CHAPTER 3

METHODS

Research Design

The purpose of this study was to test the feasibility and acceptability of an intervention program designed to increase osteoporosis knowledge, health beliefs, and self-efficacy with regards to calcium consumption and brisk walking exercise in Thai older adults. The main dependent variables in this study were calcium consumption and brisk walking. The study participants were recruited from one Senior Center in Chiang Mai, Thailand. Selection of only one Senior Center in this study was due to the researcher's concern to threats to internal validity that may be found if demographics differed among the Senior Centers. The one group pre-posttest design was chosen to achieve the purpose with economical use of resources and issues of intervention selection bias. Baseline data were collected prior to the implementation of the intervention. Follow-up data were collected at the end of the education sessions, 3- month, and 6-month after enrollment.

The study occurred in three stages. In the pre-treatment, baseline measures were collected for osteoporosis knowledge, osteoporosis health beliefs, osteoporosis self-efficacy, calcium intake, exercise practices, and brisk walking exercise. In the intervention or treatment phase, the educational intervention program "Join the Movement to Have Healthy Bones Project: JHBP" was given by the investigator.

After the treatment phase, osteoporosis knowledge, osteoporosis health beliefs, osteoporosis self-efficacy, calcium intake, and brisk walking exercise were measured.

Setting

Chiang Mai is located in the northern part of Thailand and consists of twenty-two districts. Due to the fact that Chiang Mai is a big city, a number of Senior Centers are established in various districts as health care resources for older adults. The Health Promotion Center for the Elderly (HPCE) at the Faculty of Nursing, Chiang Mai University was chosen to recruit prospective participants. Older adults who are members of this Center come from both urban and rural areas around the Faculty of Nursing, Chiang Mai University; with similar characteristics of northern Thai, they seem to be representative of older adults living in Chiang Mai. The HPCE is located in the Faculty of Nursing, Chiang Mai University, and serves as a health information resource for older adults living in Chiang Mai. This Center provides a sustained supportive environment for both initial and long-term behavior changes. The major goal of the HPCE is to promote well- being for older persons. For these reasons, the HPCE is a place, which is suitable to develop a prototype of health promotion for other centers in Chiang Mai.

The HPCE consists of 1,325 men and women who are 60 years and over. Key persons who run the HPCE are eight professional nurses who are faculty members, a secretary, and 15 representatives of the older adult participants. The members have a meeting twice a month. They participate in health surveys, health education, and health promotion programs provided by the HPCE service on the first and the third Friday of the month. Each meeting consists of about 150 older adults.

Sample

A selected sampling recruitment approach was used. A letter asking for permission to collect data in the HPCE was sent to the head of health personnel. After human subject approval and permission from the chairperson of the HPCE, all participants who were attending at the HPCE during January 2003 were contacted for participation in the study (Appendix A: Contact Letter). The researcher initially made an appointment with prospective participants for personal introduction and to inform them of the purpose and methods of the study (Appendix B: Participant Information Sheet). The prospective participants were invited to participate in the study. They were assured that all information would be kept confidential and that they were free to withdraw from the study at any time if they wished so. If an individual expressed interest and met all of the inclusion criteria, he/she would be recruited in the study, and then written consent (Appendix C: Informed Consent Form) was obtained before entering the study.

Sample Size

An estimate of the sample size in the study was calculated by using a sample size determinant formula for repeated measurement analysis (Viwatwongkasem, 1994). A level of significance of .05 (probability of a type I error) and a power of .80 (1- probability of type II error) were designated in this study. Since there was not any other study that similar has been conducted, data required to calculate the sample size were gained from a similar study (Peterson et al, 2000). By using the aforementioned method, the sample of 31 individuals was suggested in this study (Appendix D). As the participants in this study would be monitored for change of their behaviors for six months, participants dropping out from the study might threaten the study validity. A previous study (Peterson et al., 2000) reported an attrition rate of 34%; therefore, the sample in this study was increased by adding 34% more participants. The sample needed in this study was therefore 42 individuals.

Inclusion/Exclusion Criteria

The inclusion criteria for the study sample were (a) age 60 and older, (b) having no cognitive impairment as evaluated by the Set Test, (c) having no uncontrolled medical illnesses that might limit participation in brisk walking exercise, (d) being willing to participate in the study, (e) attending the HPCE, (f) being able to read and write Thai, (g) not planning scheduled surgery during the duration of the study, and (h) not having plans to travel or to move from Chiang Mai during the duration of the study. Prospective participants who used aided devices such as canes and walkers were excluded from the study.

Human Subject

Ethical approval was granted from the Human Experimentation Committee Research Institute for Health Sciences (RIHES), Chiang Mai University, Thailand (Appendix E). Participants underwent an informed consent procedure by signing written consent prior to study participation.

Instrumentation

The instruments employed in this study included two parts (Appendix F). The first part encompassed the Demographic Questionnaire, and the screening tools (the Set Test, the Exercise Survey, and the Ultrasound Bone Measurement). The second part had the instruments used to evaluate outcomes, which included the Facts on Osteoporosis Quiz (FOOQ), the Osteoporosis Health Belief Scale (OHBS), the Osteoporosis Self-Efficacy Scale (OSES), the Dietary Calcium Food-Frequency Questionnaire, Pedometer device, the Program Evaluation Questionnaire, and the Post-Study Interview Guide.

