exercise, drug therapy, and surgery. Weight reduction in general, dietary change in combination with exercise and behavior therapy are suggested (O'Reilly & Doherty, 2001: 564). For dietary change, the patients who need to lose weight should follow the recommendation as eat a diet low in carbohydrate and high in fiber, avoid fatty or high cholesterol diet, eat protein diet from fish than meat or beef, avoid frequent irregular eating, avoid desserts and sweet beverage such as soft drink, tea or coffee, and avoid alcoholic drinks such as whisky, beer or wine. Additionally, frequent self-monitoring can help patients to encourage weight loss.

There are some studies conducted to explore the association between obesity and knee OA. Evidence have shown that patients who can lose weight and do the exercises can mostly improve their OA (ARC, 2004: 12). In a study of 126 patients with bilateral knee OA and obesity, the subjects were classified into three groups by their stages of OA, and each group was divided into three subgroups. The subjects in subgroups A, B, and C, received weight reduction treatment, weight reduction and electrotherapy modalities, and only electrotherapy modalities for relief pain, respectively. Weight reduction treatment included weekly auricular acupuncture, counseling for dietary control, and aerobic exercise. The results showed that there were more weight reduction and pain reduction, increased in ambulation speed, and decreased in Lequesne's index of the subjects in subgroups A and B than those in subgroup C (Huang et al., 2000: 398-404).

Messier and colleagues (Messier et al., 2000: 1062) compared an exercise with weight reduction program and exercise alone in 24 community-dwelling obese older adults with OA of the knee. The subjects in the experimental group received an exercise program with weight reduction whereas those in the control group received only an exercise program. The results revealed that, after 24 weeks of intervention, the subjects in the experimental group reduced more weight (8.5 kilograms) than those in

the control group (1.8 kilograms). Finding from this study revealed a significance of reducing pain, improving function and increasing muscle strength in both groups.

A large consistent controlled trial was conducted on 316 sedentary overweight and obese older adults with knee OA (Rejeski et al., 2002: 422). The subjects were randomly classified into one of four groups: healthy lifestyle control; dietary weight loss; structured exercise; or combined exercise and dietary weight loss. Exercise training consisted of aerobic and strength training for 60 minutes, three times weekly for 18 months in group and home-based setting. Results revealed that the participants in control group lost 1.3 percent of body weight whereas those in exercise group, dietary group, and combined exercise and dietary treatment group lost 2.6, 5.7, and 4.4 percent, respectively.

3. Assistive or supportive devices such as cane, crutches, walker, and knee brace or splint, were used to decrease stress on weakened joints and bones during weight-bearing activities (Mourad, 1995: 42; Stanley & Pattillo, 2005: 145). Knee braces, which are designed to decrease the load on the medial or lateral side of the joint deformity and to reduce pain associated with high compartment loading, are occasionally used to correct deformity (Creamer, 2000: 452). This is supported by results from a study conducted on five subjects diagnosed with medial compartment OA. A valgus loading knee brace significantly reduced the varus moment during gait at 20 and 25 percent of stance, and contributed to reduce pain in patients with a varus deformity (Self, Greenwald, & Pflaster, 2000: 191-192). A related study also found a reduction in pain in 12 of 15 subjects when using braces (Komistek, 1999 as cited in Creamer, 2000). However, wearing comfortable shoes with shock-absorbing insoles which is another supportive device, can also reduce knee pain, while using heel wedges is a method of correcting the abnormal biomechanics seen in knee OA (Creamer, 2000: 452).

4. Thermal modalities including heat, cold, or other treatments such as diathermy are also suggested for patients with knee OA. Pain, a predominant symptom of knee OA, is often relieved with use of heat or cold application by vasodilatation or vasoconstriction (Mourad, 1995: 44). Heat therapy, although avoided during acute inflammation, can be applied by various modalities including hot packs, ultrasound, whirlpool, paraffin wax, and massage (Altizer, 1998: 494). Evidence from a double-

blind randomized controlled pilot study designed to test the effects of a heat-retaining knee sleeve (specially fabricated to retain body heat) on 52 patients with symptomatic knee OA (Mazzuca et al., 2004: 716) revealed that after 4 weeks of sleeve wear subjects in the active treatment group reported a 16% decrease in mean WOMAC pain score relative to baseline ($p = .001$).

5. Alternative approaches such as reflexology and acupuncture are effective treatments of knee OA (Creamer, 2000: 453). The evidence from Haera's study revealed that reflexology used as a complementary therapy relieved joint pain and decreased drug used for relief of pain (Haera, 2003).

Pharmacological therapy

Pain is the most discomfort symptom of OA and is the main reason why patients inquire about medical treatment (Creamer, 2000: 450). Pharmacologic agents such as analgesics and nonsteroidal anti-inflammatory drugs (NSAIDs) augment the benefits of the nonpharmacologic modalities (Mazzuca et al., 2004: 716).

Simple analgesics such as acetaminophen and aspirin are used to treat OA (Surasak Nilganuwong, B.E. 2544: 144-146). Although full dose acetaminophen is recommended as the first line drug treatment of OA, there is evidence that the simple drug is underused. In the Women's Health and Aging Study, for example, 41% of women with severe lower limb OA pain were using less than 20% of the recommended maximum dose of simple analgesia (Pahor et al., 1999 as cited in Creamer, 2000).

Nonsteroidal anti-inflammatory drugs (NSAIDs) such as naproxen, piroxicam, and diclofenac are often used in patients with OA. Principle of treatment is adequate a low dose NSAID for effective painless, and stopping with disadvantage for fewer side effects, especially gastrointestinal ulcers (ARC, 2004: 10; Surasak Nilganuwong, B.E. 2544: 144-146). Newer NSAIDs like cyclooxygenase-2 (COX-2) inhibitors may be used in patients for whom simple analgesia is inadequate (Creamer, 2000: 450). These products are no more effective in OA than existing NSAIDs, but have significantly less toxicity of the gastrointestinal tract (Langman et al., 1999 as cited in Creamer, 2000). On the other hand, these products increase risks of heart attack and stroke;

therefore, they are not suitable for people who have had underlying such diseases (ARC, 2004: 11).

However, other drugs, such as glucosamine and chondroitin sulfate, intra-articular hyaluronic and corticosteroids, and antispasmodics are also popular to use for symptomatic knee OA. Glucosamine and chondroitin sulfate are naturally occurring amino monosaccharide constituent of articular cartilage glycosaminoglycans (Creamer, 2000: 453) and have been used for supplementing natural cartilage of the joint. Intra-articular hyaluronic has been accessible for the treatment of symptomatic knee OA by supplementing natural synovial fluid of the joint (ARC, 2004: 11; Creamer, 2000: 453).

Intra-articular corticosteroids, either injected into tender spots around the knee or the affected joint itself, are powerful anti-inflammatory hormones that are naturally produced in the body or synthetic for use as medicine to temporarily relief pain. However, they are normally not recommended for more than two or three treatments per year (ARC, 2004: 11; NIAMS, 2002: 16-17).

Antispasmodics were also used to relief muscle spasm caused by muscle pain, while other analgesics, a centrally acting mu opioid agonist, such as oxycodone and tramadol (Creamer, 2000: 452) are also effective to relief moderate and severe pain.

Surgery

The treatment may be suggested for patients when physical therapy, assistive devices, medical therapeutics and other treatments do not lead to significant improvement, and when pain becomes disabling (Stanley & Pattillo, 2005: 145). Operations used to treat the OA patients include arthroscopic debridement, realignment osteotomy, and knee arthroplasty.

Arthroscopic debridement is performed to remove loose pieces of bone and cartilage from the joint and resurface bones if they are causing mechanical symptoms of buckling or locking (NIAMS, 2002: 18). On the other hand, realignment osteotomy is made to correct the position of bone to the right alignment (NIAMS, 2002: 18).

Arthroplasty is the surgical replacement of joint performed to relieve pain, improve or maintain range of motion, and correct deformity. Arthroplasty includes replacement of part of a joint, surgical reshaping of the bones of the joints, or total

joint replacement (Stanley & Pattillo, 2005: 145-146). Total joint replacement is of great value in the treatment of OA pain, especially at hip or knee (Creamer, 2000: 453). In a community-based study of the outcome of knee replacement, patients reported having significant and persistent relief of pain, improved physical function, and had satisfaction with the result 2-7 years post-operatively (Hawker et al., 1998 as cited in Creamer, 2000).

In conclusion, the treatments for patients with OA of the knee including patient education, non- and pharmacological treatment, and surgery were employed for patients with OA of the knee to relieve discomfort and pain, reduce stiffness, improve function of joint, reduce any further damage to the joint, and empower self taking care to the patient for health and well-being. Additionally, the patients were provided with knowledge on preventions and decrements of knee symptoms of OA to develop their abilities and capabilities for self taking care that result in symptom relief and functional improvement.

Self-Efficacy Theory

Self-efficacy theory proposed by Albert Bandura, was developed from a social learning theory which maintain that persons learn from the past event and experience by observation, self regulation, and perceived self-efficacy. This learning from any evidence is an experience that affects the persons' behavior and influences confidence to act or making decision in the future (Bandura, 1977: 58-59). According to the social learning theory, behavior does not happen or change by environmental factors alone. Behavior is a reciprocal determinant of three factors including a) internal personal factors in the form of cognitive, affective, and biological events, b) behavior condition, and c) external environmental influences. They create interactions, which result in a 'triadic reciprocity' as each factor influences more or less different effect (Bandura, 1997: 6). Self-efficacy is a cognitive process of individuals' confidence in their perception to regulate their motivation, through processes, emotional states, and social environment in performing a specific behavior (Bandura, 1977: 79-80). Perceived self-

efficacy is a part of self-reflective capability in the cognitive process that results in changing behaviors (Bandura, 1986: 21).

Perceived self-efficacy is defined as confidence of people's competency to organize and execute the courses of action required to produce given attainments (Bandura, 1997: 3). Persons' action is based on self-efficacy. If person believe that they have self-efficacy, they will show capability, tolerance, and accomplishment behaviors. Thus, people who have high self-efficacy will seek information to prevent or stop risky behaviors and seek care during the onset of symptoms more than those with low self-efficacy. Furthermore, self-efficacy is considered the best prediction of health promotion.

Self-efficacy is a dynamic cognitive process in which an individual evaluates his or her competency to perform a given behavior as shown in Figure 1. The purpose of self-efficacy for explanation and prediction in behavior is founded on the proposition that behavior is initiated, performed and maintained as a function of efficacy beliefs (efficacy expectations) and outcome expectations. Efficacy beliefs are expectations about individuals' ability to engage in or master behavior, while outcome expectations are expectations about outcomes as the results from individuals' engagement in behavior (Bandura, 1997: 21-23).

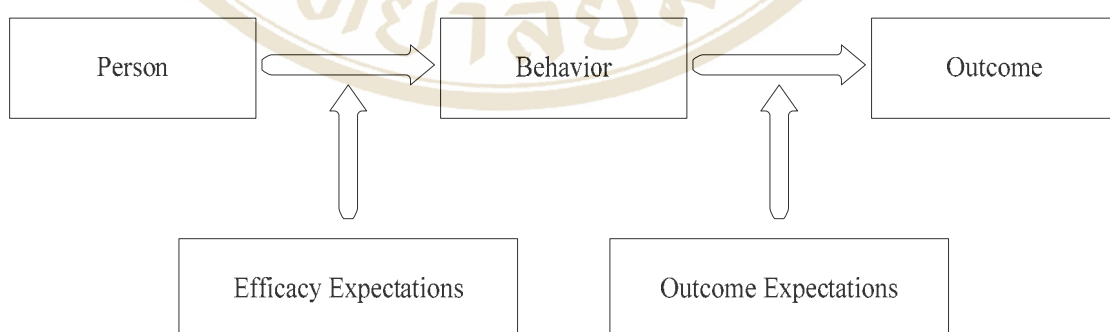


Figure 2. The Relationship between Self-efficacy Beliefs and Outcome Expectancies from Behavior (Bandura, 1997: 22)

Sources of efficacy expectations

Perceived self-efficacy is based on four principle sources of information including enactive mastery experiences, vicarious experiences, verbal persuasions, and physiological and affective states (Bandura, 1977: 81-82; Bandura, 1986: 399-409; Bandura, 1997: 80-113).

1. Enactive mastery experiences. These are the most influential source of efficacy information because they provide the most authentic evidence of whether one can master whatever it takes to succeed. Successful performances increase self-efficacy, whereas repeated failures reduce it, especially when failures occur before a sense of efficacy is gradually built. Developing enactive mastery experiences can be enhanced through direct performance accomplishments. The effect of actual experience on self-efficacy is modified by individuals' interpretations of their performance and desired outcome. The extent to which individuals will change their perceived efficacy through performance experiences depends on, among other factors, their perceptions of their abilities, the perceived difficulty of the task, the amount of effort they expend, the amount of external support they receive, the circumstances under which they perform, the timing and pattern of their success and failure experiences, and the way these enactive experiences are cognitively organized and reconstructed in memory.

2. Vicarious experiences. These are alterations self-efficacy through transmission of competencies and comparison with attainments of others. Others individuals' performances provide a primary source of information on skills and abilities. Previous observation in another person's behavior is associated with observer's self-efficacy, depending on whether the observer perceived these experiences as positive or negative. Observational learning can has powerful impact on perceived self-efficacy, especially in the absence of previous experience. Supporting persons to observe effective role models is important to gain their self-efficacy and promote positive behavior. For further encouraging the role modeling effect, demonstrations should make a complex behavior simpler by breaking it into easy steps for success. Vicarious experiences were applied during live and also symbolic modeling. Live model is the model that observers can interact with, or the model in which observers do not have to depend on constructors or symbols. Symbolic

model is the model that observers can pass symbols such as cinema, video, slide, cartoon or written materials. The presentation of the model depends on behaviors and applications.

3. Verbal persuasions. Individuals frequently take the appraisal of others as valid assessment of their own abilities that can affect the level of self-efficacy. They are guided to try hard enough to be successful by encouragement from influential others such as healthcare professionals and peers, and cultivated their belief that they have the ability to achieve success. Social persuasion can reinforce individuals' sense of efficacy, especially when they are struggling with difficulties. Persons who get persuasive verbalization are more likely to mobilize greater effort and increased perceived self-efficacy.

4. Physiological and affective states (emotional arousal). These can influence persons who individually judge their capability, strength, and vulnerability to dysfunction. Individual make inferences about their abilities from emotional arousals and other physiologic cue experiences while enacting behavior or expecting its enactment. Positive interpretations of arousals such as excitement and satisfaction augment individuals' sense of self-efficacy; whereas negative interpretations like pain, fatigue, discomfort, anxiety, and stress reduce it. Learning to control and adjust appropriate positive and negative physiological and affective states is a considerable step in gaining behavior proficiency.

In summary, health behavioral change is the result of reciprocal relationships among personal factors, behavior, and environment. Therefore, self-efficacy and outcome expectations are dynamic and form the most important characteristics that determine behavioral change. Evidence from various studies indicated that self-efficacy promotes health behavioral changes in diverse population.

Many studies in people with OA of the knee, using self-efficacy theory as a theoretical framework, indicated that enhancing self-efficacy interventions could increase exercise behavior and physical activities, and reduce knee pain and discomfort related to OA of the knee. A study of 72 patients with OA of the knee OA (Jarunee Nantavanotayan, B.E. 2539) assessed the effectiveness of the health education program with an application of self-efficacy theory aimed to relieve knee pain among these patients. The 36 subjects in the experimental group received health

education program applying self-efficacy theory, whereas the 36 subjects in the comparison group received routine instruction. The study revealed that the experimental group had significantly increased in efficacy expectation more than before the intervention and more than those of the comparison group. Moreover, outcome expectation and behavior including avoidance knee joint pressure, efficacy of weight control, and quadriceps exercise in the experimental group had significantly improved more than before the participation.

A consistent study of health education promotion program with an application of self-efficacy theory and health belief model for OA of the knee people in the elderly club at Thammasat Chalermprakiat Hospital (Kaysorn Sumpaothong, B.E. 2536) revealed that 40 elderly persons who received health education promotion program had gained more self-efficacy expectation and behaved rightly than before the intervention and than those of the 36 older adults in a comparison group.

In a community-based study conducted to examine the effectiveness of traditional Thai exercise program for OA of the knee among the elderly in Amphur Watphleng, Ratchaburi Province (Thongsamrit, 1998), the 36 subjects in the experimental group received specific instruction on Thai traditional physical exercise which was developed by applying self-efficacy and social support theories, whereas the 36 subjects in the comparison group received routine instruction from the district hospital. The results showed that the experimental group got significantly higher mean scores of self-efficacy expectation, outcome expectation, muscle recovery, and knee OA condition control than before the intervention and than those of the comparison group. The difference in mean scores of those variables before and after the intervention in the experimental group was also significantly higher than those in the comparison group. Results showed that the instruction of Thai traditional physical exercise with the application of self-efficacy and social support theories can control and relieve OA of the knee condition in the elderly group since elderly who received this instruction could reduce their use of medicine and lower their pain from OA of the knee. A related study was conducted on 141 patients who had chronic OA of the knee at the out patient clinic, Department of Orthopedics Pramongkutklao Hospital (Moungthong, 2000). Sixty nine patients in the experimental group participated in a health education program in the field of OA by applying self-efficacy theory, whereas

72 of those in the comparison group did not. This study revealed that after the participation, the experimental group had significantly increase in self-efficacy and outcome expectation on self-care behaviors more than before participation in the intervention and those in the comparison group. The health education program provided participants to change self-care behaviors on diet control, regular quadriceps exercise and prevention of the positions that might increase pressure on the knee joints. These changes of self-care behaviors resulted in decreased body weight body mass index and knee joint pain.

