CHAPTER 4

FINDINGS AND DISCUSSION

This chapter includes: 1) a description of the demographic and clinical characteristics of the participants, and 2) a presentation of findings and related discussion.

Findings

Demographic and Clinical Characteristics of the Participants

A recruitment announcement was posted in the Health Promotion Center for the Elderly (HPCE) of Faculty of Nursing, Chiang Mai University, Thailand. Of the 57 enrolled participants, 51 adults (89.47%) completed class sessions. Participants were predominantly women (98%). The average age was 69.64 years (SD ± 5.21, age range 60-80). About 54.9% of the participants had received primary school education, and 41.2% of those had received secondary school education. Most participants (62.7%) did not report having any diseases. Nearly fourteen percent (13.7%) of participants (n = 7) had a previous history of bone fractures related to a fall. Investigation of risk factors for osteoporosis in these participants revealed that of all participants, 19.6% (n = 10) currently consumed one cup of coffee or other caffeinated drink per day, and 5.9% (n = 3) consumed one glass of alcohol per day. Few participants (3.9%; n = 2) were underweight by body mass index (BMI < 18.5; mean = 24.61; SD ± 2.8; range 18.13-29.38). An approximate 50% of participants had severe low bone mass. Thirteen percent of participants reported a positive family history of osteoporosis. Few participants (7.8%; n = 4) used HRT, and less than 30% (n = 15) of participants reported taking calcium supplements. Additional variables are included in Table 3.

Table 3

Demographic and Clinical Characteristics of the Participants (n = 51)

Variable	Mean ± SD	Number (n)	Percent (%)
Age (year)	69.64 ± 5.21		
60-74		44	86.3
75-80		7	13.7
Body Mass Index (kg/m^2)	24.61 ± 2.8		
normal (18.5-24.9)		25	49.0
over-weight (25-29.9)		24	47.1
underweight (< 18.5)		2	3.9
Gender			
female		50	98.0
male		1	2.0
Educational Level			
primary school		28	54.9
secondary school		21	41.2
baccalaureate		1	2.0
graduate or higher		1	2.0
Present Illness			
not having any disease		32	62.7
bone fracture related to falling		7	13.7
diabetes mellitus (DM)		4	7.8
hypertension		2	3.9
rheumatoid arthritis & bone fracture		2	3.9
allergic symptom		1	2.0
peptic ulcer		1	2.0
DM & chronic obstructive pulmonary disease (COPD)		1	2.0
bone fracture & COPD & hyperthyroidism		1	2.0

Table 3 (continued)

Variable	Number (n)	Percent (%)
Medication Use		
none	45	88.2
antihypertensive	2	3.9
steroid	2	3.9
aspirin	1	2.0
steroid & aspirin	1	2.0
Calcium Supplement		
no	36	70.6
yes	15	29.4
Hormone Replacement Therapy		
no	47	92.2
yes	4	7.8
Alcohol Consumption		
never consumed	45	88.2
less than 1 glass / day currently	3	5.9
less than 1 glass / day in the past	2	3.9
1 glass / day or more in the past	1	2.0
Caffeine Consumption		
never consumed	32	62.7
1 cup / day or more currently	10	19.6
1 cup / day or more in the past	5	9.8
less than 1 cup / day in the past	2	3.9
less than 1 cup / day currently	2	3.9
Smoking		
never smoked	46	90.2
smoked less than 1 pack / day in the past	5	9.8
Family History of Osteoporosis		
no	45	88.2
mother	5	9.8
mother and sister	1	2.8
Ultrasound Bone Mass Screening		
severe low bone mass (T-scores < -2.5)	27	52.9
low bone mass (T-scores between –1 and – 2.5)	17	33.3
normal (T-scores > -1)	7	13.7

At the baseline, the majority of participants (88.2%) performed some types of exercise. Tai Chi and walking were reported as the most popular types of exercises (52.9%, n = 27 and 51%, n = 26, respectively). Although most participants exercised, only about 50% of those reported doing weight-bearing exercise. About 30% of those who exercised reported a high level of exercise; 11.8% were sedentary (Table 4).