The Demographic Questionnaire

This instrument was designed to obtain information on sex, age, education, weight, height, and risk factors (e.g. family history of osteoporosis, illness history, drug history, estrogen replacement therapy, and calcium supplement), and lifestyle factors (smoking, alcohol intake, and daily caffeine intake). This questionnaire consists of 10 items. Age, weight, and height are provided with open–ended responses, while other items are multiple-choice questions.

The Set Test

The Set Test was used for screening mental status in the elderly. The test was performed by asking the participants to name as many items as they can recall in each of four successive categories or sets including colors, animals, fruits, and towns. A score of 1 is given for a correct answer, with a maximum of 10 in each set. A maximum total score is 40. A person with a score 25 or over is considered mentally intact. The Set Test is an appropriate tool to be used with people from a variety of educational levels, social status, cultures, and norms. It is performed rapidly and fairly easily (Isaacs & Kennie, 1973).

Validity and reliability of the instrument. Validity testing was initially obtained from a sample of 189 older adults in the East End of Glasgow, England (Isaacs & Kennie, 1973). The participants were representatives of old and very old people whose ages ranged from 65 to 74 (n = 35; male = 16, and female = 19), from 75 to 84 (n = 89; male = 43, and female = 46), and from 85 and over (n = 65; male = 31, and female = 34). The findings suggested that a person with a score of fewer than 15 on the test closely corresponded to a clinical diagnosis of dementia. Scores ranging from 15 to 24 showed a lesser degree of association with dementia, while subjects with a score 25 or over were normal. The Set Test was used to evaluate the mental status of Thai older adults in some studies (Lausawatchaikul, 2000; Nakaphongse, 1996; Saenmanoch, 1998). It was recommended to be extremely helpful to evaluate the mental status of older adults, and to perform rapidly and fairly easily (2-3 minutes). In this study, scores obtained by the Set Test ranged from 25 to 40 ($\bar{X}$ = 38.49, SD = 3.58). Time required for responding was between 2 and 10 minutes ($\bar{X}$ = 5.56, SD = 2.29). Interestingly, the category of town caused the recall difficulty for an older adult who did not often go outside her hometown. This result was consistent with the study conducted by Lausawatchaikul (2000), who reported that three older adults who had never go outside their home had the recall difficulty on the category of town or cities.

The Exercise Survey

This survey instrument was modified by Aree-Ue and Pothiban (2003) from the Self-Report Athletic Pursuits Questionnaire (Stillman, Lohman, Slaughter, & Massey, 1986) and a recommendation for exercise from the National Osteoporosis Society (National Osteoporosis Society, n.d.-b). The instrument assessed four aspects of physical activities including the type, frequency, duration, and level of intensity of an exercise session. The types of exercise were brisk walking, jogging, and dancing. In addition, an open-ended question was also provided for either weight bearing or non-weight bearing exercise responses. Participants were asked to identify the type, frequency, and duration of each exercise in a typical week. The intensity of the exercise was estimated by asking the participants to rate his/her breathing at the end of exercise on a scale from 0 to 3 according to the following response: (0) normal; (1) a little faster than normal; (2) a lot faster, but talking is possible; and (3) so fast that talking is not possible. If participants participated in more than one type of exercises, the mean scores of frequency and duration were pooled. Participants were classified as high and low exercisers. Participants who exercised more than three times a week for a minimum of 30 minutes with an intensity rate of at least 1 were assigned into the high category, whereas the others who engaged in exercise less than aforementioned criteria were assigned into the low exercise category.

Validity of the instrument. Face validity of the modified instrument was judged by three experts in gerontological nursing (Aree-Ue & Pothiban, 2003).

Ultrasound Bone Measurement

Ultrasound bone measurement, Lunar Achilles, was used to measure bone mass and bone microarchitecture at the right heel (the os calcis). The Lunar Achilles reports the speed of sound (SOS, m/s), broadband ultrasound attenuation (BUA, dB/MHz), and the Stiffness Index (SI). The SOS value is determined by the transit time of a sound wave as it passes through the heel, while the BUA value involves sending a broadband ultrasound pulse through the bone and measuring the reduction of intensity at different frequencies. The combination of SOS and BUA expresses a single clinical measure that is the SI value (SI = 0.67 x BUA + 0.28 x SOS – 420) (Lunar Corporation, 1998). Based on the operations manual provided by the manufacturer, the SOS, BUA, and SI values are compared with the reference values in young Japanese (SOS = 1,558 ± 24 m/s; BUA = 113 ± 5 dB/MHz; SI = 90 ± 10). SI results expressed as T-scores are used to diagnose osteoporosis in the same way as are T- scores obtained by DEXA. For this study, a bone mass T-score between 1 standard deviation (SD) below the young normal mean of Japanese and equal to 2.5 SD below was defined as low bone mass. A bone mass T-score over 2.5 SD below the young normal mean was classified as severe low bone mass, while having a bone mass T-score between 0 and -1 SD was considered within normal range.

Validity of the instrument. The precision (reproducibility) which was reported as the coefficients of variation were 0.15%-0.7% for SOS, 0.4%-3.0% for BUA, and 0.2%-3.0% for SI, which indicates that the standard error is low and the precision is good (Homik & Hailey, 1998). In addition, to verify the accuracy of operation of this device, standardization and calibration with phantoms were performed before the first measurement each day (Lunar Corporation, 1998).

The Facts on Osteoporosis Quiz (FOOQ)

The FOOQ was used to examine osteoporosis knowledge in the elderly. The FOOQ consists of 25 items with a 3-choice format: true, false, and don't know. There are eight items reflecting general facts about osteoporosis, seven items related to preventive behaviors, and 10 items related to risk factors. A score of 1 is given for a correct answer and 0 for the incorrect one or for the answer "don't know" The total possible score on FOOQ is 25. Higher scores indicate more knowledge of osteoporosis (Ailinger et al., 1998).