Conclusion

OA of the knee is a chronic and degenerative condition affecting middle-aged and older adults which its prevalence associated with increased age and repetitive mistaken use of joints. Without appropriate prevention and management of the disease, effect in physical, psychological, social and economic aspects will lead to poor quality of life and a struggle of health insurance system. Previous studies suggest a number of methods for prevention and decrease symptoms of knee OA, especially health education and exercise. In spite of an effectiveness of the methods mentioned in elderly, there were reports of discontinuity in following health care instructions since health practice behaviors are usually challenging to change and required to be consistent in order to obtain favorable effect. Many studies applied self-efficacy theory in developing health education and exercise program that indicated the effectiveness on good health behavior purposely exercise. Furthermore, concerning the appropriate management and prevention knee OA in middle-aged adults is important to slow down the progression of the severity of knee symptoms in later life. Hence, this study aims to examine the impact of integrated health education and exercise program, facilities-based and supervised home-based exercise program, based on self-efficacy theory among middle-aged adults. Participants who participated in either the program are expected to reduce knee pain, decrease severity of knee symptoms, increase health status and quality of life. Also, supervised home-based exercise program is desirable for application in most patients with OA of the knee in term of economization. Nonetheless, personnel in the organizations with the sport center facilities have more choices of exercise.

CHAPTER III

MATERIALS AND METHODS

Research Design

This study was a quasi-experimental study, two comparison group pretest-posttest design, conducted to determine the impact of an integrated health education and exercise program on knowledge, self-efficacy expectations, behaviors and health outcomes among middle-aged adults with osteoarthritis (OA) of the knee. Data were collected at baseline, 2-, 8-, and 12-week after the implementation of the program as shown in Figure 3.

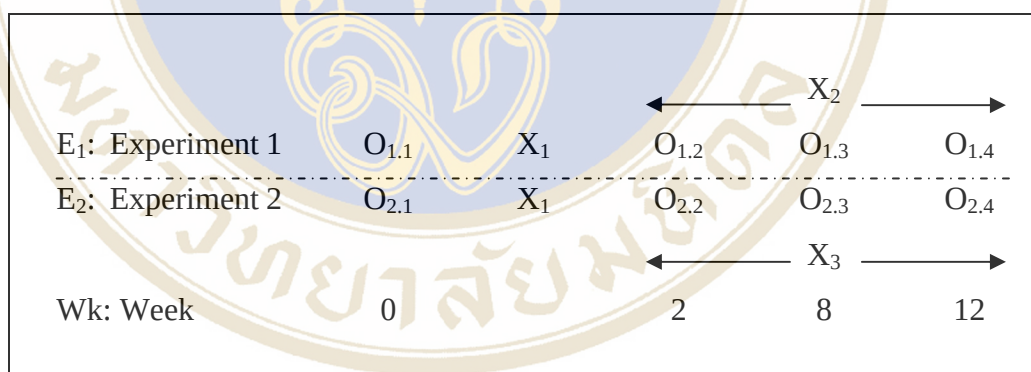


Figure 3. Description of Data Collection Periods

Experimental group 1: Participants received a health education program (X₁) and executed the 12 week facilities-based exercise program (X₂)

Experimental group 2: Participants received a health education program (X₁) and executed the 12 week supervised home-based exercise program (X₃)

X₁: Health education program

X₂: Facilities-based exercise program

- X₃:** Supervised home-based exercise program
- O_{1.1}, O_{2.1}:** Data collection and assessments at baseline
- O_{1.2}, O_{2.2}:** Data collection and assessments at the 2nd weeks after enrollment
- O_{1.3}, O_{2.3}:** Data collection and assessments at the 8th weeks after enrollment
- O_{1.4}, O_{2.4}:** Data collection and assessments at the 12th weeks after enrollment

Population and Sample

Population

The target populations of the study were personnel of the Faculty of Medicine, Ramathibodi Hospital, and patients visiting the orthopaedics outpatient department of the Faculty of Medicine, Ramathibodi Hospital, Bangkok. They were middle-aged (aged 38-59 years) women who suffered knee pain and had clinical symptoms of OA of the knee.

Sample

The approximate sample size was computed by using following equation: (Jayantorn Patumanond, B.E. 2541: 181)

$$n_1 = \frac{(Z_\alpha + Z_\beta)^2 \times \sigma^2 \times (r + 1)}{(\mu_1 - \mu_0)^2 \times r} \quad \text{While } r = \frac{n_0}{n_1}$$

n_0 = Number of control group

n_1 = Number of treatment group

r = Ratio of control and treatment

Z_α = Standard of Z table at type I error (α)

Z_β = Standard of Z table at type II error (β)

σ = Standard deviation in population (Assume that both groups were same resource)

μ_0 = Mean of outcome in control group

μ_1 = Mean of outcome in treatment group

The study determined based on statistical power analysis, at a significance level of .05, a desired power of .08, and set number of treatment and control group as equal ($r = 1$). Means of the results from a previous similar study was used to calculate the sample size in this study (Jarunee Nantavanotayan, B.E. 2539).

Substitution in the equation:

$$n_1 = \frac{(1.96 + 0.84)^2 \times (3.33)^2 \times (1 + 1)}{(40.22 - 37.88)^2 \times 1} = 31.73$$

The sample size for the study should be 32. Since participants in this study would be monitored for 12 weeks, participants dropping out from the study might threaten the study validity. Adding 10 percent attrition rate was considered; therefore, the sample needed in each group for detecting a significance difference between groups was 35 individuals.

Inclusion criteria. The inclusion criteria were:

1. Met the clinical classification criteria of OA of the knee of the American College of Rheumatology as followings (Altman et al, 1991: 11)

- a. Age 38 years or above
- b. Knee pain for most days of prior month
- c. Crepitus on active joint motion
- d. Morning or resting stiffness of the knee ≤ 30 minutes
- e. Bony enlargement

According to the criteria, participants would be recruited in the study if they met the criteria as:

- 1) a, b, c, d or
- 2) b, c, d, e or
- 3) b, e

Or participants were eligible if they were diagnosed with OA of the knee by orthopaedists

2. Not having knee injury e.g. fractures

3. Not having orthopaedic surgery of major lower extremity joint e.g. knee or hip arthroplasty, menisectomy, arthroscope
4. Not currently treated by using steroid injection into the affected knee
5. Not planning for total knee arthroplasty during participation in the study
6. Not having serious medical conditions of that were contraindicated to exercise e.g. unstable angina, myocardial infarction, respiratory disease
7. Willing to participate in the study and signed an informed consent pre-participation

Exclusion criteria. The exclusion criteria were as following:

1. Performed the facilities-based exercise program less than twice a week for experimental group 1 and performed the supervised home-based exercise program less than twice a week on average for experimental group 2.
2. Had progression of severity of knee symptoms leading to receiving medical treatments such as steroid injection or operation.
3. Declined or withdrew from the study.

At initial recruitment, there were 73 participants who met inclusion criteria and agreed to participate in the study. They were assigned into two groups by convenience sampling technique and matching similar characteristics namely job characteristics, severity of knee symptoms, body mass index (BMI), and age. There were 36 participants in the experimental group 1 and 37 participants in the experimental group 2.

Setting

The study was conducted at the orthopaedics outpatient department and the Sport Center of the Faculty of Medicine, Ramathibodi Hospital from January to May 2007. The orthopaedics outpatient department provides the service for clients who have musculo-skeletal problems, e.g. knee, hip, and spine problems. For patients who experience knee problems, they can access the medical services on patient education, non- and pharmacological treatment, or surgery. Regarding the Sport Center, it was set up to facilitate personnel who are working at Ramathibodi Hospital with several

devices for exercising. Additionally, there are sports trainers who are responsible to advise how to perform suitable exercise. The Sport Center opens from 5 a.m. to 10 p.m.

Instruments

Instruments for data collection

1. **The demographic questionnaire** (Appendix A). The questionnaire was developed by the researcher in order to gain information (i.e. age, educational level, occupation, and job characteristics), body weight and height, symptoms related to OA of the knee, methods of treatments, pain management of the affected knee, medical history, and previous exercise practice. Some items were open-ended questions, while the others were checklist questions.

2. **The OA knowledge test** (Appendix B). This instrument was translated and modified from “test your arthritis knowledge” (American Academy of Orthopaedic Surgeons, 2003) by the researcher. This 10-item question was employed as to assess the participants’ knowledge about OA including deterioration, causes and risk factors, signs and symptoms, and impact and management of OA. It was a true/ false format. One point was given for each correct answer. The possible total score ranged from 0 to 10. The higher scores, the more knowledge on OA.

Validity and reliability. After translation and modification of the test, the instrument was validated for its appropriate language and content by five experts including one orthopaedist, one physiatrist (rehabilitation physician), two orthopaedic clinical nursing teachers, and one clinical orthopaedic nurse specialist (Appendix I). The test was corrected following the experts’ recommendations. Then, it was administered to test for reliability among 10 middle-aged patients with OA of the knee who shared similar characteristics to the participants. The KR-20 was reported as .82.

3. **Self-Efficacy expectation questionnaire** (Appendix C). The instrument was used in order to assess self-efficacy expectation of health behaviors. This 15-item instrument was developed by Jarunee Nantavanotayan (B.E. 2539) based on the self-efficacy theory. There were positive and negative items. The score for each positive

item was 0 (no), 1 (uncertainty), and 2 (yes) and the scores were reversed for negative items. The possible total score ranged from 0 to 30. The higher scores, the more self-efficacy expectation of the participants.

Validity and reliability. The original instrument was validated by five experts and revised as the experts recommended. After that, the validity and reliability were tested among 30 middle-aged patients with OA of the knee who shared similar characteristics to the participants. The Cronbach's alpha coefficient of the instrument was .75 (Jarunee Nantavanotayan, B.E. 2539). The instrument was not tested for reliability prior to study because the study sample had similar characteristics to the previous study sample. The Cronbach's alpha coefficient of the instrument in this study was .80.

4. Health behavior questionnaire (Appendix D). The instrument was employed to assess participants' health behaviors. This 11-item instrument was developed by Jarunee Nantavanotayan (B.E. 2539). It investigated three subjects namely maintain of optimal weight (5 items), joint protection (4 items), and exercise (2 items). There were positive and negative items. The score for each positive item ranged from 0 (never) to 3 (usually) while the scores for negative item was reversed. The possible total score ranged from 0 to 33. The high scores showed that the participants performed suitable health behaviors related to reduce knee OA symptoms.

Validity and reliability. The original instrument was validated by five experts. The revision following the experts' recommendation was done. Then, it was tested for reliability among 30 middle-aged patients with OA of the knee who shared similar characteristics to the participants. However, the Cronbach's alpha coefficient of the instrument was not reported in the previous study (Jarunee Nantavanotayan, B.E. 2539). In this study, the instrument was administered to test for reliability among 10 middle-aged patients with OA of the knee who shared similar characteristics to the participants. The Cronbach's alpha coefficient of the instrument was .68 in the preceding study, and was .78 in the succeeding study.

5. Modified WOMAC scale (Appendix E). This instrument was first developed as the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) by Bellamy and Buchanan (1986) to assess pain, stiffness, and physical function for patients with OA. It was translated and modified by Sek Aksaranugraha

(B.E. 2543). This 24-item instrument consisted of three parts including pain questions (5 items), stiffness questions (2 items), and physical function questions (17 items). The instrument was employed to assess the severity of knee symptoms (SEV-OA). The score of each item ranged from 0 (good) to 10 (bad). The possible total score ranged from 0 to 240. The high score indicated that the participants had severity of OA knee symptoms.

Validity and reliability. The instrument is commonly used as a standard public instrument. The published studies were reported elsewhere, for instance, Mazzuca, Page, Meldrum, Brandt, & Petty-Saphon, (2004), O'Reilly et al. (1999), Chirawan Tanwattana et al. (B.E. 2545), and Chadin Samorrapoom (B.E. 2543). All WOMAC subscales (pain, stiffness, and physical function) were internally consistent with Cronbach's coefficient alpha of 0.91, 0.81, and 0.84, respectively (Salaffi et al., 2003). In Thai people, the test-retest reliability had correlation coefficients ranging from 0.65 to 0.71. The internal consistency had an alpha ranging from 0.85 to 0.97 (Kuptniratsaikul & Rattanachaiyanont, 2007).

6. Back-leg dynamometer (Appendix J). It is a device used to assess quadriceps muscle strength. It shows the maximal force of the quadriceps muscle group to perform an extended knee. The participants followed procedure for muscle strength testing which was conducted by the researcher. The highest data among two testing was selected to calculate for muscle strength. The data was then divided by individual body weight; the muscle strength was reported as kilogram per body weight. The criterion to evaluate muscle strength was interpreted on the basis of age and sex of participants (Ministry of Tourism and Sports, B.E. 2548).

Procedure for muscle strength testing. The participants stood on the stand of the instrument, bent and separated their knees until they reach 130 degrees of knee flexion with back and arms straight. Afterward, they held the handle in probation of hands and fixed the chain in optimal length. Later, the participants extended knee with highest force. Finally, the participants repeated the same procedure once more. The higher data was recorded. Then, the data was divided by individual body weight.

Validity and reliability. Calibration was done by the manufactory at first and maintained by the distributor of Marathon, Company. The researcher was trained to use this instrument by sports trainers at the Sport Center, Faculty of Medicine,

Ramathibodi Hospital. Repeated training for muscle strength testing decreased error of the study. The inter-rater reliability was .73.

7. Goniometer (Appendix J). It is a standard tool with 360 degree clear plastic used to assess range of motion (ROM) of the affected knee. It consists of a protactor with a movable and a fixed arm. Measuring ROM was performed during full extension and flexion of the knee. The participants' ROM was measured by the researcher based on the procedure for ROM measurement. A normal value of knee extension and flexion ranged from 0 to 140 degrees (Pornchai Mulpruek, B.E. 2547: 51; Sattaya Rojanasthien & Samphan Phadungkiat, B.E. 2536: 73). If the participants could extend the knee larger than 0 degree or has knee flexion less than 140 degrees, they would be determined as abnormal ROM.

Procedure for ROM measurement. This measurement used Cave and Robert's method or Neutro-0-method. The angle of joint started at 0° and was increased by knee joint movement (Chattaya Jitraphai, B.E. 2543: 27-28). The participants sat on a chair and tried to maximally flex and extend their knees by themselves. The fulcrum of the goniometer was placed at the lateral epicondyle of femur and the fixed arm aligned parallel with the straight-leg. Then, the participants fully stretched the leg. The movable arm of the goniometer was aligned parallel with the leg and the angle was recorded. Finally, the participants flexed their knees until reaching maximal ROM. The movable arm of the goniometer was aligned parallel with the leg as above and the angle was recorded. The other knee was measured based on the same procedure.

Validity and reliability. Calibration was done by measuring a series of angles compared with a protractor. The researcher was trained for using this instrument by an orthopaedist. Repeated training for ROM measurement would decrease error of the study. The inter-rater reliability was .78.

Instruments for the implemented intervention program

1. Knee OA booklet (Appendix K). The booklet was translated and modified from an information booklet "OA of the knee" (Arthritis Research Campaign, 2004) combining with literature review by the researcher. Content of the booklet contained

three topics. The first topic describes general information regarding OA of the knee including definition of knee OA, how OA of the knee develops, and what causes and risk factors are. The second topic provides information on diagnosis and treatment strategies that explains how patients can recognize the knee symptoms, and how health care providers diagnose and treat it. The last topic is the management of OA of the knee consisting of advices the patients in regard to weight control, quadriceps exercise and joint protection.

Validity and reliability. The content validity was confirmed by five experts (Appendix I), the same experts as mentioned in the OA knowledge test validity. The booklet was revised following the experts' recommendations. Then, it was tested among 5 middle-aged patients with OA of the knee who share similar characteristics to the participants aimed at testing the language understanding and well visualized reading. It was modified following suggestions before publishing.

2. VCD entitled 'Knee OA Prevention and Management' (Appendix L). The VCD was developed by the researcher. The VCD's content was consistent with the content in the booklet including general information regarding OA of the knee, diagnosis and treatment strategies, and management of OA of the knee.

Validity and reliability. The content validity was tested by five experts, the same experts as mentioned in the OA knowledge test validity. Then, the revision was done after receiving the experts' recommendations. It was tested for satisfaction in listening and watching among 5 middle-aged patients with OA of the knee who share similar characteristics to the prospective participants prior to implement.

3. Weighing scale with height meter (SECA). It was used to measure weight and height. The weight was read in details of a hundred gram, or one-tenth kilogram, and the height was read in centimeters with details of millimeters. The participants were asked to stand barefoot on the accurate weighing scale and closed their heels together, stretching upward to the fullest extension for height measuring.

Validity and reliability. Calibration was done as a routine schedule annually; the latest calibration was assessed in March 2006. However, it was calibrated before data collection in January 2007.