Table 4

Participants' Participation in Physical Activity at Baseline (n = 51)

Variable	Number (%)	High level of exercise*** n (%)	Low level of exercise n (%)
Did not exercise	6 (11.8)		
*Exercise**	45 (88.2)	14 (31.1)	31 (68.9)
Tai Chi	27 (52.9)	18 (66.6)	9 (33.4)
walking	26 (51.0)	9 (34.6)	17 (65.4)
cycling	17 (33.3)	5 (29.4)	12 (70.6)
jogging	10 (19.6)	1 (10.0)	9 (90.0)
aerobic dance	8 (15.7)	3 (37.5)	5 (62.5)
other, such as yoga	8 (15.7)	1 (12.5)	7 (87.5)
*weight-bearing***	29 (56.8)	14 (48.2)	15 (51.8)

Note: * each participant may perform more than one type of exercise
** walking, jogging, and aerobic dance
*** exercise at least 3 times a week, duration of at least 30 minutes / time, and intensity of at least 1

Question # 1. Is an osteoporosis prevention program feasible and acceptable for Thai older adults?

Feasibility of the program was determined by: retention of study participants, burden of outcome measures, and the problems of implementation of the program.

Eighty-four prospective participants were willing to participate in the study. Three women and one man were excluded because they were less than 60 years old. Additionally, three women were diagnosed as having osteoarthritis of the knee. Another three had planned to travel for subsequent 6 months. One woman was one-month post-abdominal surgery. The remaining seventy-three prospective participants, who met inclusion criteria, were randomly selected to participate in the study. Based on a sample size determinant formula for repeated measurement analysis, 42 participants were needed. However, another 15 prospective participants who met inclusion criteria were included in the study because they would like to participate in the study with their friends. At the beginning of the study, 57 older adults were enrolled. During program implementation (a 4-week class session), six participants dropped out (10.53%). Reasons for dropping-out were having religious activities at temples (two persons), having religious travel (two persons), having death of a family member (one person), and thinking of herself as being healthy, no need to join the program (one person). The remaining 51 participants were monitored at 3 and 6-months of enrollment.

At 3-month after enrollment, two participants (3.92%) dropped out: one was unable to continue due to family problems and another had an injury related to falls while doing of exercise. Forty-nine participants remained in the study. At 6-month after enrollment, one participant dropped out (2.04%) since she had to take care of her new grand child. The total number of participants who dropped out from the study was nine (15.79%).

The burden of outcome measures was evaluated by mean time required for completion of questionnaires. The longer time required for completion of the questionnaires represented that the more burden some of an outcome measure. Participants with secondary school or higher education spent less time to complete the FOOQ, Dietary Calcium Food- Frequency Intake, and all questionnaires, compared with participants with primary school education (Table 5).

Table 5

Times (minutes) Required for Completion of Questionnaires (n = 51)

Questionnaire	Time Required for Completing Questionnaires $\bar{X}$ ± SD (range)	
	Primary school group (n = 28)	Secondary school and higher group (n = 23)
Demographics	1.75 ± 0.88 (1-4)	1.73 ± 0.75 (1-3)
Set Test	5.77 ± 2.17 (2-10)	5.30 ± 2.45 (2-10)
Exercise Survey	7.26 ± 1.75 (3-10)	6.86 ± 1.81 (3-10)
Facts on Osteoporosis Quiz*	7.92 ± 2.52 (3-12)	5.56 ± 1.90 (2-10)
Osteoporosis Health Belief Scale	13.23 ± 4.33 (6-26)	10.61 ± 6.56 (2-30)
Osteoporosis Self- Efficacy Scale	6.25 ± 2.64 (2-12)	6.60 ± 3.01 (2-13)
Dietary Calcium Food-Frequency Intake*	9.62 ± 2.90 (5-15)	6.86 ± 2.78 (3-12)
Program Evaluation	9.64 ± 2.81 (5-16)	8.47 ± 4.60 (2-23)
Total time*	61.05 ± 10.75 (38-82)	51.73 ± 12.49 (33-74)

* $\rho < .05$

The problems in program implementation were described in terms of participant recruitment and educational methods. Regarding participant recruitment problem, many older adults would have liked to participate in this study, but because of time limitations, could not. Osteoporosis-related content, length of sessions, and teaching-learning environment were evaluated. Participants reported not having any problem with the educational methods used during program implementation. They appreciated a variety of approaches. For example, they liked videotape presentations where they could see pictures and could listen to the voice at the same time. Games and a group discussion provided a chance to share their ideas and persuaded them to engage in provided activities. Furthermore, most participants provided very good feedback for the questionnaires that having more than three response choices caused confusion. Participants suggested all questions have three response choices.