Validity and reliability of the instrument. The content validity of the instrument has been judged by two nursing experts who were investigators in NIH–funded clinical trials on osteoporosis. Each item of the instrument was assessed for relevance and accuracy on a score of 1 (not relevant), 2 (somewhat relevant), 3 (quite relevant), and 4 (very relevant). The content validity index measured the proportion of agreement between the experts on items assigned a "3" or "4". The content validity index was .92. Six items considered by the experts as "somewhat" or "not relevant or accurate" were dropped from the original 34-item version. The construct validity was tested by using item analysis on the remaining 28 items. Three items were deleted after they did not meet criteria for item difficulty or/and item discrimination.

Internal consistency reliability, Kuder- Richardson Formula 20 (KR-20), was initially tested on a convenient sample of 104 women who were graduate nursing students (n = 21), students in a sociology course that included undergraduates and graduates (n = 30), undergraduate pre-clinical nursing students (n = 26), and community women (n = 27). The internal consistency of the FOOQ was .83 for the total sample (Ailinger et al., 1998). Ailinger and Emerson (1998) reported that internal consistency reliability was .84 in a study on 247 women (mean age = 46; SD ± 10).

Since the FOOQ was developed in English, it was translated into Thai and is described elsewhere (Aree-Ue & Pothiban, 2003). The internal consistency reliability of the FOOQ Thai version reported in a study conducted on 111 Thai older adults (mean age = 68.46 years; SD ± 5.68) was .89. In this study, internal consistency reliability was .82, .75, .75, and .68 at the baseline, immediately after class, 3 and 6-month after enrollment, respectively.

The Osteoporosis Health Belief Scale (OHBS)

The OHBS developed by Kim, Horan, and Gendler (1991) was used to measure health beliefs related to osteoporosis. This instrument focuses on two risk reduction behaviors: calcium intake and physical exercise. The OHBS is a 42-item self-report questionnaire. It consists of seven subscales including perceived susceptibility of developing osteoporosis, seriousness of osteoporosis, benefits of calcium intake, benefits of weight-bearing exercise, barriers to weight-bearing exercise, barriers to calcium intake, and health motivation for preventing the development of osteoporosis. A 5-point Likert scale was used to rate items from strong disagreement (1) to strong agreement (5) in each subscale. The potential range for each subscale is 6 to 30, with total possible scores ranging from 42 to 210.

Validity and reliability of the instrument. The OHBS consists of basic concepts based on the HBM. The concepts of susceptibility, seriousness, and health motivation relate to the single threat of developing osteoporosis, while the concepts of barriers and benefits logically include attitudes about two types of behaviors: the barriers and benefits related to calcium intake and those related to physical exercise.

The construct validity of the osteoporosis health belief calcium scale (five factors: susceptibility, seriousness, benefits, barriers, and motivation) was assessed by factor analysis. Factor loading ranged from .40 to .80. The five factors accounted for 49.4% of the total variance. The concurrent validity was assessed by grouping participants into calcium intake scores. A discriminant function analysis was correctly identified by discriminating the participants who consumed calcium greater than or equal to 50% of the Recommended Daily Allowance (RDA) from the other of those who consumed calcium less than 50% RDA.

The construct validity of the osteoporosis health belief exercise scale was also evaluated by factor analysis. Factor loadings ranged from .45 to .80. The five factors accounted for 49.3% of the total variance. In addition, the concurrent validity of the osteoporosis health belief exercise scale was assessed by a discriminant function analysis. Participants were grouped in high or low levels of exercises based on the Athletic Pursuits Questionnaire scores. Findings showed that the variables were accurately classified (Kim, Horan, Gendler, & Patel, 1991).

The internal consistency reliability of the OHBS reported in the original study ranged from .61 to .80 of the study conducted on older adults whose ages between 60 and 93 years (Kim, Horan, Gendler, & Patel, 1991). The reliability reported in studies conducted on young and older women ranged from .74 to .84 (Sedlak et al., 1998;

Sedlak, Doheny, & Jones, 2000) and from .71 to .82 in older men (Sedlak, Doheny, & Estok, 2000).

The original version of the OHBS is in English. It was translated into Thai by Piaseu, Belza, and Mitchell (2001). The reliability coefficients (Cronbach's alpha) for the OHBS Thai version ranged from 0.82 to 0.95 in each subscale on 100 undergraduate nursing students (mean age = 18.48, SD ± 0.6). The OHBS Thai version was piloted on 10 older adults before administrating in this study. Three items of the Thai version were revised by the researcher because the older adults reported that words contained on those items were not clear. The reliability of the Thai revised version for the entire scale was .78. The total reliability for the entire scale in this study was .74, .91, .87, .83 at baseline, immediately after class, 3 and 6-month after enrollment, respectively.

The Osteoporosis Self-Efficacy Scale (OSES)

The OSES was created by Horan et al. (1998) based on Bandura's concept of self-efficacy, which used to measure self-efficacy associated with osteoporosis prevention behaviors of calcium intake and exercise. The original version of the instrument was a 12-item magnitude scale representing the three theoretical dimensions of efficacy expectations: a) initiation, b) maintenance, and c) persistence in performing the activity. The possible score for each item ranges from not at all confident (0) to very confident (10). A total possible score ranges from 0 to 120. The instrument was extended to 21 items with visual analogs in which the lower anchor of a 10-cm line was not at all confident (0) and the upper end was very confident (10). The total possible scores range from 21 to 210 (Horan et al., 1998).