4. **Cross trainer** (95Xi total body trainer of Life Fitness Company) (Appendix J). It is a device for exercising to produce muscular and cardiovascular endurance without worsening pain or exacerbating arthritis symptoms. Exercising with the cross trainer included isotonic and isokinetic exercises of quadriceps and hamstrings muscle groups.

Validity and reliability. Calibration was done as a routine schedule for every 4 months by the distributor. The last calibration was done in January 2007.

5. **The assessment form** (Appendix F) was developed by the researcher for recording body weight, ROM and muscle strength of an individual participant.

6. **Exercise performance record form** was developed by the researcher for recording the number of facilities-based (Appendix G) or supervised home-based (Appendix H) exercise practice per week.

Methods

Preparation phase. In this phase, several activities were performed.

1. Develop the instruments of the study.
2. Test for validity and reliability of the instrument.
3. Submit study's proposal to the Institutional Review Board (IRB), Faculty of Medicine, Ramathibodi Hospital, Mahidol University.
4. Send permission letters for data collection from the Faculty of Graduate Studies to the chairman of the Sport Center and the Orthopaedics Department, Faculty of Medicine, Ramathibodi Hospital, Mahidol University.
5. Train the research assistants.
6. Recruit the voluntary participants by posters, web board, and handbills. Then, select the eligible participants who meet the inclusion criteria of the study.
7. Explain the purpose and benefits of the study, protection of human rights, and complete an informed consent
8. Collect data at the baseline time.

Implementation phase. Participants went through procedure as follows:

A 12-week intervention consisted of health education program and exercise program. The health education program was designed as to provide general information regarding OA of the knee including definition, causes and risk factors, signs and symptoms, diagnosis, treatments, and preventions and management of OA of the knee focusing on lifestyle behavioral changes for joint protection, weight control strategies, and quadriceps muscle exercises for muscle strength and joint ROM enhancements. Regarding lifestyle behavioral changes, a person must feel confident in his/her ability to take action and persist in action; therefore, the developed intervention was applied the self-efficacy as a basis.

At baseline. The health education program was provided once as workshop to the group of participants with knee OA as follow:

1. The first 15 minutes were set up for evaluating baseline data, and discussing information to worksheets and practice suggestions.
2. The education session lasted 60 minutes with slides of power points and 30 minutes with VCD presentation, and was conducted and summarized the content matter delivered during each part of education by the researcher.
3. Additional 15 minutes were provided for any question from the participants and group discussion. The discussion was focused on information including symptoms and participations' effects on life, personal behaviors related to OA of the knee, individual risk factors and management of OA of the knee, benefits of exercise in people with OA of the knee and precaution.
4. A knee OA booklet was given to each participant after the education session.

After health education program was provided, the participants in experimental group 1 would then be given a facilities-based exercise program consisted of isotonic and isokinetic quadriceps muscle strengthening exercise. They were individually trained by a sport trainer to use cross trainer at the Sport Center of Faculty of Medicine, Ramathibodi Hospital until they felt confident in performing exercise by themselves. They will treadle a cross trainer up and down repeatedly, and were assigned to perform 30 minutes exercise per session, three times a week during 12

weeks after enrollment of the study throughout protocol for exercise with cross trainer. The participants were also required to meet the researcher at least once a week.

Protocol for exercise with cross trainer;

1. Checking pulse rate before beginning an exercise and apply polar, a heart rate chest strap, for heart rate monitoring during exercise
2. Getting on a cross trainer machine. Standing on neutral position and holding the inner handlebars.
3. Begin treading to start the machine. Setting the mode of exercise as fat burn.
4. Warm up for 5 minutes by treading with speed of five kilometers/hour.
5. Aerobic exercise with increasing speed until it reaches 10 kilometers/hour. Try to maintain the speed for 15 minutes (15 minutes in the first and second week, 20 minutes in the third and fourth week, and 25-30 minutes in the fifth to twelfth week). Pause and rest, if exhausted or necessary. During exercise, intensity should be equal or less than 75 percent of maximum heart rate. The equation is maximum heart rate equals to 220 minus age. The participants' heart rate monitoring was shown on message window of the machine.
6. Cool down for 5 minutes by slowing down the speed of exercise.
7. Stretching for 5 minutes after getting off the machine.

According to the experimental group 2, after health education program was provided, the participants would then be given a supervised home-based exercise program consisted of isotonic and isometric quadriceps muscle strengthening exercise by VCD presentation. They were individually trained by the researcher to work on quadriceps muscle exercise at various methods on lying, sitting, and standing positions until precisely executed their exercises by themselves. They were asked to perform 10 cycles of exercise per session, three times a day, and three days a week during 12 weeks period. The participants could exercise with skillful, well and convenient exercise at home or work place by themselves. They were called by the researcher to discuss any problem or remind to keep performing exercise practice at least once a week.

At the 8th and 12th week follow-up. A group meeting was offered.

- This was designed to facilitate information support, to monitor their progress in changing their behavior and their barriers, and to allow time for practicing and developing a new behavior with gradual step by step changes. The participants were checked their exercise performance record forms; appreciation was given to participants who held on exercise, while exploration barriers, suggestion, and encouragement were provided for participants who reported a problem with doing exercise. Moreover, the participants who were successful in adherence of intervention program were asked to be a role model to demonstrate and share experiences by telling about their problem solving and management strategies in detail at the 8th week of group meeting. Booster intervention dose with providing overall knowledge about prevention and management OA of the knee by individual discussion was also given to the participants at 8-week and 12-week follow-ups. Additionally, an individual counseling by telephone (experimental group 2), or face to face (experimental group 1) was also provided during the 12-week intervention to identify individual problems and barriers, encourage and reinforce participants to make gradual changes, and discuss and share strategies for overcoming barriers occurred.

An integrated health education and exercise program developed based on self-efficacy theory aimed at an increment of self-efficacy expectation for health behavior practice in which related to reduce OA knee symptoms. The program was conducted by the researcher through four strategies: a) enactive mastery experiences, b) vicarious experiences, c) verbal persuasion, and d) emotional arousal. The self-efficacy theory derived for developing intervention strategies used in this study is illustrated in Table 2.

Table 2. The Intervention Program Strategies Based on the Self-efficacy Theory

Sources of efficacy expectations	Facilities-based program	Supervised home-based program
1. Enactive mastery experiences	- Provided knowledge about OA of the knee by slides and VCD presentation, and a given booklet - Discusses and shared information following the presentation - Conducted exercise program and demonstrated exercise with cross trainer by the researcher - Trained and performed exercise with cross trainer under instructions - Shared experiences for training exercise - Provided a group or individual discussion once a week - Encouraged and reinforced participants to make gradual changes - Set goals forwards once a week - Rewarded for progressive changes and maintenance - Afforded booster intervention dose with providing overall knowledge about prevention and management knee OA by individual discussion	- Provided knowledge about OA of the knee by slides and VCD presentation, and a given booklet - Discusses and shared information following the presentation - Conducted exercise program and demonstrated self quadriceps exercise by the researcher - Trained and performed quadriceps exercise under instructions - Shared experiences for training exercise - Provided an individual discussion by phone once a week - Encouraged and reinforced participants to make gradual changes - Set goals forwards once a week - Rewarded for progressive changes and maintenance - Afforded booster intervention dose with providing overall knowledge about prevention and management knee OA by individual discussion

Table 2. The Intervention Program Strategies Based on the Self-efficacy Theory
(Continued)

Sources of efficacy expectations	Facilities-based program	Supervised home-based program
2. Vicarious experiences	- Demonstrated modeling and shared experiences by the participants who succeeded in doing exercise at the 8th week - Exemplified the dietary menus as models	- Demonstrated modeling and shared experiences by the participants who succeeded in doing exercise at the 8th week - Exemplified the dietary menus as models
3. Verbal persuasion	- Motivated and encouraged participants to engage in exercise once a week on an appointed day - Taught and coached during group or individual meeting to encourage the participants to believe they could perform activities - Exemplified the successful participants at the 8th week	- Motivated and encouraged participants to engage in exercise once a week on a calling day - Taught and coached during group or telephone meeting to encourage the participants to believe they could perform activities - Exemplified the successful participants at the 8th week
4. Emotional arousal	- Evaluated emotion and physical performance after exercise - Reported individual physical performance assessment at the 8th and 12th week - Identified individual problems and barriers, such as knee pain - Discusses and shared strategies for overcoming barriers occurred	- Evaluated emotion and physical performance after exercise - Reported individual physical performance assessment at the 8th and 12th week - Identified individual problems and barriers, such as knee pain - Discusses and shared strategies for overcoming barriers occurred

Data Collection

Data collection was gathered by the researcher and four research assistants, two registered nurses and two sports trainers at the Sport Center of Faculty of Medicine, Ramathibodi Hospital. The registered nurses, who have three years or more experience in orthopaedic nursing, were given all details of the study and were trained to assist in measuring muscle strength and ROM, and in completing study questionnaires. The Sport Center's trainers, who were the experts in sport science and exercise machine, were prepared the data collection procedure in detail. On the other hand, the sports trainers were responsible for introducing and assisting the eligible participants in exercising with cross trainers, and they recorded exercise practice of the participants performed each day.

The researcher conducted the intervention and data collection procedure for the eligible participants in both groups, and gathered all data especially muscle strength, and ROM, while the nurse research assistants gathered some data: the demographic questionnaire, the OA knowledge test, self-efficacy expectation questionnaire, health behaviors questionnaire, modified WOMAC scale, weight, and height.

The data was collected four times as follows:

1. **At the baseline.** The demographic questionnaire, the OA knowledge test, self-efficacy expectation questionnaire, health practice behaviors questionnaire, modified WOMAC scale, weight and height, muscle strength, and ROM were assessed.
2. **At the 2nd week of the study.** The OA knowledge test and self-efficacy expectation questionnaire were sent by mailing.
3. **At the 8th week of the study.** The data as at the baseline except the demographic questionnaire, and height was accomplished.
4. **At the 12th week of the study.** The data was assessed the same as data collection at the 8th week of the study.

The summarized research procedure and data collection of this study are illustrated in Table 3.

Table 3. Summary of the Research Procedures and Data Collection

Weeks	Events	Measurement/ Data Collection
0	Sample recruitment Group selection (Assignment) A session of health education	The 1 st data collection (At the baseline)
1	Participation in the program	—
2	“_____”	The 2 nd data collection (OA Knowledge, SEE)
3	“_____”	—
4	“_____”	—
5	“_____”	—
6	“_____”	—
7	“_____”	—
8	“_____”	The 3 rd data collection (OA Knowledge, SEE, Behavior, HO)
9	“_____”	—
10	“_____”	—
11	“_____”	—
12	“_____”	The 4 th data collection (OA Knowledge, SEE, Behavior, HO)

Note: OA = Osteoarthritis; SEE = Self-efficacy expectation; HO = Health outcomes

Data Analysis

Data were analyzed by using a statistical package software program. The statistical analyses in this study included:

1. Descriptive statistics. These were employed to describe number and percentage of participants' characteristics, demonstrate mean and standard deviations of study variables including OA knowledge score, self-efficacy expectation score, behavior, severity of knee symptoms, muscle strength, ROM and BMI.

2. Chi-square test. It was used to examine the comparisons of the participants' characteristics between groups at the baseline including educational level, occupation, job characteristics, the characteristics regarding knee pain, history of treatment, pain self-management, underlying disease, and characteristics related to exercise behavior.

3. Fisher's exact test. It was used to compare a characteristic (cane used regarding knee pain) that did not meet assumption of Chi-square test with expected count of less than 5 as a maximum 20%, between groups at the baseline.

4. Independent t-test. It was used to test the differences in dependent variables including age, weight, height, and BMI between groups at the baseline. Before applying this test, assumption of normality on the variables was investigated.

5. Repeated measures analysis of variance (ANOVA): Two-factor repeated measure design with repeated measures on one factor. It was employed to test differences of dependent study variables between and within groups at different time points (at the baseline, the 2nd, 8th, and 12th week after enrollment).

The study variables were the OA knowledge, SEE, behavior, and health outcomes. Health outcomes were evaluated as follows: a) severity of knee symptom (SEV-OA); b) muscle strength; c) range of motion (ROM); and d) body mass index (BMI). All study variables were tested for normality, homogeneity of variance and covariance matrices, and compound symmetry to meet the assumptions of parametric analysis for repeated measures ANOVA. The One-sample Kolmogorov-Smirnov test was used for normality testing of study variables at each time in each group. Box's test of equality of covariance matrices across groups, Levene's test of equality of error variances across groups, and Mauchly's test of sphericity for compound symmetry were also analyzed. If results met the assumptions, the study variables then would be

analyzed by using the repeated measures ANOVA. If the test was significant, it would denote that at least one of measurements differed from the others. Then, multiple comparisons using Bonferroni method were used to detect differences in details for further analysis. Regarding muscle strength and right knee flexion ROM, a significant difference between two groups (the experimental group 1 and group 2), was found at the baseline; therefore, these variables were assigned as covariance in the repeated measures ANOVA to test difference of these variables.

Protection of Human Rights

This study was approved by the Institutional Review Board (IRB), Faculty of Medicine, Ramathibodi Hospital, Mahidol University (Appendix M). Additionally, information for the study was provided to potential participants in details: the purpose of the study, procedure, benefits and potential risks, and confidentiality. The participants had the right to protect from possibility of discomfort, disturbance, or excessive burden. They were assured that they could withdraw from the study at any time or decline to answer any specific question. This would not affect any health care services or the relationship between the participants and health care providers at the Ramathibodi Hospital. The participants in both groups would receive another exercise program after a completion of the study if they actually needed. The consent form (Appendix N) was completed by the participants who agreed to participate in the study before participating in the intervention program.

CHAPTER IV

RESULTS

The study's results are presented as follows: the descriptions of the participants' characteristics, the comparisons of variables between groups at baseline, and hypotheses testing at different time.

Characteristics of the Participants

Initially, there were 36 of participants who met inclusion criteria and agreed to participate in the study in the experimental group 1 and 37 in the experimental group 2. Five participants in the experimental group 1 and three in the experimental group 2 dropped out during the study. The reasons for dropping out in the experimental group 1 were having severe knee pain and inflammation after beginning the exercise program (one person), having an accident at work station and injured her knee at the 2nd week of the intervention (one person), having a serious gastrointestinal problem needed to further investigation (one person), and having time constraints: one participant was absent for over two weeks during the exercise program, and the other performed the exercise program less than twice a week. Regarding the experimental group 2, one participant had wrist pain and could not perform muscle strength testing at the 8th week assessment. The others two participants lost follow up and could not be contacted by the telephone. The remaining participants who completed the study are 31 and 34 individuals in the experimental group 1 and 2, respectively.

The majority of the participants in both groups received bachelor degree (64.6%); are government services (70.8%); and have similar job characteristics such as dynamic activity (47.7%). Regarding knee pain, there are significantly different in duration of pain ($p = .031$) and affected knee pain ($p = .045$) between the two groups. The duration of pain in the experimental group 1 is 3.97 years whereas it is 3.09 years on the average in the group 2. The participants in the experimental group 1 have

mostly knee pain in one side, but those in group 2 have mostly knee pain in both sides. However, Chi-square test revealed non-significant differences in history of treatment, pain self-management, and cane used between groups.

Additional information of participants' characteristics is also presented that most participants do not have any underlying disease. Some participants have had underlying disease (e.g. hypertension 18.5%; thyroid 10.8%; dyslipidemia 6.2%). Characteristics related to exercise behavior are not different in the experimental group 1 compared to the experimental group 2. Details of all participants' characteristics are illustrated in Table 4.

Table 4. Number and Percentage of Participant Characteristics (Total N = 65)

Demographics	Experimental Group 1 (n = 31)		Experimental Group 2 (n = 34)		X ²	p
	n	%	n	%		
Educational level					.000	1.000
- Bachelor degree and higher	24	77.4	26	76.5		
- Primary and high school	7	22.6	8	23.5		
Occupation					3.781	.052
- Government official	26	83.9	20	58.8		
- Others (e.g. private business, housewife)	5	16.1	14	41.2		
Job characteristics					1.671	.434
- Dynamic activity	17	54.8	14	41.2		
- Most sitting	10	32.3	12	35.3		
- Most standing & walking	4	12.9	8	23.5		
Duration of pain					6.936	.031
- < 1 year	10	32.3	6	17.6		
- 1-5 years	13	41.9	25	73.6		
- > 5 years	8	25.8	3	8.8		
Affected knee pain					6.185	.045
- Right knee	11	35.5	12	35.3		
- Left knee	11	35.5	4	11.8		
- Both knee	9	29.0	18	52.9		
History of treatment					.408	.523
- Never	18	58.1	16	47.1		
- Medication	13	41.9	18	52.9		

Table 4. Number and Percentage of Participant Characteristics (Continued)

Demographics	Experimental Group 1 (n = 31)		Experimental Group 2 (n = 34)		X ²	p
	n	%	n	%		
Pain self-management					3.154	.532
- Joint rest	12	38.7	8	23.5		
- Combined methods	7	22.6	6	17.6		
- Exercise	6	19.4	8	23.5		
- Medication	4	12.9	9	26.6		
- None	2	6.4	3	8.8		
Cane use regarding knee pain[†]						.341
- Never use	28	90.3	33	97.1		
- Use	3	9.7	1	2.9		
Underlying disease					1.515	.467
- None	19	61.3	16	47.0		
- Hypertension and dyslipidemia	7	22.6	9	26.5		
- Others (e.g. diabetes mellitus, thyroid, asthma)	5	16.1	9	26.5		
Type of exercise (as usual)					3.583	.310
- None	6	19.4	9	26.4		
- Walking	6	19.4	11	32.4		
- Running	7	22.5	3	8.8		
- Others (e.g. aerobic exercise, yoga)	12	38.7	11	32.4		
Frequency of exercise					3.059	.548
- None	6	19.4	8	23.5		
- 1-2 days per month	8	25.8	4	11.8		
- 1-2 days per week	9	29.0	9	26.5		
- 3-5 days per week	6	19.4	8	23.5		
- > 5 days per week	2	6.4	5	14.7		

[†] Evaluated by using Fisher's Exact Test

The participants' age ranges from 38 to 59 years old, with an average age of 50.99 (SD 5.45). The mean age of participants in experimental group 1 is lower than those of the experimental group 2, and it is significant difference between groups at the baseline ($p = .001$). However, weight, height, and BMI reveal non-significant difference between groups at the baseline (Table 5). The participants were 38.5% overweight (BMI 25.0 to 29.9 kg/m²) and 6.2% obese (BMI 30.0 to 39.9 kg/m²).