Acceptability of the program was determined by participants' ratings on the program evaluation questionnaire and by participants' comments. Higher score obtained represents higher acceptability. Applying pedometer was the most accepted part of the program with a high percentage of agreement (93.93% for pedometer record and 92.80% for pedometer use). The usefulness of the program was also highly accepted (92.62%) as displayed in Table 6.

Table 6

Acceptability Rating Scores of the Program (n = 48)

Variables	Range of possible scores	Range of actual scores	Mean ± SD of score	Mean ± SD of % agreement
Program evaluation				
Usefulness of program	1-30	17-30	27.79 ± 2.65	92.62 ± 8.84
Increase calcium intake	1-30	14-30	26.46 ± 3.72	88.19 ± 12.39
Walking practice	1-40	26-40	36.35 ± 3.72	90.88 ± 9.30
Research study evaluation				
Questionnaire use	1-20	6-20	14.54 ± 3.77	72.70 ± 18.84
Pedometer use	1-50	36-50	46.40 ± 4.21	92.80 ± 8.41
Pedometer record	1-20	9-20	18.79 ± 2.28	93.93 ± 11.41
Total	1-190	29-190	171.00±14.64	90.00 ± 7.70

Moreover, issues arising from post-study interviews and open ended-questions revealed substantial information. The information is summarized below.

Usefulness of the program. Usefulness refers to the participants' perception of gaining more information about osteoporosis, having a guideline for healthy behavior, and receiving appropriate learning methods. Gaining more information is that the participants perceived positive results of attending the JHBP as one participant said:

> The program helped me to learn more about developing and preventing osteoporosis. I especially liked having bone screening that helped to raise my awareness on my susceptiblity to osteoporosis.

Regarding having a guideline for healthy behavior practice, the participants were generally satisfied with the JHBP. Some mentioned that they were currently keeping the walking exercise and dietary calcium-rich food in their daily lives, as described in the following description:

> I generally did walking exercise, but never knew that it could promote bone health. Right now, I understand. I will follow the walking exercise program to improve my bone health. I had heard about the effect of dietary calcium intake on bone health, but I didn't know how much calcium I should take. Now, I know that I should take calcium 800 mg/d.

As JHBP used several methods including lecture, visual aids, demonstrations, hands on activities, and written information to help participants to gain more information, one participant described about these learning styles as following:

> I would say that the program motivated me to learn about osteoporosis. Learning and getting information week by week was appropriate for my age. I enjoyed learning by watching videotape where I could see the moving pictures and could listen to the voice at the same time. Also, I liked the power point presentation and a small group discussion in which I could share my ideas and ask if I had some questions.

Perceived benefits of pedometer use. Many older adults were very satisfied with use of pedometers while walking. This feeling resulted from the participants' perception that pedometer use can enhance their walking, monitor their walking progress, and develop walking skill. The participants felt that using a pedometer while walking helped them walk regularly. An example was noted by one participant:

> I walk every day with my pedometer on. I was interested in finding out how many steps per day that I did.

Regarding monitoring the progress of walking exercise, one participant noted that:

> I really enjoyed walking whenever I saw my walking step increase. I set my goal to increase my walking. I observed my progress on my pedometer.

Moreover, the use of pedometers to record walking activities provided objective data to monitor changes in walking practice. Some participants stated that the reading showed on the pedometers helped them adjust their walking as noted by the following:

> Since I have used a pedometer whenever I walked, I now can set up a goal of walking without a pedometer. I can estimate my walking speed now.

Perceived benefits of increasing calcium in the diet. Knowledge on benefits of more calcium in the diet was reflected by the participants' perception of their ability to select calcium rich-food and to share food information with others. When the participants were asked to share their experience of attending the JHBP and about their dietary calcium rich-food intake, they mentioned the JHBP helped them learn about the kinds of daily foods, which is a good source of calcium, some said that:

> I enjoy the program very much. It is useful and helps me learn that not only milk, but also green-leafy vegetables which contain plenty of calcium.

On the topic of ability to share food information with others, participants expressed:

> I showed the pamphlets about dietary calcium-rich food sources to my friends, who did not have a chance to attend the program.

Experiencing barriers to walking exercise. Participants reported some reasons for not doing exercise, which included getting leg pain, feeling lazy, fear of falling, and because of rain as seen from the following excerpts:

> I regularly walk, but I did more walking when I first used the pedometer. On the following day, I had pain in my legs. I needed to stop walking for a few days.