Validity and reliability of the instrument. Initial reliability and validity of the instrument were tested by using a principal factor analysis (PFA) in 201 women (mean age = 56, SD ± 14.18). The OSE-Exercise and OSE-Calcium factors accounted for 86% of item covariation and had internal consistency estimates of .94 and .93, respectively (Horan et al., 1998).

Construct validity was examined by testing hypotheses related to the construct validity of the measure. In addition, convergent and discriminant validity were explored. The OSE-Exercise scores showed substantial correlations with the Atherosclerosis Baecke Habitual Physical Activity Questionnaire (ABHPAQ), but the ABHPAQ showed negligible correlation with the OSE-Calcium scores that are evidence of discriminate validity. In contrast, the OSE-Calcium scores correlated more highly with reported calcium intake, whereas calcium intake showed no correlation with the OSE-Exercise scores. A final examination of the construct validity was assessed by using the regression study. The results of the hierarchical regression indicated the incremental validity of the OSE scores.

Reliability of the instrument was reported on both the original version and the extended version. The internal consistency reliability of the original version was .86 at the pretest and .92 at the posttest reported by a study conducted on 31 young college women (Sedlak et al., 1998), and was .90 in a study conducted on 138 older men (Sedlak, Doheny, & Estok, 2000). In a study conducted on 100 female undergraduate nursing students, the internal consistency reliability ranged from .94 to .96 (Piaseu, Belza et al., 2001).

The original version of the instrument was employed in this study since the authors (Kim, Horan, & Gendler, 1991) suggested that it was appropriated when administered by the elderly. The original version of the instrument is in English, so it was translated into Thai by the researcher. The most common and highly recommended procedure for translating an instrument from the source language (SL, English language in this case) to the target language (TL, Thai language in this case) is back translation (Brislin, 1970). Back translation technique was used with the following steps (Jones & Kay, 1992):

1. The researchers personally developed the translated instrument by translating the SL language into Thai language. Two bilingual translators who were geriatric nurses were asked to translate the items from Thai into English.
2. The researcher and the translators discussed the items that did not seem equivalent on either the English or the Thai. Then, changes on those items were made. The back translation process was reworked until the researcher and the translators were assured that the English and Thai versions were equivalent. However, since the purpose of the research was operational, which aimed to examine the difference between two cultural groups, the translation used in this study was asymmetrical approach that SL original must be loyally translated into the TL (Werner & Campbell, 1970).
3. A pilot testing was the last step in developing the TL version of the original instrument. Ten Thai older adults were invited to participate in the pilot testing aimed to examine not only the quality of the translation, but also the practical aspects of administration. Results revealed that most participants (80%) indicated good understanding on written items. Few participants reported much time consumed on decision making to select the answer of

each item. The internal consistency reliability of entire scales was.92, which was considered adequate (Nunnally, 1978). Additionally, Werner and Campbell (1970) claimed that finding similarity in psychometric properties including reliability, validity, and factor structure for two forms in both languages indicated adequacy of translation. An alternative method for assessing the psychometric soundness of the TL is to administer the SL and the second SL (developed through back translation) to monolingual subjects and compares scores from the two SL forms. This method presents a triangulation onto the TL version of the instrument (Jones, 1986; Werner & Campbell, 1970). The OSES two SL versions, an original and developed through back translation version, were administered to four American elderly, and findings indicated that scores obtained from each item in both versions were similar in each participant scoring (r = 1.0).

The reliability coefficient (Cronbach's alpha) for the Thai version used in this study was .92, .91, .87, .85 at the baseline, immediately after class, 3 and 6- month after enrollment, respectively.

The Dietary Calcium Food-Frequency Questionnaire

This measure was developed by Piaseu (1994). It was used to assess dietary calcium intake by estimating the number of calcium-rich foods listed on the basis of a day, week, and month. Participants were asked to provide information about frequency intake of 20 calcium-rich foods listed in the questionnaire, such as milk, ice cream, eggs, fish, fruits and vegetables, cereals, shellfish, and others. The calcium content for each food item was derived from manufacturer's data and from tables of nutritive values of Thai foods (Nutrition Division of the Public Health Ministry, n.d.). The sum for each of these foods from their standardized calcium content was calculated into milligrams per day.

Validity of the instrument. The face validity of the original version of the Food-Frequency Questionnaire was examined by the three experts in nutrition. Convergent validity indicated a correlation between the Food-Frequency Questionnaire scores and the three day food record scores of 50 participants (Piaseu, 1994).

Pedometer Device

A pedometer, FreeStyle PacerPro (FreeStyle, 2002), is a self-monitoring device considered to objectively assess physical activity. It was used in this study to challenge participants to increase walking and maintain their distance at a high level. The Freestyle PacerPro measures vertical oscillations, and uses the individual subject's stride length to compute the distance walked. To determine stride length, participants were instructed to walk twelve steps at their normal speed. A sum of distance values was computed in feet, and then it was divided by 12 to yield a single stride length. In a previous study, the pedometer was recommended to be worn at the left side where it produced more accurate measurement than that on the other side (Bassett et al., 1996). In addition, participants were instructed to position it on their belts or on the top of their shorts or trousers as close to the hip area as possible. When worn, the device must be parallel to the ground to function properly. The participants in this study were asked to wear the pedometer during walking exercise and to record the pedometer reading of their own walking exercise values including steps, speed, distances, energy, and times per day on their personal calendars for a 7-day period. They were instructed to record data immediately after completing their walking exercise and to reset the pedometer to zero each day. The participants were asked to return the pedometer record to the investigator at the baseline and follow-up periods (3 and 6-months after enrollment). After collection of pedometer diaries from the participants, a sum of data was computed to determine the average walking exercise values per week.