Table 5. Mean and Standard Deviations of Participant Characteristics

Demographics	Total (n = 65)		Group 1 (n = 31)		Group 2 (n = 34)		t	p
	Mean	SD	Mean	SD	Mean	SD		
Age (year)	50.99	5.45	48.77	5.41	53.01	4.70	-3.381	.001
Weight (kg)	60.53	8.78	59.05	8.85	61.88	8.63	-1.303	.197
Height (cm)	156.18	5.61	155.86	5.49	156.47	5.78	-.440	.662
BMI (kg/m ²)	24.80	3.24	24.30	3.33	25.26	3.14	-1.202	.234

Comparisons of Study Variables between Groups at the Baseline

At the baseline assessments, the independent t-test was used to compare the difference of variables between groups. Osteoarthritis (OA) knowledge, self-efficacy expectation (SEE), behavior and severity of knee symptom (SEV-OA) reveal non-significant difference between groups. On the other hand, muscle strength indicates a statistical difference. In relation to range of motion, right knee flexion is significantly different where there is no different between the experimental group 1 and the experimental group 2 in other variables (Table 6).

Table 6. Comparisons of Variables between the Experimental Group 1 and 2 at baseline

Variables	Group 1 (n = 31)		Group 2 (n = 34)		t	p
	Mean	SD	Mean	SD		
Osteoarthritis knowledge	5.26	1.37	5.74	1.64	-1.269	.209
Self-efficacy expectation	21.22	4.27	22.15	4.47	-.852	.397
Behavior	18.48	4.68	16.47	4.32	1.803	.076
Severity of knee symptom	53.39	44.30	45.44	34.41	.811	.420
Muscle strength	61.05	22.37	48.08	15.44	2.695	.009
Range of motion						
- Right knee flexion	126.13	10.22	118.62	9.33	3.097	.003
- Left knee flexion	122.90	10.23	119.12	8.87	1.598	.115

Impact of the Integrated Health Education and Exercise Program

Results demonstrate the impact of the integrated health education and exercise program on improvement of the study outcomes. Mean scores and standard deviation of study variables at the baseline, 2nd, 8th, and 12th week are shown in Table 7.

Table 7. Mean Scores and Standard Deviation of Study Variables

Variables	Baseline	2 nd week	8 th week	12 th week
	Mean $\pm$ SD	Mean $\pm$ SD	Mean $\pm$ SD	Mean $\pm$ SD
Osteoarthritis knowledge				
Group 1	5.26 $\pm$ 1.37	6.81 $\pm$ 1.11	6.68 $\pm$ 1.35	7.10 $\pm$ 1.49
Group 2	5.74 $\pm$ 1.64	6.26 $\pm$ 1.16	6.65 $\pm$ 1.59	6.71 $\pm$ 1.47
Total	5.51 $\pm$ 1.52	6.52 $\pm$ 1.16	6.66 $\pm$ 1.47	6.89 $\pm$ 1.48
Self-efficacy expectation				
Group 1	21.22 $\pm$ 4.27	23.19 $\pm$ 3.96	23.40 $\pm$ 3.74	23.40 $\pm$ 3.74
Group 2	22.15 $\pm$ 4.47	25.00 $\pm$ 5.09	24.15 $\pm$ 3.45	25.12 $\pm$ 3.01
Total	21.71 $\pm$ 4.37	24.14 $\pm$ 4.64	23.79 $\pm$ 3.58	24.30 $\pm$ 3.46
Behavior				
Group 1	18.48 $\pm$ 4.68		22.42 $\pm$ 3.10	21.97 $\pm$ 3.09
Group 2	16.47 $\pm$ 4.32		21.00 $\pm$ 3.83	21.74 $\pm$ 4.03
Total	17.43 $\pm$ 4.58		21.68 $\pm$ 3.55	21.85 $\pm$ 3.59
Severity of knee symptom				
Group 1	53.39 $\pm$ 44.30		12.81 $\pm$ 15.33	7.52 $\pm$ 10.15
Group 2	45.44 $\pm$ 34.41		30.32 $\pm$ 24.34	23.53 $\pm$ 22.33
Total	49.23 $\pm$ 39.33		21.97 $\pm$ 22.21	15.89 $\pm$ 19.25
Muscle strength				
Group 1	61.05 $\pm$ 22.37		77.21 $\pm$ 20.73	89.37 $\pm$ 25.11
Group 2	48.08 $\pm$ 15.44		64.63 $\pm$ 15.35	69.59 $\pm$ 16.40
Total	54.27 $\pm$ 20.00		70.63 $\pm$ 19.05	79.03 $\pm$ 23.10
Right knee flexion range of motion				
Group 1	126.13 $\pm$ 10.22		130.00 $\pm$ 7.53	132.26 $\pm$ 7.05
Group 2	118.62 $\pm$ 9.33		123.74 $\pm$ 7.56	126.88 $\pm$ 6.11
Total	122.20 $\pm$ 10.40		126.72 $\pm$ 8.12	129.45 $\pm$ 7.06
Left knee flexion range of motion				
Group 1	122.90 $\pm$ 10.23		127.42 $\pm$ 7.62	129.68 $\pm$ 6.94
Group 2	119.12 $\pm$ 8.87		124.12 $\pm$ 9.33	128.29 $\pm$ 6.14
Total	120.92 $\pm$ 9.65		125.69 $\pm$ 8.66	128.95 $\pm$ 6.52
BMI				
Group 1	24.30 $\pm$ 3.33		23.96 $\pm$ 3.18	23.83 $\pm$ 3.15
Group 2	25.26 $\pm$ 3.14		25.26 $\pm$ 3.25	25.27 $\pm$ 3.15
Total	24.80 $\pm$ 3.24		24.64 $\pm$ 3.26	24.58 $\pm$ 3.21

Hypothesis 1. The middle-aged adults with osteoarthritis of the knee who participated in an integrated health education and exercise program have more osteoarthritis knowledge than before entering the program.

After participate in the program, the OA knowledge mean scores increase in both experimental groups when compared with the score at baseline. In testing of the hypothesis, OA knowledge scores in experimental group 1 and group 2 were compared between different time points. Repeated measures ANOVA was employed to investigate the differences of OA knowledge at the baseline, the 2nd, 8th, and 12th week. The OA knowledge mean scores reveal difference over time ($p < .001$) and between interaction effect of group and time ($p = .043$), but does not show a significant difference between groups (Table 8), although the experimental group 1 demonstrates lower OA knowledge scores than group 2 at the baseline, but it develops higher OA knowledge score at the 2nd, 8th, and 12th week after enrollment.

Table 8. Comparisons of Osteoarthritis Knowledge Mean Scores between Different Time Points

Source of Variations	SS	df	MS	F	p
Between subjects					
- Group	.957	1	.957	.219	.641
- Error	274.990	63	4.365		
Within subjects					
- Time	74.880	3	24.960	20.752	<.001
- Time * Group	9.988	3	3.329	2.768	.043
- Error (time)	227.327	189	1.203		
Total	588.142	259			

When pairwise comparisons using Bonferroni procedures was employed to test the mean difference in OA knowledge scores at different time periods, all OA knowledge scores are significantly increased; from baseline to 2-week, from baseline to 8-week, and from baseline to 12-week after enrollment (mean difference score: 1.039; 1.166; and 1.405, respectively, $p < .001$). However, changes of OA knowledge mean scores in each group over time are presented in Appendix O.

With aforementioned results, hypothesis 1 is supported by the result that participants in both the experimental group develop significantly higher OA knowledge score than before entering the program.

Hypothesis 2. The middle-aged adults with osteoarthritis of the knee who participated in an integrated health education and exercise program will have higher self-efficacy expectation than before entering the program.

After the intervention, the SEE mean scores augmented in both groups when compared with initial assessment. For the hypothesis testing, SEE in experimental group 1 and group 2 was compared between different time points. Repeated measures ANOVA was employed to detect differences of SEE at the baseline, the 2nd, 8th, and 12th week. SEE does not show a significant difference between groups ($p = .102$) or between interaction effect of group and time ($p = .631$). However, the significant difference on direct effect of SEE changes over time ($p < .001$) (Table 9).

Table 9. Comparisons of Self-efficacy Expectation Mean Scores between Different Time Points

Source of Variations	SS	df	MS	F	p
Between subjects					
- Group	109.704	1	109.704	2.757	.102
- Error	2507.199	63	39.797		
Within subjects					
- Time	278.412	3	92.804	11.282	<.001
- Time * Group	14.247	3	4.749	.577	.631
- Error (time)	1554.628	189	8.226		
Total	4464.190	259			

Concerning SEE mean scores between different time points, pairwise comparisons using Bonferroni procedures was used. The results indicate that the SEE mean score at baseline is significantly different from the 2nd, 8th, and 12th week (mean difference score: 2.411, $p = .001$; 2.089, $p = .001$; and 2.574, $p < .001$, respectively). Regarding changes of SEE mean scores in each group over time, they are presented in Appendix O.

Hypothesis 2, therefore, is supported by the result that participants in both the experimental group 1 and group 2 perceive significantly higher SEE after entering the intervention program, compared with initial enrollment.

Hypothesis 3. The middle-aged adults with osteoarthritis of the knee who participated in an integrated health education and exercise program have higher behavior scores than before entering the program.

After participating in the program, the behavior scores are enhanced in participants of both groups when compared with preliminary assessment. To examine the hypothesis, behavior scores in experimental group 1 and group 2 were compared between different time points. Participants' behavior does not reveal a significant difference between groups ($p = .134$) or between interaction effect of group and time ($p = .152$) whereas it shows a significant difference on direct effect of behavior changes over time ($p < .001$) (Table 10). Participants in the experimental group 1 improve behavior the same as those in the experimental group 2 during the 12 weeks of the study.

Table 10. Comparisons of Behavior Mean Scores between Different Time Points

Source of Variations	SS	df	MS	F	p
Between subjects					
- Group	72.606	1	72.606	2.301	.134
- Error	1988.348	63	31.561		
Within subjects					
- Time	801.432	2	400.716	57.441	<.001
- Time * Group	26.663	2	13.331	1.911	.152
- Error (time)	878.999	126	6.976		
Total	3768.048	194			

In relation to a significant difference of behavior over time, pairwise comparisons using Bonferroni procedure was used for further analysis. Participants' behavior reveals a significant difference between at baseline and 2-week, baseline and 8-week, and baseline and 12-week assessment (mean difference score: 4.232, $p < .001$;

and 4.374, $p < .001$, respectively). However, changes of behavior mean scores in each group over time are presented in Appendix O.

Since participants in both groups have significantly higher behavior scores than before entering the program, hypothesis 3 is verified.

Hypothesis 4. The middle-aged adults with osteoarthritis of the knee who participated in an integrated health education and exercise program have better health outcomes than before entering the program.

Health outcomes are evaluated as follow: a) severity of knee symptom (SEV-OA); b) muscle strength; c) range of motion (ROM) including right knee flexion (RF-ROM) and left knee flexion (LF-ROM); and d) body mass index (BMI). All independent variables in the experimental group 1 and group 2 were compared between different time points. For the hypothesis testing, comparisons of variables across different time points by using repeated measures ANOVA demonstrated that all variables of health outcomes in both group revealed significant differences in at least one of the three time points in each dependent variable as following.

Severity of knee symptom. After participation in the program, the SEV-OA trends to reduce in both experimental groups at every time of assessments. SEV-OA in the experimental group 1 and group 2 were compared between different time points. Repeated measures ANOVA was employed to detect differences of SEV-OA at the baseline, the 8th and 12th week. SEV-OA does not reveal a significant difference between groups ($p = .128$) whereas it shows a significant difference on direct effect of SEV-OA changes over time ($p < .001$) and between interaction effect of group and time ($p < .001$) (Table 11). Participants in the experimental group 1 reduce their SEV-OA as the same as those in the experimental group 2 during the 12 weeks of the study.

Table 11. Comparisons of Severity of Knee Symptoms between Different Time Points

Source of Variations	SS	df	MS	F	p
Between subjects					
- Group	3538.000	1	3538.000	2.382	.128
- Error	93591.815	63	1485.584		
Within subjects					
- Time	42391.514	2	21195.757	52.880	<.001
- Time * Group	6619.493	2	3309.747	8.257	<.001
- Error (time)	50504.414	126	400.829		
Total	196645.236	194			

In relation to SEV-OA mean scores between different time points, pairwise comparisons using Bonferroni procedure was employed. The results show that the SEV-OA mean scores at baseline are significantly different from 8-week, and from 12-week (mean difference score: -27.849, $p < .001$; and -33.891, $p < .001$, respectively). Additionally, a significant difference is detected between the 8th and the 12th week of the intervention (mean difference score = -6.042, $p < .001$).

Regarding a significant difference between interaction effect of group and time, changes of SEV-OA mean scores in each group over time are presented in Appendix O.

Muscle strength. Results indicate that participants in the experimental group 1 and group 2 improve their muscle strength in a different way during the 12 weeks of the study. Muscle strength in both experimental groups was also compared between different time points. Repeated measures ANOVA with covariate was employed to investigate the differences of muscle strength at the baseline, the 8th, and 12th week. The muscle strength at baseline was treated as a covariate variable since it shows a significant difference between groups ($p = .009$) (Table 6). The results reveal difference over time ($p < .001$), between interaction effect of group and time ($p = .013$) and between groups ($p = .044$) (Table 12).

Table 12. Comparisons of Muscle Strength between Different Time Points

Source of Variations	SS	df	MS	F	p
Between subjects					
- Covariate	40057.601	1	40057.601	143.944	<.001
- Group	1175.754	1	1175.754	4.225	.044
- Error	17253.703	62	278.286		
Within subjects					
- Time	7402.715	2	3701.358	38.005	<.001
- Time * Group	883.106	2	441.553	4.534	.013
- Error (time)	12076.397	124	97.390		
Total	78849.276	192			

When pairwise comparisons by Bonferroni procedure was used, the result reveals a significant differences of muscle strength between at the baseline and the 8th week (mean difference score = 16.473, $p < .001$), at the baseline and the 12th week (mean difference score = 25.014, $p < .001$), and at the 8th and 12th week (mean difference score = 8.541, $p < .001$). After participation in the program, the muscle strength increases in both experimental groups at every periods of follow-up. However, changes of muscle strength mean scores in each group over time are presented in Appendix O.

Range of motion (ROM). Range of motion was investigated in terms of right knee flexion (RF-ROM) and left knee flexion (LF-ROM). For the RF-ROM, the experimental group 1 and the experimental group 2 progress their RF-ROM during the 12 weeks of the study differently. RF-ROM in both experimental groups was compared between different time points. Repeated measures ANOVA with covariate was used to investigate the differences of RF-ROM at the baseline, the 8th and 12th week. The RF-ROM at baseline was treated as a covariate variable since it displays a significant difference between groups ($p = .003$) (Table 6). The results reveal a difference over time ($p < .001$) and between groups ($p = .041$), although it does not display a significant difference between interaction effect of group and time ($p = .085$) (Table 13).

Table 13. Comparisons of Right Knee Flexion Range of Motion between Different Time Points

Source of Variations	SS	df	MS	F	p
Between subjects					
- Covariate	6137.760	1	6137.760	158.908	<.001
- Group	168.948	1	168.948	4.374	.041
- Error	2394.731	62	38.625		
Within subjects					
- Time	1921.517	2	960.759	56.111	<.001
- Time * Group	85.981	2	42.990	2.511	.085
- Error (time)	2123.185	124	17.122		
Total	12832.122	192			

To test a significant difference over time, pairwise comparisons using Bonferroni procedure was used. Multiple comparisons in RF-ROM reveals a significant differences between at the baseline and the 8th week (mean difference score = 4.587, $p < .001$), at the baseline and the 12th week (mean difference score = 7.321, $p < .001$), and between the 8th and 12th week (mean difference score = 2.734, $p = .001$). After participation in the program, the right knee flexion increases in both experimental groups at every time of assessments. As regards changes of RF-ROM in each group over time, they are presented in Appendix O.