For me, sometime I felt good, and did not think I need to do walking exercise. However, when I joined the program, I looked at the clock and realized it was the time I should go for exercise. It seemed like I needed a push.

I knew walking faster than normal was good for my bones, but sometimes I worried about falling. I didn't want to fall and break a hip.

I did not get out and walk more during this week because of rain. I think that it was a good time for gardening.

It was often cloudy in the evening. I guessed it will be raining, so I did not go out to walk.

Experiencing barriers to calcium-rich food intake. Experiencing barriers to calcium-rich food intake refers to participants' perception of unavailable food options, which were needed for their healthy bones. The barriers to calcium-rich food resulted from the following factors:

1. Feeling up set with bad odour of some foods. Some participants expressed that they were not happy to eat foods with bad smell as an example:

I didn't think about milk because of its smell; I didn't like it at all. I asked myself how I can get calcium; what types of calcium rich-food sources are appropriate for me.

2. Difference of favorite foods of family members. For Thai culture, family members will share and have meals together. Some participants mentioned that it was difficult to prepare foods, which contained more calcium as stated by one participant:

Even if I knew what kinds of calcium rich-foods or I prepared foods by myself, I could not prepare calcium-rich food for myself. My spouse did not like some foods. It was hard for him to change his dietary habit, so I needed to prepare foods that were his favorite.

3. Having no choice. Most participants lived with their children. Some mentioned that their children wanted to do everything for them, especially food preparation. They did not need to think about foods. One participant stated:

> I lived with my son's family. My daughter in-law took responsibility for preparing our meals. I never asked for the food I needed because I didn't want to hurt her feeling.

Social support. Social support is the sense of family support and group support that led participants to succeed in keeping preventive behavior practice. Participants mentioned their family members encouraged them to keep exercising, reminded them to attend follow-up meetings, and prepared meals for them. An example stated as follows:

> My son always asked me whether I did my walking each day. He said that I was in the program, so I should keep practicing. As well, he offered me a drive whenever he observed that I did not go out for few days; he always gave me a drive to the center.

> My daughter was a nurse. She always suggested me to drink milk. I did not know that drinking milk was that important for my bones until I had an opportunity to participate in the program. I asked her to give me more than one cup of milk.

Group support was another factor that participants mentioned encouraging their walking exercise. Evidence such as:

> I thought it didn't take any extra time to walk. I enjoyed walking with......We didn't like to walk alone, especially, when we had problems regarding pedometer record; we could help each other if we got together.

Table 7

Summary of Program Acceptability

Categories	Subcategories
1. Usefulness of the Program Perception of gaining more information about osteoporosis, having guidelines for preventive behavior practice, and getting appropriate learning method	1a) gaining more information 1b) having a guideline for healthy behavior practice 1c) getting appropriate learning method
2. Perceived Benefits of Pedometer Use A feeling of satisfaction of using a pedometer during walking exercise	2a) enhancing walking exercise 2b) monitoring progress of walking exercise 2c) developing skill of walking exercise
3. Perceived Benefits of Increasing Calcium in the Diet Experiencing ability to select calcium-rich food and to share food information with others	3a) increase in calcium-rich food intake 3b) share calcium-rich food information with family and friends
4. Experiencing Barriers to Walking Exercise Responding to physical, emotional, and environmental factors served as barriers to exercise	4a) getting leg pain 4b) feeling lazy 4c) fear of falling 4d) weather obstacle
5. Experiencing Barriers to Calcium Rich Food Intake Perceived unavailable calcium-rich food options	5a) feeling upset with bad odour of some foods 5b) differences in favorite foods of family members' 5c) having no choice
6. Social Support Feeling a sense of family and group support contribute to success of goals	6a) family support 6b) group support

Question # 2. Is there any short-term (immediately after class) and intermediate (3 and 6- months after enrollment) effect of osteoporosis prevention program on knowledge, health beliefs, self-efficacy related to osteoporosis)?

Changes in knowledge of osteoporosis across time are shown in Table 8. Mean osteoporosis knowledge scores, as well as percentages of correct responses increased at the short-term and intermediate period. Correct answers were given about 53.17% at pretest. Participants had the lowest number of correct responses on risk factors (47.64%), followed by general facts about osteoporosis (55.14%) and preventive behavior (58.82%) as shown in Table 9. Additionally, results from the repeated measures analysis indicated a significant difference in osteoporosis knowledge over time ($F_{3,141} = 45.21$; $\rho < .05$), as shown in Table 10.