Validity and reliability of the instrument. The Freestyle PacerPro was tested for accuracy by subjects walking in different situations: with a 4.88-km sidewalk, with different walking surface, and with different speed. Results indicated a reasonably accurate, recording 102.6% (left) and 87.5% (right) of all distance walked and steps taken (Bassett et al., 1996). Prior to this study, twenty-four pedometers were randomly selected to test accuracy. Twelve participants were asked to wear two pedometers (the one on the left and the other on the right side) during walking at 100 count steps. The steps obtained from pedometer reading ranged from 85 to 103 steps ($\overline{X}$ = 95.92; SD ± 5.8) on the left side and from 78 to 112 ($\overline{X}$ = 98.16; SD ± 9.2) on the right side. The pedometer reading reported an average error of 4.75 (SD ± 5.2) on the left side and 6.83 (SD ± 6.1) on the right side, compared with actual walking steps. However, the difference among actual walking steps, pedometer reading steps on the left side, and pedometer reading steps on the right side was determined by using one-way ANOVA. There was not a significant difference among steps taken from these three sources. On the other hand, the coefficient of variation (CV) of this device at the left side and the right side was 6.04% and 9.3%, respectively.

Program Evaluation Questionnaire

This questionnaire was modified from the 18-item Follow-up questionnaire developed by Warms (2002). The modified version was employed to evaluate the acceptability of the program, which included the program evaluation and the research study evaluation. This questionnaire consists of 21 items: a ten-point scale is designed for 18 items, and three items are open-ended questions. The program evaluation questions include: three items related to usefulness of the program, three items reflected calcium intake suggestions, and four items related to walking exercise practice. The research study evaluation questions include: two items of measurement burden, four items related to pedometer use, and two items related to pedometer record. Three open-ended questions asked participants to specify any question they found particularly difficult to answer and to comment on the easiest and most difficult aspects of pedometer use and record.

Validity of the instrument. Content validity was served as validation of this questionnaire based on a two-stage process proposed by Lynn (1986). The two-stage process includes a developmental stage and a judgment/quantification stage. For the developmental stage, three steps were adopted. First, a comprehensive review of the literature provided domain contents. Then items reflecting the domain of content were generated. Finally, the actual instrument was created through appropriate wording in each item and scoring response. However, item and scoring format were developed by using the Follow-up Questionnaire (Warms, 2002) as a basis.

For the judgment/quantification stage, a panel of content experts to review and validate the relevance of items to the domain of content was needed. According to

Waltz, Strickland, and Lenz (1991), a panel of experts should have at least two reviewers who are experts in the content area to be measured, and at least one expert who is knowledgeable about instrument construction. Additionally, the expert should present characteristics, such as clinical experience with the target population and achieved professionalism in the topic area (Davis, 1992). Lynn (1986) suggested that a minimum of five experts would provide a sufficient level of control for chance agreement. In this study, five experts who met those aforementioned criteria were invited to be a panel expert. The experts were asked to validate each item of the instrument by using the four-point Likert scale (1 = not relevant, 2 = somewhat relevant, 3 = quite relevant, 4 = highly relevant), which were used to quantitatively analyze agreement for each item and entire instrument. Eventually, the experts were encouraged to address the wording and clarify each item and entire instrument. In order to make a decision about inclusion/ revision/exclusion of items, interrater agreement in the experts use of rating scale was employed (Waltz et al., 1991). Interrater agreement was evaluated by computing the number of agreements among the two experts (all items were rated 1 or 2 by both experts, plus all items rated 3 or 4 by both experts) divided by the total number of items (Appendix G). The interrater agreement of each item ranged from .80 to .95, and was .87 for the entire instrument. This value is higher than .70, which is a minimally acceptable value (Martuza, 1977).

The Content Validity Index (CVI) was also calculated. The CVI formula was addressed by the number of expert agreements on items rated 3 or 4 divided by total number of experts (Appendix H) (Wynd & Schaefer, 2002). The CVI of the entire instrument was 91%. However, six items indicated an agreement lower than 69%, which was not considered as achievement of agreement (Tilden, Nelson, & May, 1990). Six items then were revised based on the suggestion of the expert reviewers.

Post-Study Interview Guide

The structure interview guide was used to gain information regarding the experience of the participants during their participation in the study. There were nine items. The first three items focus on appropriateness of the osteoporosis prevention program. Three items relate to exercise with brisk walking and factors inhibiting them from doing walking exercise. Another three items are asked about dietary calcium intake and factors kept them from dietary calcium food consumption. Data were analyzed by using content analysis.

Validity of the instrument. Content validity of the instrument was used to test validity of the interview guide. The stage of validity testing was the same as aforementioned process of validity testing of the Program Evaluation Questionnaire. The interrater agreement of each item ranged from .75 to .87, and was .87 of the entire questions. The CVI of the entire questions was .92. However, there were two items needing to be revised since the CVI of those items were 60% and 80%, which were lower than achievement of a CVI agreement criterion (Tilden et al., 1990).