Regarding left knee flexion, the experimental group 1 progress their left knee flexion ROM as the same as those in the experimental group 2 during the 12 weeks of the study. LF-ROM in experimental group 1 and group 2 were compared between different time points. Repeated measures ANOVA was used to investigate the differences of LF-ROM at the baseline, the 8th, and the 12th week. The LF-ROM reveals difference over time ($p < .001$), whereas it does not display a significant difference between groups ($p = .120$) and between interaction effect of group and time (Table 14).

Table 14. Comparisons of Left Knee Flexion Range of Motion between Different Time Points

Source of Variations	SS	df	MS	F	p
Between subjects					
- Group	387.823	1	387.823	2.490	.120
- Error	9814.157	63	155.780		
Within subjects					
- Time	2088.453	2	1044.227	40.798	<.001
- Time * Group	52.351	2	26.175	1.023	.363
- Error (time)	3224.993	126	25.595		
Total	15567.777	194			

When Bonferroni procedure was employed to test a significant difference over time, multiple comparisons in LF-ROM reveals a significant difference between at the baseline and the 8th week (mean difference score = 4.758, $p < .001$), at the baseline and the 12th week (mean difference score = 7.975, $p < .001$), and between the 8th and 12th week (mean difference score = 3.217, $p = .001$). After participation in the program, the LF-ROM increases in both experimental groups at every time of assessments. Regarding changes of LF-ROM in each group over time, they are presented in Appendix O.

Body mass index. The last variable of health outcomes is BMI. After participation in the program, the BMI of participants in both the experimental group 1 and group 2 decreased during the 12 weeks of the study. Using repeated measures ANOVA to detect differences of BMI at the baseline, the 8th, and 12th week, BMI does not reveal a significant difference between groups ($p = .123$). However, there is a significant difference on direct effect of BMI over time ($p = .002$) and between interaction effect of group and time ($p < .001$) (Table 15).

Table 15. Comparisons of Body Mass Index Mean Score between Different Time Points

Source of Variations	SS	df	MS	F	p
Between subjects					
- Group	74.435	1	74.435	2.444	.123
- Error	1918.836	63	30.458		
Within subjects					
- Time	1.851	2	.925	6.786	.002
- Time * Group	1.970	2	.985	7.225	.001
- Error (time)	17.179	126	.136		
Total	2014.271	194			

By using multiple comparisons, BMI mean score reveals a significant difference only between the baseline and the 12th week of measurements (mean different score = -.231, $p < .01$); however, it trends to decrease after participation in the program.

For the significant difference between interaction effect of group and time, changes of BMI mean score in each group over time are presented in Appendix O. The experimental group 1 displays lower BMI than group 2 at every time points. BMI in the experimental group 1 trends to decrease, whereas it is not different in the experimental group 2 between the baseline and other assessment times.

During 12 weeks of the implemented intervention program, participants in both experimental groups have significant improvement of all health outcome variables. With these findings, hypothesis 4 is supported.

Hypothesis 5. There is no difference between osteoarthritis knowledge, self-efficacy expectation, behavior, and health outcomes among the middle-aged adults with osteoarthritis of the knee who participated in the experimental group 1 and those who participated in group 2.

To test of the hypothesis, all study variables including OA knowledge, SEE, behavior, and health outcomes in experimental group 1 and group 2 were compared between groups at each time point by using repeated measures ANOVA. OA knowledge, SEE, behavior, SEV-OA, LF-ROM, and BMI have non-significant

differences between groups over time as shown in table 8 to 15 ($F_{1,63} = .219$, $p = .641$; $F_{1,63} = 2.757$, $p = .102$; $F_{1,63} = 2.301$, $p = .134$; $F_{1,63} = 2.382$, $p = .128$; $F_{1,63} = 2.490$, $p = .120$; and $F_{1,63} = 2.444$, $p = .123$, respectively). On the other hand, muscle strength and RF-ROM reveal a significant difference between groups ($F_{1,62} = 4.225$, $p = .044$; and $F_{1,62} = 4.374$, $p = .041$, respectively). Therefore, hypothesis 5 is partly supported.



CHAPTER V

DISCUSSION

This chapter presents a discussion on participants' characteristics and research findings related to hypotheses testing, which includes a discussion on the impact of an integrated health education and exercise program on knowledge, self-efficacy expectations, behaviors, and health outcomes among middle-aged adults with osteoarthritis (OA) of the knee as well as the contribution of the research to nursing knowledge development.

Characteristics of the Participants

Participants in this study were women, aged 38 to 59 years old. That is based on research sample criteria of middle-aged adults with knee pain from OA, and is similar to other study that OA of the knee is more likely to occur among women than men (Chanpen Chuprapawan, B.E. 2543; ARC, 2004: 6; Felson, 2003: 9; Mourad, 1995: 41). The majority of the participants in both groups had received bachelor degree (64.6%) and was government officers (70.8%). Thus, they easily understood health education and could be self-reported for all questionnaires. However, when some items of modified WOMAC scale were difficulty to answer, the researcher and research assistants paid a clarification.

Participants in experimental group 1 and group 2 had similar job characteristics. Thirty-four participants had inappropriate health behaviors (most sitting, 33.9%; most standing and walking, 18.5%) that increase joint stress. Occupational overuse of the knee joints is a risk factor of OA, especially occupations related either to sitting postures such as kneeling, squatting, sitting on the haunches and Thai traditional sitting for more than 30 minutes (Cooper et al., 1994 as cited in Pranee Karnjanavorawong, B.E. 2539: 13). A hospital-based case-control study of the risk factors associated with OA of the knee in people aged 45 years and over who

registered at an orthopaedic clinic, Maharaj Nakhon Ratchasima Hospital, indicated that sitting postures such as kneeling, squatting, and Thai traditional sitting for longer than 6 hours/week increased the risk by 20.90 times (95% CI = 10.70 to 40.80), 16.62 times (95% CI = 9.36 to 29.48) and 4.86 times (95% CI = 2.77 to 8.54), respectively (Ngamsutikul, 2000: 82).

Knee pain is a predominant symptom of OA. All participants in this study experienced knee pain. The duration of the pain in experimental group 1 was 3.97 years and 3.09 years on average in group 2. Pain, usually asymmetrical, is an individual experience and its extent must be individually determined (Mourad, 1995: 41). The most participants in experimental group 1 had knee pain for one side but those in group 2 had mostly knee pain in both sides. Furthermore, pain is a common reason for seeking medical advice (O'Reilly & Doherty, 2003: 198). In this study, most of the participants managed their pain by taking medication, exercise, joint rest, or combined methods by themselves, with 47.7% of the participants had ever treated with medication used.

No significant difference was found on body mass index (BMI) between groups. However, there were 38.5% overweight (BMI 25.0 to 29.9 kg/m²) and 6.2% obese (BMI 30.0 to 39.9 kg/m²) participants that result in risk for developing in OA in these participants. These were supported by some studies. A longitudinal study of 5,284 participants with neither OA of the knee nor hip indicated that the risk of OA increased with higher BMI (Hootman, Macera, Helmick, & Blair, 2003: 636). Another study showed that the body mass index (BMI) of 25.0 to 29.9 kg/m² and 30 kg/m² or greater increased the risk by 2.27 times (95% CI=1.41 to 3.63) and 6.75 times (95% CI=2.71 to 19.80), respectively (Ngamsutikul, 2000: 82). Likewise, population-based studies of OA have consistently revealed that obese persons have higher risks of knee OA than non-obese control subjects (Huang et al., 2000: 398).

Some participants have had underlying diseases (e.g. hypertension 18.5%; thyroid 10.8%; dyslipidemia 6.2%), but these illness did not lead to any obstacle for exercise. This was supported by evidence that there were 76.9% participants who had been exercising prior to the study. Also, they have hold on quadriceps exercise during participating in the program confirmed by their exercise performance record forms.

Impact of an Integrated Health Education and Exercise Program

The impact of an integrated health education and exercise program on knowledge, self-efficacy expectations, behaviors and health outcomes among middle-aged adults with OA of the knee is presented on the basis of hypotheses testing as followings.

Hypothesis 1. The middle-aged adults with osteoarthritis of the knee who participated in an integrated health education and exercise program have more osteoarthritis knowledge than before entering the program.

The results of the study supported the hypothesis since they indicated that the integrated health education and exercise program can improve OA knowledge in both experimental groups. These findings were congruent with other studies (de Jong, Hopman-Rock, Tak, & Klazinga, 2004: 316-321; Rawiworrakul, 1999; Bootsaba Oupaichit, B.E. 2537). Although most intervention study did not present or measure OA knowledge improvement among OA patients, health education itself is a set of planned educational activities designed to help participants improve their knowledge, behaviors, health status, as well as health care utilization (Barlow & Lorig, 2003: 322). Several factors facilitated the process of OA knowledge development from given health education. Since the participants were middle-aged adults and 76.9% of them had received bachelor degree and higher education, most of them may be easily understand health education provided by the researcher. Additionally, the researcher applied group or individual direct approach to better educate the participants by using various method of education namely power point and VCD presentation, modeling and demonstration, group discussion, and a booklet given to recall the health education they received. These strategies were supported by previous studies revealed that application of diverse method of health education helped participants to have better learning and remembrance resulting in improvement their knowledge (Beare, 1999; Phillips, 1999). Moreover, the fact that most participants already had symptom of knee OA especially knee pain made them to be interested, concerned of and seek self taking care. In addition, when they enter the program where most participants were continuously compliance to practicing desirable behaviors and exercising; they followed up, repeated health education, and enhance their knowledge as a result.

Hypothesis 2. The middle-aged adults with osteoarthritis of the knee who participated in an integrated health education and exercise program have higher self-efficacy expectation than before entering the program.

Regarding perceived self-efficacy expectation (SEE), participants in experimental group 1 and group 2 perceived significantly higher SEE after participating in the intervention program, compared with initial enrollment. This result revealed the effectiveness of motivation strategy to enhance SEE among participants in both experimental groups and confirmed the influence of the intervention of this study on enhancing SEE for exercise, which may further influence regular exercise behavior. These results were congruent with other studies (de Jong et al., 2004: 316-321; Jarunee Nantavanotayan, B.E. 2539; Kaysorn Sumpaonthong, B.E. 2536; Mounghthong, 2000; Rawiworrakul, 2006; Thongsamrit, 1998). The increasing in SEE may be explained by several reasons. The developed program, facilities-based and supervised home-based exercise program, was based on self-efficacy theory (Bandura, 1997). SEE can be enhanced through four sources namely enactive mastery experiences, vicarious experiences, verbal persuasions, and emotional arousal. These were employed for developing the integrated health education and exercise program that comprises of patient education and facilities- or home-based exercise program in this study. Additionally, it might also be influenced by session of the health education program, which could helped participants aware of what to do and how to deal with their knee pain, and the researcher paid attention and socialization to the participants during the 12 weeks of the intervention that encourage them to improve SEE for exercise. Moreover, it might have been influenced by participants' high expectations that exercise could have beneficial health outcomes. Furthermore, the more participants are compliant with exercise, the further the disease symptoms decrease, which made them augmented their SEE for exercise. Another possible reason is that participants' knowledge improvement could promote them to increase SEE. With aforementioned evidences, the hypothesis 2 was supported.

Hypothesis 3. The middle-aged adults with osteoarthritis of the knee who participated in an integrated health education and exercise program have higher behavior scores than before entering the program.

The hypothesis 3 was supported since after the participation in the program of this study, the behavior scores were enhanced for the participants in both experimental groups when compared with preliminary assessment. Participants of intervention program in experimental group 1 and group 2 had significantly higher behavior scores than before participation in the program. These results were congruent with other studies (Moungthong, 2000; Thongsamrit, 1998) and supported the assumption that enhanced SEE can change the behavior. Based on self-efficacy theory (Bandura, 1997), behavior is directly associated with SEE enhancement. If person believe that they have self-efficacy, they will therefore reveal their capability, tolerance, and accomplishment behaviors. Thus, people who have high self-efficacy will seek information to prevent or stop risk behaviors and seek care during the onset of symptoms more than those with low self-efficacy.

SEE also helped to determine how much effort participants will spend on activity and how long they will sustain – the higher the SEE, the greater the effort expenditure and persistence. The perseverance associated with high self-efficacy led to improved performance, and also sense of efficacy. Moreover, SEE affected behavior by influencing emotional reaction of individuals (Bandura, 1997). Additionally, there were evidence confirmed the relationship between high self-efficacy and exercise behavior. A study in postoperative total joint replacement patients revealed that higher level of self-efficacy was related to higher frequency and number of repetitions of exercises (Moon & Backer, 2000). In addition, the participants whom the researcher applied various method of education improved OA knowledge have enhanced SEE and more accurate behavioral improvement. Also, a study in older adults revealed that perceived SEE had a significantly direct effect on exercise behavior and an indirect effect through commitment to a plan on exercise (Chinuntuya, 2001).

Hypothesis 4. The middle-aged adults with osteoarthritis of the knee who participated in an integrated health education and exercise program have better health outcomes than before entering the program.

It was rational to expect that methods found to produce better patient outcomes in research study should produce better patient health outcomes when incorporated into everyday practice (Brown, 1999: 8). The result obtained from facilities-based and supervised home-based exercise program in the study is congruent with information noted above. The improvements of health outcomes in terms of severity of knee symptom (SEV-OA), muscle strength, range of motion (ROM) including right knee flexion and left knee flexion, and body mass index (BMI) are discussed.

SEV-OA was assessed by modified WOMAC scale (Sek Aksaranugraha, 2000), which examined pain, stiffness, and physical function related to OA of the knee. It was a subjective variable for measuring outcome of the intervention in this study. Exercise is one of the most effective treatments frequently prescribed to patients with OA of the knee for reducing joint pain and improving function (Cote, 2001: 499; Leslie, 2000: 53). A systematic review of randomized clinical trial of the effectiveness of exercise therapy in patients with knee OA concluded that, there was a substantial evidence of small to moderate beneficial effect of exercise on pain as well as other outcomes such as disability and walking performance, and a medium to great beneficial effect of global well-being (van Baar, Assendelft, Dekker, Oostendorp, & Bijlsma, 1999). While other studies supported that the exercise program was effective in decrease pain, and improve physical function in participants with OA of the knee (Chadin Samorrapoom, B.E. 2543; Chirawan Tanwattana et al., B.E. 2545; de Jong et al., 2004: 316-321; Huang, Lin, Yang, & Lee, 2003: 398-405; Hughes, Seymour, Campbell, Pollak, Huber, & Sharma, 2004; Messier et al., 2000: 1062; McCarthy, Mills, Pullen, Roberts, Silman, & Oldham, 2004: 880; Mounghong, 2000; O'Reilly, Muir, & Doherty, 1999; Ravaud et al., 2004; Rawiworrakul, 2006; Schilke, Johnson, Housh, & O'Dell, 1996; Suomi & Collier, 2003: 1589-1593).

In this study, SEV-OA in both experimental groups was compared between different points of time. Participants in experimental group 1 revealed a significant reduction of SEV-OA during the 12 weeks of the study, the same result applied for those in the experimental group 2. It trended to decrease in both experimental groups

at every time of assessments. The result was consistent with particular study (Huang et al., 2003: 398-405) and concluded that muscle strengthening exercises have considerably affected on health outcomes in participants with OA of the knee especially in term of reduction of SEV-OA. This was supported by another study (Rawiworrakul, 2006) that provided patients with a community-based exercise program developed on the basis of self-efficacy theory. Possible explanation for decreasing of SEV-OA is that the participants believed that the assessment they performed quadriceps exercise every four weeks were treatments for their knee symptoms, therefore, they felt less pain than usually be. Additionally, participants in this study showed good health practice especially, adhere to quadriceps exercise leading to pain reduction and decreasing joint stiffness.

Muscle strength can protect the knees from getting OA, and may prevent disease progression for patients with OA (Felson & Zhang, 1998 as cited in Leslie, 2000: 53). In relation to muscle weakness, there were some evidences which supported that muscle weakness also increased the risk of knee OA (Altman et al., 1986: 1040; Altman, 1991a: 41-42; Altman, 1991b: 10; Apichana Kovindha, B.E. 2546: 203-204; Ebersole, Hess, Touhy, & Jett, 2005: 385; Leslie, 2000: 52). A loss of tensile strength for load support with the changes in the cartilage matrix composition leads to transmission of greater force to chondrocytes and subchondral bone causing chondrocytes sustain greater injury (Cote, 2001: 497), so simple active exercises to strengthen the quadriceps can decrease joint cartilage deterioration. This study revealed that the participants in each exercise group had significant enhancement in muscle strength after participating in the program and at follow-up when compared with initial assessment. The result was consistent with other studies (Chadin Samorrapoom, B.E. 2543; Huang et al., 2003: 398-405; Kuptniratsaikul, Tosayanonda, Nilganuwong, & Thamalikitkul, 2002a: 33; Messier et al., 2000: 1062; Mikesky, Mazzuca, Brandt, Perkins, Damush, & Lane, 2006; Rawiworrakul, 2006; Schilke et al., 1996). There are some reasons to support the findings. One possible reason is that the exercise program, either cross-training exercise or self quadriceps muscle exercise, was an isometric, isotonic and isokinetic muscle-strengthening exercise aiming at increase in muscle strength. Another reason is that the intervention to assess and report individual physical performance every four-week and self-recorded exercise

performance was an important factor encouraging the participants to continue and comply with planned exercise behavior resulting in muscle strength enhancement.

A correlation study indicated the severity of OA was based on muscle strength and pain (Orapin Swangwatanasade, B.E. 2540), this may be another reason explaining a reduction of SEV-OA. According to muscle weakness, joints become fewer stables and less able to carry a load as a result in increased disability. Consequently, patients avoid activity even more until it causes a downward spiral toward increasing physical disability (Apichana Kovindha, B.E. 2546: 203-204). Therefore, the participants who participated in the exercise program and gained muscle strength improvement in this study demonstrated a reduction their SEV-OA.

ROM was investigated in terms of right knee flexion (RF-ROM) and left knee flexion (LF-ROM), which were the objective variables to measure the outcomes. Reduced range of joint movement or increased knee stiffness may cause the patient to restrict activity, especially activities of daily living, leading to de-conditioning (Brandt, 1996 as cited in Leslie, 2000: 52) and long-term disability, as the disease progresses, arising joint deformity and instability follows (O'Reilly & Doherty, 2003: 198-199). Proper exercise promotes mobility, flexibility, muscle strength, and endurance (Stanley & Pattillo, 2005: 145).

This study revealed that the participants in each exercise group had a significant enhancement in ROM after participation in the program and at a follow-up when compared with initial assessment. The result was consistent with other studies (Rawiworrakul, 2006; Schilke et al., 1996). The exercise program in both experimental groups was applied with expectation to enhance quadriceps muscle strength. Consequently, the participants showed less pain, improvement of physical function (Chadin Samorrapoom, B.E. 2543; Chirawan Tanwattana et al., B.E. 2545; de Jong et al., 2004: 316-321; Huang et al., 2003: 398-405; Hughes et al., 2004; Messier et al., 2000: 1062; McCarthy et al., 2004: 880; Mounghthong, 2000; O'Reilly, Muir, & Doherty, 1999; Ravaud et al., 2004; Rawiworrakul, 2006; Schilke et al., 1996; Suomi & Collier, 2003: 1589-1593) as discussed above. While the participants who suffered stiffness of their knees were continuously compliant with exercise in this study, ROM will enhance, and in consequence ease the suffering from the disease.

BMI is a measure to assess grade of obesity. Obesity or overweight increases risks of OA of the knee (Hootman et al., 2003; Nantana Kasitanon, B.E. 2546; Worawit Louthrenoo, B.E. 2546: 28-29). A longitudinal study reported that the risk of OA increased as the participants got higher BMI (Hootman et al., 2003: 636). Therefore, weight reduction in overweight and obese patients is a practical treatment for OA of the knee (Muir & Webber, 2003: 372). The intervention in this study designed to decrease body weight or BMI of the participants by advice dietary behavioral change, exercise, and frequent self-monitoring, and by demonstration dietary menus with individual discussion. Results showed weight reduction that was consistent with other studies. The participants who received weight reduction program including weekly auricular acupuncture, counseling for dietary controlled, and aerobic exercise showed more weight reduction, pain reduction, ambulation speed, and decrease in Lequesne's index (Huang et al., 2000: 398-404). Likewise, a study compared an exercise with weight reduction program and exercise alone revealed significantly better result in pain reduction, improvement of function and increase of muscle strength in both groups (Messier et al., 2000: 1062). Therefore, the participants who participated in the exercise program had weight reduction and lowered their BMI leading to demonstrate a reduction in their SEV-OA.

Since the outcome variables in this study showed significant improvement of muscle strength and ROM, and reduction of BMI resulting in SEV-OA reduction, this hypothesis 4 was supported.

Hypothesis 5. There is no difference between osteoarthritis knowledge, self-efficacy expectation, behavior, and health outcomes among the middle-aged adults with osteoarthritis of the knee who participated in the experimental group 1 and those who participated in group 2.

The hypothesis 5 was partly supported, described as follows. All study variables including OA knowledge, SEE, behavior, and health outcomes in experimental group 1 and group 2 were compared between groups at each time point by using repeated measures analysis of variance (ANOVA). OA knowledge, SEE, behavior, SEV-OA, LF-ROM, and BMI had non-significant differences between groups over time whereas muscle strength and RF-ROM reveal a significant difference.

In this study, both the facilities-based exercise program (experimental group 1) and supervised home-based exercise program (experimental group 2) were an integrated health education and exercise program which were applied from self-efficacy theory. Though the exercise program in each experimental group was different in detail, the researcher expected similar outcomes in both the experimental groups. The result from this study was consistent with another study (Huang et al., 2003: 398-405) by which conducted to compare different muscle strengthening exercises among four groups of isokinetic, isotonic and isometric muscle-strengthening exercises and control group. The results revealed that the subjects in each treated group had a significant improvement in pain reduction, disability reduction, and walking speed after treatment and at follow-up when compared with initial assessment. It was concluded that different muscle strengthening exercises had significant effect on health outcomes in participants with OA of the knee in particular reduction of SEV-OA. In relation to modes of exercise program, the results from comparing relative effectiveness of providing a home-based exercise program versus class-based exercise program were congruent with other two studies (Chadin Samorrapoom, B.E. 2543; Chirawan Tanwattana et al., B.E. 2545), with significantly resulted in pain reduction and physical function improvement, but showed non-significant differences between groups.

Nonetheless, the participants in each exercise program showed a significant difference on muscle strength between groups. The possible reason is that exercise with cross trainer was an isotonic and isokinetic muscle-strengthening exercise that helps gain muscle strength than self quadriceps muscle exercise (home-based exercise) which was isotonic and isometric muscle-strengthening exercise. Moreover, the participant in facilities-based exercise program who exercised at the Sport Center had a chance to meet the researcher face-to-face whereas those in supervised home-based exercise program who exercised by themselves at home did not. This may encourage the facilities-based exercise participants do exercise by and the research assistants more continuously than those at home. Furthermore, the participants in facilities-based exercise program were assigned to perform a 30 minutes exercise per session, 3 times a week during 12 weeks after enrollment in the study, but those in supervised home-based exercise program were asked to perform exercise 10 cycles per time, three times

a day, and three days a week during a 12 week period for good equal outcome, which required more time. Thus, the facilities-based exercise program might encourage the participants to continuously comply with exercise than supervised home-based exercise program since participants who did exercise at home couldn't be observed, even though self-report recording of exercise performance record forms display 3-7 days/week. Cross-training exercise, therefore, helped participants gain muscle strength more than self quadriceps muscle exercise.

For the ROM, this study revealed a significant different in RF-ROM between groups whereas LF-ROM did not display a significant difference between groups ($p = .120$). It denoted that participants in experimental group 1 and 2 progress their RF-ROM during the 12 weeks of the study differently. The reason may be explained that affected knee pain in the experimental groups 1 were 20 right knees and 20 left knees (11 participants had either right knee or left knee affected and 9 participants had both knees affected) whereas those in experimental group 2 were 30 right knees and 22 left knees (12 participants had right knee affected, 4 participants had left knee affected and 18 participants had both knees affected). Thus, the participants in experimental group 1 had affected right knee pain less than those in the experimental group 2 (20 and 30 right knee pain, respectively); pain and stiffness at right knee was lesser, so they might continue to comply with exercise more than those in group 2. Consequently, they showed more progression in RF-ROM than those in group 2.

Regarding BMI, experimental group 1 displayed lower BMI than group 2 at every time-point and trended to decrease. Those in experimental group 2 did not have any difference in BMI between the baseline and other assessment times. It was explained that the facilities-based exercise program was an aerobic exercise which consumed more energy and resulted in more weight loss than the supervised home-based exercise program that was a specific quadriceps muscle exercise. Aerobic exercise is a physical activity that elevates heart rate and breathing rate which stimulate the cardiovascular system (Seguin, Epping, Buchner, Bloch, & Nelson, 2002), thereby inducing weight loss and decreasing severity of knee symptom.

In conclusion, with aforementioned discussion, the hypotheses 1-4 were supported, whereas the hypothesis 5 was partly supported.

CHAPTER VI

CONCLUSION

Three sections are presented in this chapter: 1) summary of the study, 2) limitations of the study, and 3) implications of the findings, and recommendations for further studies.

Summary of the Study

This study is a two comparison group pretest-posttest quasi-experimental study. It applied self-efficacy theory with the objective of determining the impact of an integrated health education and exercise program on knowledge, self-efficacy expectations (SEE), behaviors and health outcomes among middle-aged adults with osteoarthritis (OA) of the knee.

The study was conducted on personnel from the Faculty of Medicine, Ramathibodi Hospital and patients visiting the orthopaedics outpatient department of the Faculty of Medicine, Ramathibodi Hospital, Bangkok. Participants were recruited with the inclusion criteria as follows: being middle-aged (aged 38-59 years) adults suffering knee pain, having clinical symptoms of OA of the knee associated with the criteria of the American College of Rheumatology, having neither knee injuries nor orthopaedics surgery of major lower extremity joints, and bearing no conditions that would be the obstacles for exercise. Seventy-three participants who met the inclusion criteria and agreed to participate in the study were assigned into experimental group 1 (facilities-based exercise program) and group 2 (supervised home-based exercise program) using convenience sampling technique and matching similar characteristics, namely job characteristics, severity of knee symptoms (SEV-OA), body mass index (BMI), and age. There were 36 participants in the experimental group 1 and 37 participants in the experimental group 2. Overall, 31 and 34 participants in the experimental group 1 and 2, respectively, completed the study. The attrition rates were

13.89 and 8.11 percents in the experimental group 1 and 2, respectively or 10.96 percent in this study. After the baseline assessment of the participants, an integrated health education and exercise program based on Bandura's self-efficacy theory was conducted. The health education program was provided once as a workshop to the both group of all participants with knee OA. The participants in the experimental group 1 were then given a facilities-based exercise program, and trained by the researcher to use cross trainer at the Sport Center of Faculty of Medicine, Ramathibodi Hospital. The participants were assigned to perform 30 minutes exercise per session, 3 times a week during 12 weeks after enrolling to the study. Each participant was obliged to meet the researcher at least once a week. Whereas, those in the experimental group 2 were given a supervised home-based exercise program by VCD presentation and the researcher, and trained to do quadriceps muscle exercise until they can correctly execute the exercises by themselves. The participants were asked to perform an exercise 10 cycles each time, three times a day, and three days a week during a 12-week period. The researcher called to discuss emerging problems or reminded the participants to keep performing an exercise at least once a week. The study variables were OA knowledge, SEE, behaviors, SEV-OA, muscle strength, joint range of motion (ROM) and BMI. Data were collected at baseline, the 2nd, 8th, and 12th weeks after the implementation of the program by the researcher and four research assistants who were register nurses and two sports trainers at the Sport Center of Faculty of Medicine, Ramathibodi Hospital.

Descriptive statistics were employed to explain participants' characteristics and the study variables. Chi-square, Fisher's exact test and Independent t-test were used to examine participants' characteristic differences between groups at the baseline. Repeated measures ANOVA was employed to inspect the differences of dependent variables between and within groups at different time points (at the baseline, the 2nd, 8th, and 12th week after enrollment).

Results of this study are summarized as follow:

1. Participants in this study are women, aged 38 to 59 years old. The majority of the participants in both groups have received bachelor degree (64.6 percent), is government officers (70.8 percent), and have similar job characteristics (dynamic activity; 47.7 percent). The most participants in the experimental group 1 have knee

pain in one side, but those in group 2 have mostly knee pain in both sides. The duration of pain in the experimental group 1 is 3.97 years and 3.09 years on average in group 2. Most of the participants manage their pain by taking medication, exercise, joint rest or combined methods by themselves, with 47.7 percent of the participants have used medication. Some participants have had underlying diseases (e.g. hypertension for 18.5 percent; thyroid for 10.8 percent; dyslipidemia for 6.2 percent). There are 76.9 percent of participants who have been exercising prior to the study by walking, running, aerobic exercise or yoga. Most participants exercise for 1 to 2 days a week.

2. At the baseline assessments, OA knowledge, SEE, behavior and SEV-OA revealed non-significant difference between the experimental group 1 and group 2. On the other hand, muscle strength indicated a statistical difference. In relation to ROM, right knee flexion was significantly different whereas there was no difference between groups for left knee flexion. No significant difference was found on BMI between groups. The participants in both groups were 38.5% overweight (BMI 25.0 to 29.9 kg/m²) and 6.2% obese (BMI 30.0 to 39.9 kg/m²).

3. Results were revealed regarding hypotheses 1-4. Compared with the initial assessments, participants in both experimental groups demonstrated significant enhancement of OA knowledge, SEE, behaviors and all the health outcomes. OA knowledge and SEE showed improvement at the 2nd week after participating in the program. At the 8th week SEE started to decline, although, it still increased when compared with the baseline assessment. Advancement of behaviors, muscle strength, right knee flexion range of motion (RF-ROM) and left knee flexion range of motion (LF-ROM) were noteworthy, whereas the reduction of SEV-OA and BMI were observed. Additionally, all variables of health outcomes, except for BMI in which revealed a significant differences between the baseline and the 8th week of measurements, the baseline and the 12th week, and the 8th and 12th week whereas BMI revealed a significant difference only between the baseline and the 12th week. Therefore, the health education program of an integrated health education and exercise program based on self-efficacy theory is imperative to enhance OA knowledge, SEE and favored behavior for the patients with OA of the knee. Either facilities-based exercise program or supervised home-based exercise program improved SEV-OA,

muscle strength, ROM and probably was a cause of BMI reduction. These results demonstrated that the effectiveness of the program on health outcomes could be seen at the 8th week after participating in the program.

4. Regarding hypothesis 5, there was not significant difference in OA knowledge, SEE, behaviors, SEV-OA, LF-ROM and BMI between the participants in the experimental group 1 and group 2, whereas muscle strength and RF-ROM revealed a significant difference between groups. The participants in the experimental group 1 had non-significant decrease of BMI while those in the experimental group 2 showed the same BMI as initially measured. Hence, the facilities-based and supervised home-based exercise program both promoted OA knowledge, SEE, behavior and health outcomes but muscle strength and RF-ROM were the exception. The facilities-based exercise program augmented muscle strength and RF-ROM of the participants more than supervised home-based exercise program did.

In conclusion, the integrated health education and exercise program led to significant improvement of OA knowledge, SEE, behaviors and health outcomes among participants with OA of the knee. The facilities-based and supervised home-based exercise program contributed to advancement of OA knowledge and SEE at the 2nd week, improvement of behavior, SEV-OA, muscle strength, RF-ROM and LF-ROM at the 8th week, and reduction on BMI at the 12th week after enrollment. Muscle strength and RF-ROM were significantly different between groups.

Limitations of the Study

The results of this study should be interpreted with the understanding that there were some study limitations as follows:

1. The study was conducted on the middle-aged adults with OA of the knee who were personnel of Faculty of Medicine, Ramathibodi Hospital, and patients visiting the orthopaedics outpatient department of Faculty of Medicine, Ramathibodi Hospital, Bangkok. The participants were recruited and assigned to group based on convenience sampling technique. As a consequence, the findings of the study may not be generalized to apply for other groups of patients with OA of the knee.

2. Regarding recruitment, all voluntary samples were women. Thus, the findings of the study may not be generalized to apply to middle-aged men with OA of the knee.

3. The majority of the participants in both groups have received bachelor degree that they may have a better understanding on all given information of this intervention program than others patients with OA of the knee who have received lower educational level. Hence, the findings of the study may not be generalized to apply for those patients.

Implications and Recommendations

Based on the findings of this study, several implications and recommendations are appropriate.

Implications for nursing practice

1. This study demonstrated that an integrated health education and exercise program is effective for patients with OA of the knee in order to enhance OA knowledge, SEE, exercising behavior and health outcomes, as well as decrease SEV-OA. Hence, the integrated health education and exercise program should be applicable for decreasing and preventing severity of knee symptoms in patients with OA of the knee who shared similar characteristics to the participants in this study.

2. As a result of changing behaviors, perceived self-efficacy is a part of self-reflective capability in the cognitive process. Participants in this study increase their SEE and continue the exercise regularly. Therefore, nurses should provide health education by apply self-efficacy theory to help achieve their SEE with optimism of compliance to perform necessary activities especially exercise.

3. Participants had moderate level of OA knowledge at the initial assessment. After participating in this study, the results displayed improvement of OA knowledge, health practice behavior and health outcomes, therefore knowledge is imperative and important for patients with OA of the knee. It helps them to recognize and understand which enhances a capability to manage with the disease themselves. Consequently, OA knowledge should be disseminated as group and individual discussion.

4. Nurses should encourage people to perform exercise even when they have no symptoms of knee OA or little level of severity of knee OA as a formal prevention and reduction of knee OA symptoms as demonstration in this study.

5. As OA of the knee is a chronic disease, booster strategy is necessary to promote good health behavior and maintain healthy lives in patients. As for the interventions in this study, individual counseling by phone and filling exercise performance record form by the participants are efficacious. The record reflected that their behavior and health outcome were the results of how they comply with the program.

6. Regarding exercise program, facilities-based and supervised home-based exercise program had no significant difference on almost all study variables. The result represents the effectiveness of both programs. Thus, supervised home-based exercise program is desirable for application in most patients with OA of the knee in term of economization. Nonetheless, personnel in the organizations with facilities have more choices of exercise. Additionally, the health education and exercise program should also be provided as to help people to implement the exercise in various settings such as at the facility, community or home setting according to their convenience and cost; however, it needs to be conducted under professional advices. Strategies to encourage the patients to initiate behavioral change especially exercise should be implemented. Furthermore, the program could be generalized and lead to a proactive health policy for all people either with or without OA of the knee.