Intervention Description

The "Join the Movement to Have Healthy Bones Project: JHBP": An Osteoporosis Prevention Program

To increase and/or maintain bone mass, calcium intake as well as weight-bearing exercise has been widely accepted as important factors contributing to bone health. The recommendation of calcium intake for Thai older adults is 800 mg/day (Nutrition Division of the Public Health Ministry, n.d.). As bones are like muscles and other parts of the body, they suffer if they are not used. They need weight-bearing exercise, which puts force on the bones stimulating growth and strength. Weight-bearing exercises include brisk walking, stair climbing, hiking, dancing, weight training, jogging, skiing, aerobics, and running/walking on treadmills. Walking is a popular form of exercise as it is relatively inexpensive and it is an excellent weight-bearing exercise for older adults. In addition, findings from a previous study showed that brisk walking was the most common type of exercise for Thai older adults (Aree-Ue & Pothiban, 2003). Brisk walking 3 miles/day or walking at least 6,000 steps per day (2,000 steps = approximately 1 mile) was recommended for health benefits (Pate et al., 1995). Calcium intake and walking, therefore, were the healthy behaviors focused on in this program.

The theoretical basis for this program was the HBM (Rosenstock, 1974a) and the SE (Bandura, 1977). Based on the HBM, in order for persons who need to take action to avoid illness, the health behavior is likely to occur if an individual believes that: he/she is personally susceptible to the disease; the consequence of health problem is severe enough to have negative impact on his/her life; taking specific action would have beneficial effects; and the barriers to such action do not overwhelm the benefits. This program was designed to provide general knowledge of osteoporosis including risk factors and prevention strategies, illustrate the consequent health problems related to osteoporosis, and examine individual risk to develop osteoporosis that may increase older adults' perception of susceptibility and seriousness of such diseases. In addition, a bone mass screening and interpreted result was offered to allow the participants to see their bone mass condition. By sharing and discussing the benefits or barriers to practice healthy behavior, these were encouraged an individual to engage in such behavior. Printed materials and a telephone reminder call before their appointment were supplied as cues to action that may promote participants' readiness. With SE, in order for persons to change behavior, they have to feel confident in their ability to take action and persist in action. This program also provided clear and observable outcomes by using direct reinforcement, performance accomplishment, performance mastery, indirect reinforcement, vicarious reinforcement, verbal persuasion, and emotional arousal. Also, based on the fact that change in behavior does not have to be done at once, this program, therefore, approached behavior change in gradual steps. One needs time to make small steps to change. Thinking of behavioral change, making a plan, doing these behaviors, and practicing, are important methods to health behavior change. Thus, a 6-month follow-up of this program was an appropriate time for changing new behaviors (Prochaska et al., 1997).

Components of the intervention included a booklet, pamphlets, and a 6-month intervention. The booklet was developed by the investigator, using content from the National Osteoporosis Society as a basis (National Osteoporosis Society, n.d.-b). It contained topics to be taught throughout the program. The content was divided into four sessions. In each session, practice suggestions and worksheets were provided to encourage the participants to be aware of their risk behavior and practice of healthy behavior. The pamphlets were designed to provide information related to preventing osteoporosis, particularly exercise and nutrition. They were sent to all participants every two months as a booster dose of the education intervention program. A 6-month intervention consisted of three elements: 1) the program ran for a 4-week class session, meeting once per week, with 90 minutes per week; 2) bone mass screening was measured of all participants after attending class sessions; and 3) an individual or a group meeting was offered when the participants attended their regular meetings, twice a month, at the HPCE. An individual counseling by telephone was also provided during the 6-month intervention. This episode was designed to facilitate information support, to monitor their progress in changing their behavior and their barriers to osteoporosis prevention practices, and to allow time for practicing and developing a new behavior with gradual, step by step changes.

Objectives for each session were presented on a power point presentation before the start of each class.

1. The first 30 minutes were set up for evaluating baseline data, and discussing information related to worksheets and practice suggestions. A review of the previous session was included.
2. 45 minutes were spent presenting the information contained in each session of the booklet, proposing questions, encouraging discussion, and providing examples. The investigator summarized the content matter delivered during each session.

3. The last 15 minutes was used to discuss the assignment for the next class. Clear explanation and an example were provided in order to make sure that there was not any questions on how to do the assignment.
4. Break time was set up once per session.

The theory strategies that this intervention was based on are summarized in Table 1.

Table 1

Intervention Strategies Based on the HBM and the SE

Concept	Strategy
Perceived susceptibility	1. An educational booklet, session one, which provided information about basic facts of osteoporosis, such as the definition and risk factors. 2. Participants attended a 90-minutes class session, using power point and VDO presentation, to expand on and reinforce the booklet material. 3. Individual risk assessment and free bone mass screening, explained the results and answer any questions which arose.
Perceived severity	1. Session two of the booklet, which specified consequence problems related osteoporotic fractures 2. Discussed and shared information following the

Table 1 (continued)

Concept	Strategy
	VDO and power point presentation, which expanded the booklet material and to reinforce learning objectives.
Perceived benefits of calcium intake and brisk walking exercise	1. Educational booklet session three provided information geared toward the importance of adequate calcium intake on bone health, and the booklet session four emphasized weight-bearing exercise in building strong bone. 2. A 10-minute segment of VDO covered the benefits of calcium intake on maintaining bone mass. A 15-minute segment of VDO showed the impact of brisk walking on bone. Participants also learned that dairy foods were a good source of calcium. Posters containing information about the major calcium-rich food groups were displayed. 3. Following the VDO, the investigator summarized content and clarified the positive effects of adequate calcium intake and weight-bearing exercise on bone health.