Implications for nursing education

The role of professional nurse has developed. At the moment, nurses are charged with responsibility not only to provide quality care for the patients in hospital, but also to prevent and promote good health for people in communities. Thus, health promotion concept should be placed into the courses of nursing education.

OA of the knee is a chronic and incurable disease resulting in poor health status and low quality of life. The effectiveness of an integrated health education and exercise program was found in this study. Hence, OA of the knee should be provided to nursing students. It should be emphasized with evidence based education in main

topics that consist of general information regarding the disease, diagnosis and treatment techniques, and management strategies.

Recommendations for further studies

Further study should be recommended as the following suggestions:

1. Participants should be recruited as middle-aged and older adults with OA of the knee along with randomization method for generalization the result to populations.
2. As regards limitations of sample size recruitment, the study had a small sample size; therefore, setting expansion is needed for larger sample size resulting in generalization.
3. A longitudinal study should be performed in order to determine the effects of the facilities-based and supervised home-based exercise program on patients with OA of the knee in long-term, to evaluate rate of compliance to exercise, and to determine the effectiveness of an integrated health education and exercise program.
4. Participants in this study had little level of severity of knee OA with different level of pain which varies according to individual perception. Further study should be conducted on patients with moderate to severe level of knee OA to expand the evidence-based knowledge on the disease.
5. Although this study reflects the impacts of the integrated health education and exercise program on middle-aged adults with OA of the knee in one setting, it may not be similar to those in other general hospitals and communities in Thailand. Therefore, a study regarding this topic should be explored in different areas in order to learn about the specific problems and plan the relevant interventions.
6. Supervised home-based exercise program may need some modification in order to gain higher improvement of muscle strength which parallel to the facilities-based exercise program.

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APPENDIX A

แบบสอบถามข้อมูลทั่วไป

คำชี้แจง กรุณาทำเครื่องหมาย ✓ ลงใน ☐ หน้าข้อความ และเติมค่าลงในช่องว่างตามความเป็นจริง

1. อายุ ปี เดือน
2. ระดับการศึกษา

☐ ไม่ได้ศึกษา	☐ ต่ำกว่าประถมศึกษา	☐ ประถมศึกษา
☐ มัธยมศึกษา	☐ ปริญญาตรี	☐ สูงกว่าระดับปริญญาตรี
3. อาชีพ (โปรดระบุตำแหน่ง)
4. ลักษณะงานประจำที่ทำ (โปรดระบุ)
5. ระยะเวลาที่ปวดเข้า ปี เดือน
6. จำนวนเข้าที่มีอาการปวด ☐ 1 ข้าง (ระบุ)
7. ท่านเคยได้รับการรักษาด้วยอาการปวดข้อเข้าหรือไม่

☐ เคย (โปรดระบุ)	☐ ไม่เคย
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8. เมื่อท่านมีอาการปวดเข้า ท่านปฏิบัติอย่างไร

☐ ใช้น้ำยาบรรเทาปวด	☐ บริหารกล้ามเนื้อต้นขา	☐ พักการใช้ข้อเข้า
☐ อื่นๆ (โปรดระบุ)		
9. ท่านใช้ไม้เท้าหรือร่วมช่วยในการเดินหรือไม่

☐ ใช้	☐ ไม่ใช้
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10. ท่านมีโรคประจำตัวหรือไม่ (เช่น โรคหัวใจ โรคปอด เบาหวาน ความดันโลหิตสูง ไทรอยด์ เส้นเลือดในสมองตีบ โรคไต เป็นต้น)

☐ มี (โปรดระบุ)	☐ ไม่มี
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11. ปกติท่านมีพฤติกรรมออกกำลังกายอย่างไร

☐ ไม่เคยเลย	☐ 1 ครั้ง/ เดือน	☐ 1-2 ครั้ง/ สัปดาห์
☐ 3-5 ครั้ง/ สัปดาห์	☐ มากกว่า 5 ครั้ง/ สัปดาห์	☐ 2-3 ครั้ง/ สัปดาห์
12. กิจกรรมการออกกำลังกายที่ท่านปฏิบัติ (โปรดระบุ)

สำหรับผู้วิจัย

1. น้ำหนัก กิโลกรัม
2. ส่วนสูง เซนติเมตร

APPENDIX B

แบบประเมินความรู้เรื่องโรคข้อเข่าเสื่อม

คำชี้แจง โปรดอ่านข้อความต่อไปนี้ แล้วพิจารณาว่าข้อความนั้นถูก หรือผิด

- ถ้าข้อความนั้นเป็นข้อความที่ท่านคิดว่าถูกต้อง ให้ทำเครื่องหมาย ✓ ลงในตารางช่องถูก
- ถ้าข้อความนั้นเป็นข้อความที่ท่านคิดว่าผิด ให้ทำเครื่องหมาย ✕ ลงในตารางช่องผิด

คำถาม	ถูก	ผิด
1. ภาวะเข่าเสื่อมเป็นโรคของผู้สูงอายุ		
2. อาการที่พบบ่อยของภาวะเข่าเสื่อม คือ อาการปวดข้อเข่า		
3. คนที่มีภาวะเข่าเสื่อมต้องเรียนรู้ที่จะใช้ชีวิตอยู่กับอาการปวดข้อ		
4. ภาวะเข่าเสื่อมอาจเกิดจากการบาดเจ็บของข้อเข่าได้		
5. บางคนตื่นขึ้นมาในตอนเช้าจะมีอาการปวดเข่าจากภาวะเข่าเสื่อม		
⋮ ↓		
10. คนที่มีภาวะเข่าเสื่อมควรหลีกเลี่ยงการออกกำลังกาย เพราะกิจกรรมดังกล่าวจะทำให้สภาพของข้อแย่ลง		

APPENDIX C

แบบประเมินความมั่นใจในความสามารถตนเองของผู้ป่วยโรคข้อเข่าเสื่อม (กลุ่มทดลอง 1)

คำชี้แจง โปรดอ่านข้อความต่อไปนี้ และทำเครื่องหมาย ✓ ลงในตาราง ช่องที่ตรงกับความรู้สึกของท่านมากที่สุด คำตอบของท่าน ไม่มีการตัดสินว่าถูกหรือผิด

ข้อความ	ใช่	ไม่แน่ใจ	ไม่ใช่	สำหรับ เจ้าหน้าที่
1. ท่านสามารถออกกำลังกายที่ศูนย์กีฬาได้ทุกวัน				
2. ท่านสามารถออกกำลังกายที่ศูนย์กีฬาได้อย่างน้อยวันละ 30 นาที				
3. ท่านสามารถออกกำลังกายที่ศูนย์กีฬาได้อย่างน้อย 3 วัน ต่อสัปดาห์				
4. ท่านสามารถแบ่งเวลาไปออกกำลังกายที่ศูนย์กีฬาได้ตามที่ท่านต้องการ				
5. ท่านรู้สึกอาย ถ้าท่านต้องออกกำลังกายในสถานที่ที่ไม่เป็นส่วนตัว (ศูนย์กีฬา)				
⋮ ↓				
14. ถ้าท่านอ้วนอยู่แล้ว ปฏิบัติให้พอมลงคงยาก				

แบบประเมินความมั่นใจในความสามารถตนเองของผู้ป่วยข้อเข่าเสื่อม (กลุ่มทดลอง 2)

คำชี้แจง โปรดอ่านข้อความต่อไปนี้ และทำเครื่องหมาย ✓ ลงในตาราง ช่องที่ตรงกับความรู้สึกของท่านมากที่สุด คำตอบของท่านไม่มีการตัดสินว่าถูกหรือผิด

ข้อความ	ใช่	ไม่แน่ใจ	ไม่ใช่	สำหรับ ผู้วิจัย
1. ท่านสามารถเกร็งกล้ามเนื้อต้นขาทั้ง 2 ข้าง ได้ทุกวัน				
2. ท่านสามารถเกร็งกล้ามเนื้อต้นขาทั้ง 2 ข้าง รวมกัน อย่างน้อย วันละ 60 ครั้ง				
3. ท่านสามารถแบ่งจำนวนครั้งในการเกร็งกล้ามเนื้อ ต้นขาใน 1 วัน เป็นหลายๆ รอบ จนครบ 60 ครั้ง ได้โดยไม่จำเป็นต้องบริหารจนครบในครั้งเดียว				
4. ท่านสามารถบริหารกล้ามเนื้อต้นขาได้ทุกเช้า				
5. ท่านสามารถบริหารกล้ามเนื้อต้นขาได้ทุกคืนก่อน นอน				
⋮ ↓				
15. ถ้าท่านอ่านอยู่แล้ว ปฏิบัติให้ผมลงคงยาก				

APPENDIX D

แบบประเมินพฤติกรรมการปฏิบัติตัว

คำชี้แจง โปรดอ่านข้อความต่อไปนี้ และทำเครื่องหมาย ✓ ลงในตาราง ช่องที่ตรงกับการปฏิบัติของท่านมากที่สุด คำตอบของท่าน ไม่มีการตัดสินว่าถูกหรือผิด

ข้อความ	การปฏิบัติ				สำหรับ ผู้วิจัย
	เป็นประจำ	บ่อยครั้ง	นานๆ ครั้ง	ไม่ ปฏิบัติ	
1. ท่านรับประทานอาหารวันละ 3 มื้อ					
2. ท่านรับประทานอาหารเช้าพร้อมทุกมื้อ					
3. ท่านรับประทานจุบจิบ ไม่เป็นเวลา					
4. ท่านรับประทานผลไม้แช่อิ่ม ผลไม้รส หวานจัด ขนมหวาน น้ำอัดลม น้ำหวาน อาหารมันๆ อาหารที่เป็นกะทิ					
5. ท่านควบคุมน้ำหนักตัว					
⋮ ↓					
11. ใน 1 วัน ท่านบริหารกล้ามเนื้อต้นขา	3-4 รอบ	2 รอบ	1 รอบ		

APPENDIX E

แบบประเมินความรุนแรงของโรคข้อเข่าเสื่อม

คำชี้แจง แบบสอบถามชุดนี้ ประกอบด้วยข้อคำถาม 24 ข้อ แบ่งเป็นข้อคำถาม 3 ส่วน ดังนี้

ส่วนที่ 1 เป็นข้อคำถามเกี่ยวกับอาการปวดเข่าจำนวน 5 ข้อ

ส่วนที่ 2 เป็นข้อคำถามเกี่ยวกับอาการฝืดขัดของข้อจำนวน 2 ข้อ

ส่วนที่ 3 เป็นข้อคำถามเกี่ยวกับความสามารถทางกายจำนวน 17 ข้อ

ส่วนที่ 1 อาการปวดเข่า

กรุณาระบุระดับของอาการปวดเข่า ขณะที่ท่านทำกิจกรรมดังต่อไปนี้ (ระดับคะแนน 0 ถึง 10)

1. เดินบนพื้นราบ คะแนน _____ (0-10)

ไม่มีอาการปวด = 0

เดินแล้วปวดแต่ไม่เขย่ง = 1-2

เดินแล้วปวดและเขย่ง = 3-5

เดินแล้วปวดและเขย่ง และใช้ส้นเท้า (Brace) = 6-7

เดินแล้วปวดและเขย่ง และใช้ส้นเท้า และใช้ไม้เท้า = 8-9

เดินไม่ได้ = 10

2. เดินขึ้น-ลงบันได คะแนน _____ (0-10)

ไม่มีอาการปวด = 0

ปวดเฉพาะขึ้นหรือลงบันได = 1-2

ปวดทั้งขึ้นและลงบันได = 3-5

ใช้ผ้ายึดพันเข่า (Support) เฉพาะขึ้นหรือลงบันได = 6-7

ใช้ผ้ายึดพันเข่า (Support) เฉพาะขึ้นหรือลงบันได = 8-9

ขึ้น-ลงบันไดไม่ได้ = 10

3. ขณะนอนบนเตียงในเวลากลางคืน คะแนน _____ (0-10)

ไม่มีอาการปวด = 0

ปวดขณะงอเข่า หรือเหยียดเข่า = 1-2

ปวดขณะงอเข่า และเหยียดเข่า = 3-5

ปวดขณะพลิกตัวข้างใดข้างหนึ่ง = 6-7

ปวดขณะพลิกตัวทั้งสองข้าง = 8-9

ปวดขณะนอนเฉยๆ = 10

4. ขณะลูกนั่ง คะแนน _____ (0-10)

ไม่มีอาการปวด	= 0
ปวดขณะลงนั่ง	= 1-2
ปวดขณะลุกขึ้น	= 3-5
ปวดขณะลงนั่งและลุกขึ้น	= 6-7
ต้องใช้ผ้ายึดพันเข้า (Support) ช่วย	= 8-9
ไม่สามารถลงนั่งและลุกขึ้นเองได้เลย	= 10

5. ขณะยืนลงน้ำหนัก คะแนน _____ (0-10)

•
•
•
•
•

24. ทำงานบ้าน (เบาๆ) คะแนน _____ (0-10)

ทำได้ปกติ	= 0
ยืนทำงานได้	= 1-2
ยืนทำงานโดยใช้ผ้ายึดพันเข้า (Support)	= 3-5
ต้องนั่งทำงาน	= 6-7
นั่งทำงานได้เฉพาะอย่าง	= 8-9
ทำงานหนักไม่ได้เลย	= 10

APPENDIX F

แบบบันทึกผลการประเมินร่างกาย

ชื่อ-นามสกุลผู้เข้าร่วมโครงการ โทรศัพท์ หน่วยงาน ID (ถ้ามีเจ้าหน้าที่).....

ครั้งที่	วัน/เดือน/ปี	น้ำหนัก	ROM (Rt.)	ROM (Lt.)	Muscle Strength		
			Active	Active	วัดครั้งที่ 1	วัดครั้งที่ 2	สรุป
1			/ / _	/ / _			
2			/ / _	/ / _			
3			/ / _	/ / _			

หมายเหตุ

.....
.....
.....
.....

APPENDIX G

แบบบันทึกการออกกำลังกายของผู้เข้าร่วมการวิจัย (กลุ่มทดลอง 1)

ชื่อ-นามสกุลผู้เข้าร่วมวิจัย โทรศัพท์ ID

คำชี้แจง แบบฟอร์มนี้เป็นแบบบันทึกการออกกำลังกายด้วยเครื่องออกกำลังกายที่ศูนย์กีฬา
คณะแพทยศาสตร์โรงพยาบาลรามาธิบดี ขอให้ท่านลงบันทึกการออกกำลังกายของท่าน
ตามความเป็นจริงที่ท่านได้ปฏิบัติ

ครั้งที่	วันที่	เวลาที่ใช้	Target HR	แคลอรี่ที่ได้	หมายเหตุ
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
⋮					
↓					
44					
45					

หมายเหตุ

.....

APPENDIX H

แบบบันทึกการบริหารกล่อมเนื้อต้นขาของผู้เข้าร่วมวิจัย (กลุ่มทดลอง 2)

ชื่อ-นามสกุลผู้เข้าร่วมวิจัย โทรศัพท์ ID

คำชี้แจง แบบฟอร์มนี้เป็นแบบบันทึกการบริหารกล่อมเนื้อต้นขาของท่าน ขอให้ท่านลงบันทึกตาม
ความ เป็นจริงที่ท่านได้ปฏิบัติ

ตัวอย่างการบันทึก

สัปดาห์ที่ 1 ท่านบริหารกล่อมเนื้อต้นขาวันจันทร์ที่ 1 มกราคม 2550 รอบที่ 1 ปฏิบัติ 10
ครั้ง รอบที่ 2 ปฏิบัติ 10 ครั้ง รอบที่ 3 ปฏิบัติ 10 ครั้ง

การลงบันทึก

ช่องวันที่	ลงบันทึกเป็น	จันทร์ที่ 1 มกราคม 2550
รอบที่ 1	ลงบันทึกเป็น	10 ครั้ง
รอบที่ 2	ลงบันทึกเป็น	10 ครั้ง
รอบที่ 3	ลงบันทึกเป็น	10 ครั้ง

หมายเหตุ หากท่านไม่ได้ปฏิบัติ ลงบันทึกเป็น 0

สัปดาห์	วันที่	รอบที่ 1	รอบที่ 2	รอบที่ 3	หมายเหตุ
1					
2					
...					
12					

APPENDIX I

LIST OF EXPERTS

There were five experts who validated the content of the research instruments.
The experts include:

1. Assoc. Prof. Wiwat Wajanavisit, M.D.
Department of Orthopaedics, Faculty of Medicine, Ramathibodi Hospital,
Mahidol University
2. Asst. Prof. Visal Kantaratanakul, M.D. F.I.M.S.
Department of Rehabilitation Medicine, Faculty of Medicine, Ramathibodi
Hospital, Mahidol University
3. Asst. Prof. Montha Limtongkul, R.N., M.S. (Nursing)
Department of Nursing, Faculty of Medicine, Ramathibodi Hospital,
Mahidol University
4. Asst. Prof. Sommai Vanavanant, R.N., M.S. (Nursing)
Department of Medicine, Faculty of Medicine, Ramathibodi Hospital,
Mahidol University
5. Miss Jarunee Nantavanotayan, R.N., M.S. (Public Health)
Department of Nursing, Faculty of Medicine, Ramathibodi Hospital,
Mahidol University

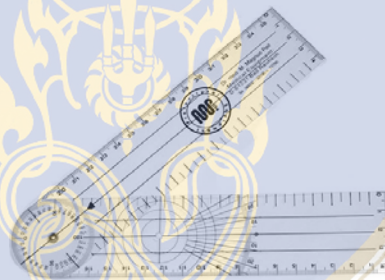
APPENDIX J

INSTRUMENTS

Back-leg Dynamometer



Goniometer



Cross Trainer



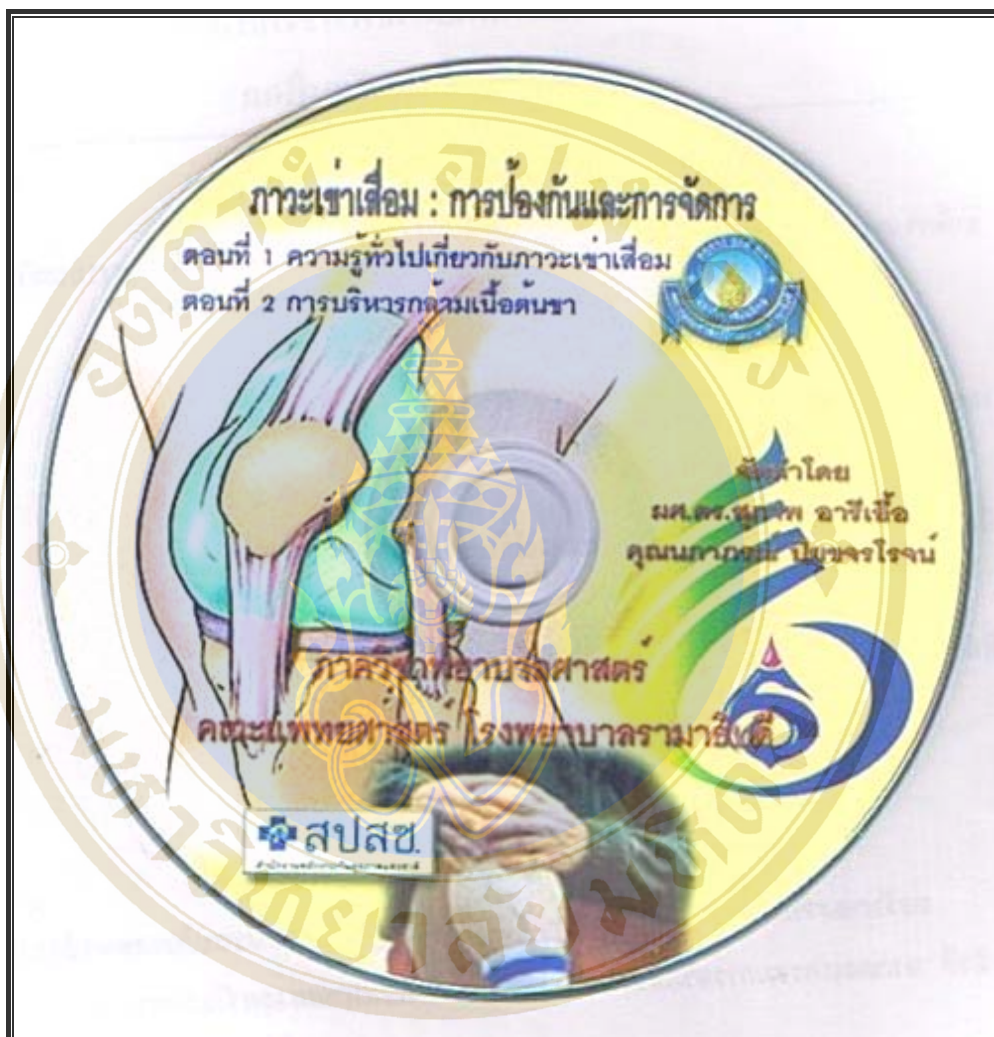
APPENDIX K

KNEE OSTEOARTHRITIS BOOKLET



APPENDIX L

VCD ENTITLED ‘KNEE OA PREVENTION AND MANAGEMENT’



APPENDIX M

DOCUMENTARY PROOF OF ETHICAL CLEARANCE

		คณะแพทยศาสตร์ โรงพยาบาลรามาธิบดี มหาวิทยาลัยมหิดล ถนนพระราม 6 กทม. 10400 โทร. (662) 354-7275, 201-1296 โทรสาร (662) 354-7233 Faculty of Medicine, Ramathibodi Hospital, Mahidol University Rama VI Road, Bangkok 10400, Thailand Tel. (662) 354-7275, 201-1296 Fax (662) 354-7233
Documentary Proof of Ethical Clearance Committee on Human Rights Related to Researches Involving Human Subjects Faculty of Medicine, Ramathibodi Hospital, Mahidol University		
		No. MURA2006/449
Title of Project	Impact of an Integrated Health Education and Exercise Program on Middle-aged Adults with Osteoarthritis of the Knee	
Protocol Number	ID 12 – 49 – 28	
Principal Investigator	Miss Naphaphorn Piyakhachornrot	
Official Address	Department of Nursing Faculty of Medicine, Ramathibodi Hospital Mahidol University	
<i>The aforementioned project has been reviewed and approved by Committee on Human Rights Related to Researches Involving Human Subjects, based on the Declaration of Helsinki.</i>		
Signature of Secretary	 Assoc. Prof. Duangrudee Wattanasirichaigoon, M.	
Committee on Human Rights Related to Researches Involving Human Subjects		
Signature of Chairman	 Prof. Boonsong Ongphiphadhanakul, M.D	
Committee on Human Rights Related to Researches Involving Human Subjects		
Date of Approval	December 20, 2006	

APPENDIX N



หนังสือยินยอมโดยได้รับการบอกกล่าวและเต็มใจ

(Informed Consent Form)

ชื่อโครงการ
 ชื่อผู้วิจัย
 *ชื่อผู้เข้าร่วมการวิจัย
 อายุ เลขที่เวชระเบียน

คำยินยอมของผู้เข้าร่วมการวิจัย

ข้าพเจ้า นาย/นาง/นางสาว ได้ทราบรายละเอียด
 ของโครงการวิจัยตลอดจนประโยชน์ และข้อเสียที่จะเกิดขึ้นต่อข้าพเจ้าจากผู้วิจัยแล้วอย่างชัดเจน ไม่มีสิ่งใด
 บิดบังซ่อนเร้นและยินยอมให้ทำการวิจัยในโครงการที่มีชื่อข้างต้น และข้าพเจ้ารู้ว่าถ้ามีปัญหาหรือข้อสงสัยเกิดขึ้น
 ข้าพเจ้าสามารถสอบถามผู้วิจัยได้ และข้าพเจ้าสามารถไม่เข้าร่วมโครงการวิจัยนี้เมื่อใดก็ได้ โดยไม่มีผลกระทบต่อ
 การรักษาที่ข้าพเจ้าพึงได้รับ นอกจากนี้ผู้วิจัยจะเก็บข้อมูลเฉพาะเกี่ยวกับตัวข้าพเจ้าเป็นความลับและจะเปิดเผยได้
 เฉพาะในรูปที่เป็นสรุปผลการวิจัย การเปิดเผยข้อมูลเกี่ยวกับตัวข้าพเจ้าต่อหน่วยงานต่างๆที่เกี่ยวข้อง กระทำได้
 เฉพาะกรณีจำเป็นด้วยเหตุผลทางวิชาการเท่านั้น

ลงชื่อ..... (ผู้เข้าร่วมการวิจัย)

..... (พยาน)

..... (พยาน)

วันที่

คำอธิบายของแพทย์หรือผู้วิจัย

ข้าพเจ้าได้อธิบายรายละเอียดของโครงการ ตลอดจนประโยชน์ของการวิจัย รวมทั้งข้อเสียที่อาจจะ
 เกิดขึ้นแก่ผู้เข้าร่วมการวิจัยทราบแล้วอย่างชัดเจน โดยไม่มีสิ่งใดบิดบังซ่อนเร้น

ลงชื่อ..... (แพทย์หรือผู้วิจัย)

วันที่.....

หมายเหตุ: กรณีผู้เข้าร่วมการวิจัยไม่สามารถอ่านหนังสือได้ ให้ผู้วิจัยอ่านข้อความในหนังสือยินยอมฯ นี้ให้แก่
 ผู้เข้าร่วมการวิจัยฟังจนเข้าใจดีแล้ว และให้ผู้เข้าร่วมการวิจัยลงนามหรือพิมพ์ลายนิ้วหัวแม่มือรับทราบในการให้
 ความยินยอมดังกล่าวข้างต้นไว้ด้วย

* ผู้เข้าร่วมการวิจัย หมายถึง ผู้ยินยอมตนให้ทำวิจัย

APPENDIX O

MEAN SCORES OF STUDY VARIABLES BETWEEN GROUPS

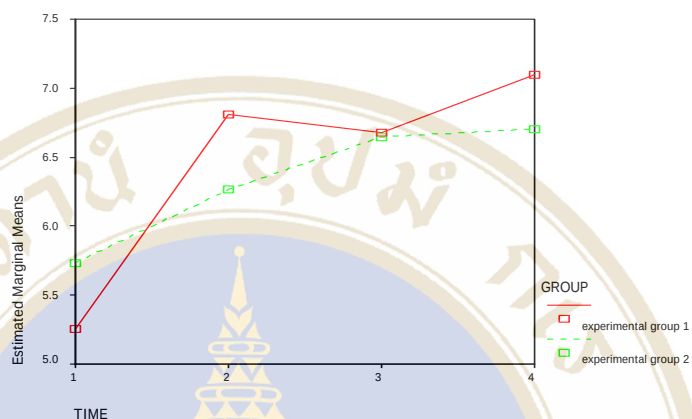


Figure A. Mean Scores of Osteoarthritis Knowledge between Groups across Different Time Points

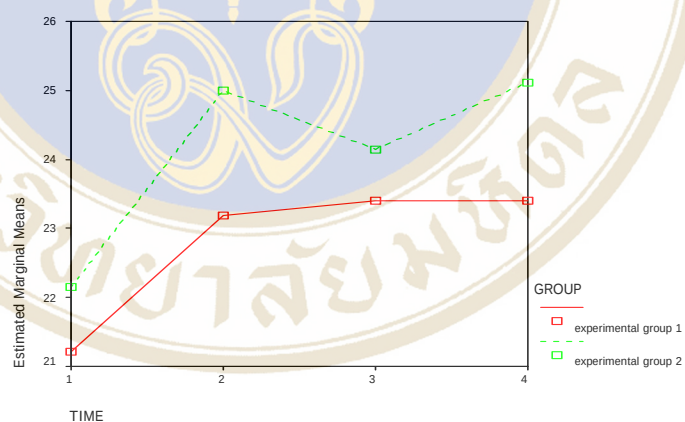


Figure B. Mean Scores of Self-efficacy Expectation between Groups across Different Time Points

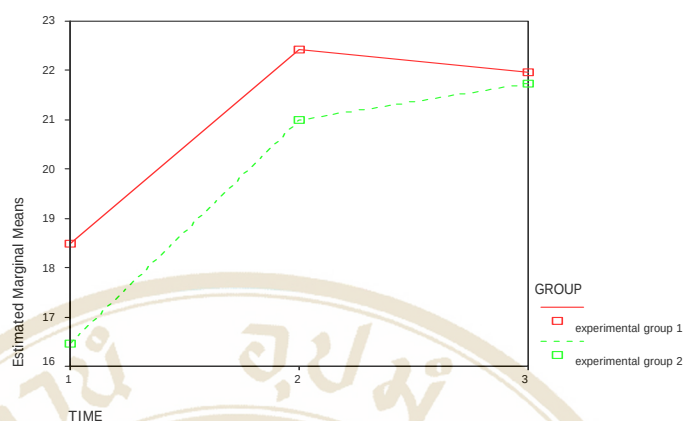


Figure C. Mean Scores of Behavior between Groups across Different Time Points

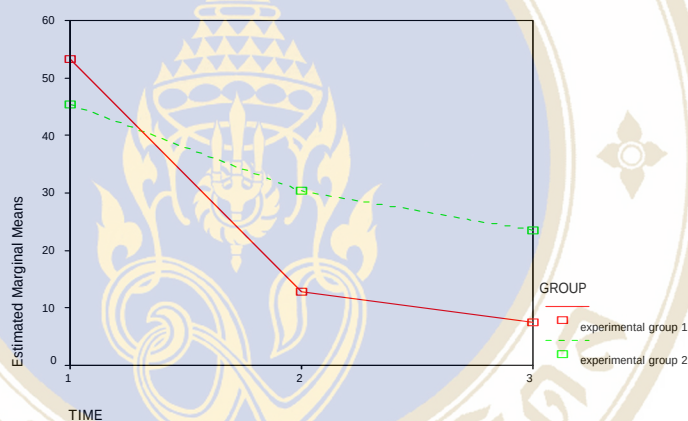


Figure D. Mean Scores of Severity of Knee Symptoms between Groups across Different Time Points

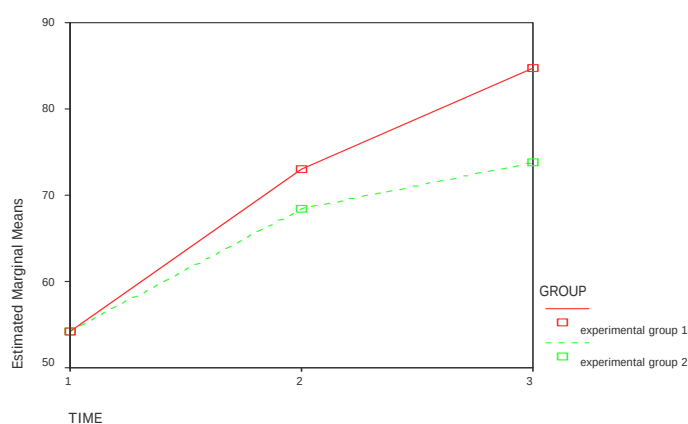


Figure E. Mean Scores of Muscle Strength between Groups across Different Time Points

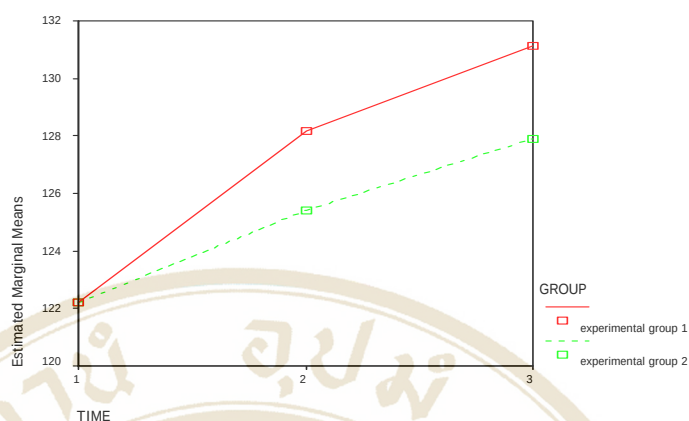


Figure F. Mean Scores of Right Knee Flexion Range of Motion between Groups across Different Time Points

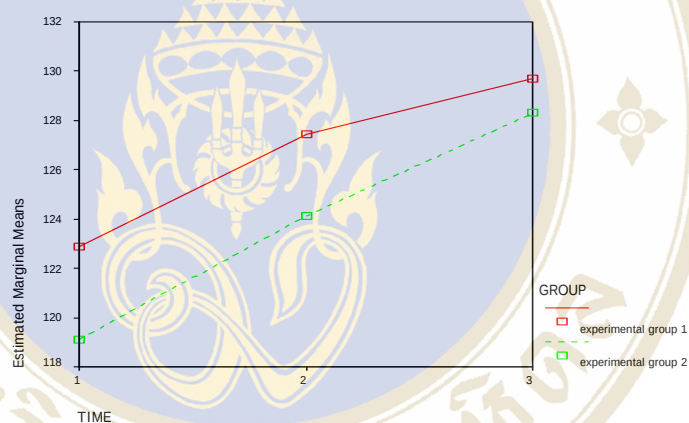


Figure G. Mean Scores of Left Knee Flexion Range of Motion between Groups across Different Time Points

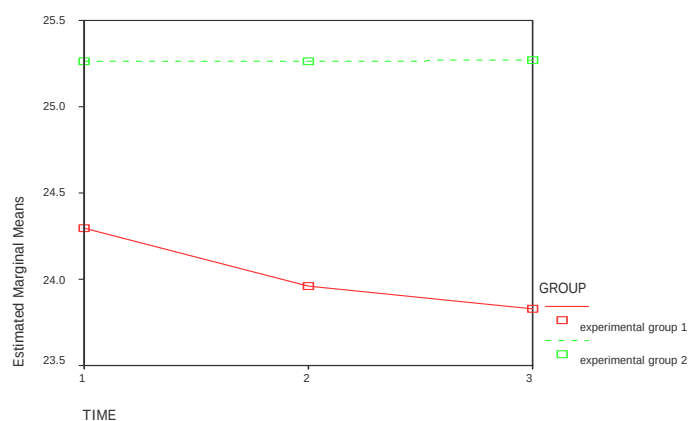


Figure H. Mean Scores of Body Mass Index between Groups across Different Time Points

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