Table 1 (continued)

Concept	Strategy
Perceived barriers to calcium intake and brisk walking exercise	1. After watching the VDO segments related to the educational booklet session three and four, summarizing the content as well as question-answer were offered to confirm the understanding of the participants. 2. A small group discussion was set up in order to allow participants' opportunities to identify barriers of calcium intake as well as weight-bearing exercise, brisk walking, and to identify appropriate ways to reduce barriers.
Cues to action	1. Printed materials including an educational booklet and pamphlets were supplied. 2. A telephone reminder call was made before appointments.
Self-efficacy *1. Direct reinforcement/ Performance mastery/ Performance accomplishment*	Strategies used to enhance osteoporosis self-efficacy based on four sources of self-efficacy as follows: 1. Provided training session on the use of and recording a pedometer. Participants learned how to select calcium-rich food and how to determine the calcium content of a particular product by examining the nutrition label. Encouragement and

Table 1 (continued)

Concept	Strategy
	reinforcement to help them make gradual changes, and rewards for changes and maintenance.
2. Indirect reinforcement/ Vicarious reinforcement	2. A 15-minute segment of the VDO demonstrated an older person who was successful on maintaining strong bones with regular brisk walking and jogging. Tips for brisk walking were included in the VDO presentation. The aim of this presentation was to encourage the participants to engage in exercise by learning from role models. While following a 10-minute segment of VDO which addressed benefits of calcium on bone health, some dairy calcium-rich foods and fortified calcium foods were displayed as examples and models, and some calcium-rich foods were given to all participants.
3. Verbal persuasion	3. Teaching and coaching during individual or group meeting or telephone counseling to encourage the participants to believe they could perform activity.

Table 1 (continued)

Concept	Strategy
4. *Emotional arousal*	4. At the follow-up sessions, problems or barriers were identified, such as leg pain and fear of falling. Discussion and sharing strategies for overcoming barriers occurred.

Procedure

The study was initiated after approval from RIHES, Chiang Mai University Thailand. The research team included the principal investigator, who was responsible for recruiting participants and implementation of educational class sessions, and a research assistant (a master nursing student) who assisted with the educational sessions and with data collection at the pre-posttest period.

A research assistant was trained in completing study questionnaires by the investigator. In addition, the research assistant was informed regarding the educational content and the educational methods. The study started once the research assistant understood the procedures.

Data Collection

The data was collected continuously over a 6-month period, from February 2003 to August 2003 with the following steps:

1. During January, an announcement in the HPCE was an approach to recruit a convenient sample, targeting individuals who perceived themselves at risk for

osteoporosis and who were willing to make a commitment to the program. Adults aged 60 years and over were eligible if they met all inclusion criteria. Then, the first appointment was held.

2. At the initial appointment, all prospective participants were again given an overview of the study. They were asked to complete a consent form before taking part in participation of the educational intervention session.

3. The participants were assigned into three groups. Each group included 15-20 individuals who would receive the same intervention. They were asked to complete baseline measures related to each educational intervention session before starting the intervention implementation.

4. After attending the educational class sessions, participants were evaluated as to the effects of the program on osteoporosis knowledge, osteoporosis health beliefs, and osteoporosis self-efficacy. Additionally, 3 and 6-months after enrollment, the follow-up assessment, which included the same measures plus dietary calcium intake and walking exercise, were investigated.

5. Once the educational class-sessions were completed, the bone mass screening was scheduled. The investigator performed bone mass screening. During the screening appointment, approximately 10 minutes were spent an explaining the results as well as answering any questions.

Table 2

Summary of Procedures for the Study

Month of the study	Procedures
February	Implementation of educational intervention.
1st week	Session I: Overview of osteoporosis & How serious is osteoporosis?
2nd week	Session II: Osteoporosis: Why wait for a fracture? Part A
3rd week	Session III: Osteoporosis: Why wait for a fracture? Part B
4th week	Session IV: Summary, posttest of knowledge, health beliefs, and self-efficacy about osteoporosis
March, 1st week	Bone mass screening
April, June, and July	Pamphlets related to osteoporosis prevention strategies were sent to participants as booster doses of the intervention treatment. Individual or small group meetings, and telephone counseling was also provided.
May and August	Follow-up assessment. Completion of all measures, and program evaluation was done in August.

Participant Retention and Compliance

To minimize the rate of participant drop out, several strategies were put in place. Participants were given a telephone reminder call two days before their appointment. If the participants failed to attend their scheduled appointments, the investigator immediately contacted them to reschedule as soon as possible. Pamphlets related to osteoporosis prevention were sent to all participants. Additionally, an individual participant could receive either counseling by telephone or by meeting with the investigator, which demonstrated care for the person and not just the data.

Data Analysis

Data obtained were quantified and analyzed by using the statistical package for Social Science for Windows (SPSS/FW) (SPSS Advance Models 10.0, 1999). Descriptive statistics, means and standard deviations were computed for all outcome variables. Frequency distributions (number and percent) were summarized demographic variables. Analysis of variance (ANOVA, repeated measure) and Friedman Test were computed for osteoporosis knowledge, osteoporosis health beliefs, and osteoporosis self-efficacy to determine a change in these variables over a short term (immediately after class) and an intermediate period (3 and 6-months after enrollment). Additionally, a change of osteoporosis preventive behaviors, calcium intake and brisk walking exercise (number of steps, speed, distance, energy, and length of time in this case), was examined at 3 and 6-months after enrollment. The data analysis plan for each specific objective is presented.

Objective # 1. To evaluate the feasibility and acceptability of osteoporosis prevention program for Thai older adults

Three criteria used to determine the feasibility of the program was the retention of study participants, burden of outcome measures, and the problems of implementation of the program. Retention of the participants was concluded as the number and percent of participants who completed the program and completed all data collection procedures. Participants who dropped out from the study were interviewed in order to identify reasons. Burden of outcome measures was examined by time required for completion for baseline measures and follow-up measures. Mean time scores were analyzed by using descriptive statistics.

Acceptability was determined by participants' ratings of acceptability of the program and by participants' providing information when the post-study interview was used. Using descriptive statistics summarized participant ratings of the program acceptability, and transcription and content analysis of responses to questions about program acceptability and burden and post-study interview guide were done to look for categories.

Objective # 2. To investigate the short-term (immediately after class) and intermediate (3 and 6-months after enrollment) effects of osteoporosis prevention program on knowledge, health beliefs, and self-efficacy related to osteoporosis in older adults

The effects of osteoporosis prevention program on knowledge, attitudes and beliefs, and self-efficacy related to osteoporosis were evaluated based on an increasing of osteoporosis knowledge, osteoporosis health beliefs, and osteoporosis self-efficacy. In order to determine a change over time, baseline osteoporosis health beliefs, osteoporosis knowledge, and osteoporosis self-efficacy scores were compared with the same at a short-term (immediately after class) and at 3 and 6-months after enrollment by using ANOVA for repeated measures or using Friedman Test.

Objective # 3. To evaluate the effects of osteoporosis prevention program on intermediate (3 and 6- months after enrollment) osteoporosis preventive behavior in older adults

The effects of the program on osteoporosis preventive behaviors were evaluated by increasing calcium intake and brisk walking exercise. The calcium intake scores and walking exercise prior to the study were compared with those at 3 and 6-months after enrollment. A mean score was calculated by taking the total raw scores for each participant and dividing this by the total number of the participants for each variable and each at 3 and 6-months after enrollment. Overall calcium intake scores and walking exercise were compared across length of times. Once the mean scores have been computed, an ANOVA for repeated measures was computed to determine a change over time.

Realizing that assumptions are crucial in analysis of variance, violation of assumption should be considered before it has a serious effect on Type I and Type II error rates, and power (Stevens, 2002). Assumptions for a single group repeated ANOVA include two basic assumptions for ANOVA (the normal distribution of dependent variable and homogeneity of variance) and one assumption called compound symmetry, which are composed of two parts. The first part is that the correlations across the measurements are the same; the second part is that the variance should be equal across measurements (Munro, 2001). Testing assumptions were employed before analyzing the data. Since it is difficult to complete test of multivariate normality, univariate normality is a necessary condition for multivariate normality. Therefore, univariate normality was examined by both statistical and graphical tests. The Kolmogorov-Smirnov statistic test was used to assess normality of all variables in this study. The null hypothesis of the Kolmogorov-Smirnov statistic test is that population is normal distributed. A rejection of this null hypothesis indicated that variable is not normally distributed. For the graphical test, the scatter plot was employed; the elliptical shape for each pair of variables indicated the normality. The raw data of some subscales of OHBS and OSES have substantially deviated from normal, so data transformations were used in order to make them more normal. Based on the shape of the original raw data, a reflect square root transformation was applied to produce normal distributions for some subscales of OHBS including perceived susceptibility, perceived seriousness, perceived benefits of exercise, and perceived barriers to calcium intake since these variables showed that a distribution differed moderately in a negative skew from normal. Similarly, the reflect square root transformation was used for OSES for the same reason as mentioned on those subscales of OHBS. However, a square root transformation was used to produce normal distributions for other subscales of OHBS: perceived benefits of calcium intake and perceived barriers of exercise as a distribution of these variables differed moderately in a positive skew from normal (Mertler & Vannatta, 2002).

A Mauchyly's test was used to test the assumption of the compound symmetry. If the test is significant, it indicates that the assumption has not been met (Munro, 1993). In this case, alternative approaches, namely to report multivariate results and to adjust the degree of freedom in the univariate approach, are recommended. In this study, although some subscales of OHBS: 1) perceived benefits of exercise, 2) perceived barriers to exercise, and 3) perceived barriers to calcium intake, and OSES was transformed to produce more normal distributions, they had not been met the assumption of the compound symmetry; therefore, the non parametric statistic test, Friedman Test, was employed to examine changes in these variables over time, and then the Wilcoxon Signed Rank Test was used to test multiple-comparison of the Freidman Test results. Also, it should be noted that calcium intake data had not met the compound symmetry, but raw data indicated strongly normality. To adjust the degree of freedom in the univariate by using epsilon factor corrections, namely Huynh-Feldt was applied to test a change in calcium intake variable over time since this approach can decrease the likelihood of type I error and more power than the other approach, reporting the multivariate results. All other variables met all assumption criteria, a repeated measure analysis was used, and then the Bonferoni procedure was applied to test pairwise comparison. The Bonferoni procedure involves dividing the desired level of significance by the number of paired comparisions. For example, if there are k treatments, to keep overall α at .05, the Bonferoni do each test at the .05[k (k-1)/2] of significance (k treatments = k (k-1)/2 paired comparisons). Therefore, it can keep overall α under control at .05 level that can reduce the probability of rejecting falsely of the multiple statistical tests (Stevens, 2002).

Another statistic analysis called the two-factor split-plot or mixed ANOVA design was used in this study to compare changes in calcium intake and walking exercise over time between participants with normal or low bone mass and participants with severe low bone mass.