Table 8

Osteoporosis Knowledge Scores (n = 48)

Osteoporosis Knowledge	Possible score	Baseline $\bar{X} \pm SD$	Immediately after class $\bar{X} \pm SD$	3-month $\bar{X} \pm SD$	6-month $\bar{X} \pm SD$
Total	0-25	13.2 ± 4.6	17.8 ± 2.8	17.0 ± 2.8	19.2 ± 2.3
General facts	0-8	4.4 ± 1.6	5.9 ± 1.2	5.7 ± 1.1	5.9 ± 1.0
Osteoporosis preventive behavior	0-7	4.1 ± 1.6	5.5 ± 1.1	5.1 ± 1.0	5.6 ± 1.1
Risk factor	0-10	4.7 ± 1.9	6.2 ± 1.5	6.2 ± 1.4	7.6 ± 1.0

Table 9

Correct Response of Osteoporosis Knowledge Score (n = 48)

Osteoporosis Knowledge	Baseline % correct ($\bar{X}$ ± SD)	Immediately after class % correct ($\bar{X}$ ± SD)	3-month % correct ($\bar{X}$ ± SD)	6-month % correct ($\bar{X}$ ± SD)
Total	53.17 ± 18.35	70.82 ± 11.17	68.08 ± 11.21	77.16 ± 9.33
General facts	55.14 ± 20.64	73.77 ± 15.25	71.25 ± 14.77	73.95 ± 13.35
Osteoporosis preventive behavior	58.82 ± 22.97	78.99 ± 16.25	73.14 ± 14.89	81.25 ± 15.91
Risk factor	47.64 ± 19.14	62.74 ± 15.24	62.00 ± 14.42	76.87 ± 10.94

Table 10

Changes in Osteoporosis Knowledge over Time (n = 48)

Source	SS	df	MS	F	Sig.
Osteoporosis Knowledge	964.47	3	321.49	45.21	.000
Error	1002.77	141	7.11		

Note: Evaluated by using one-factor repeated measures ANOVA
Significance was set at .05 level

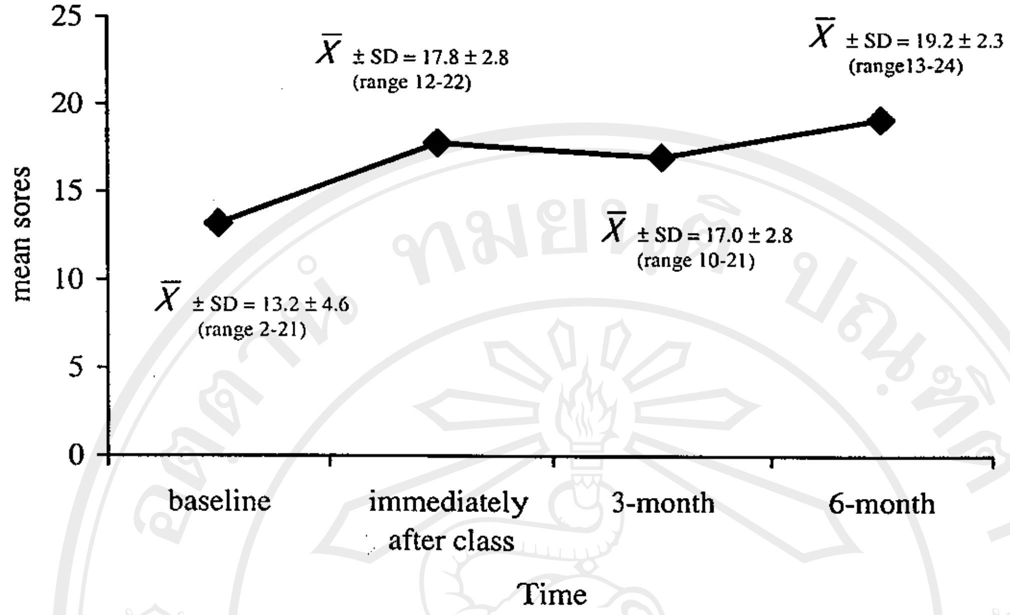

Figure 4. The mean ($\overline{X}$ ± SD) and range of osteoporosis knowledge scores over time

The mean scores of osteoporosis health beliefs have changed over time. Except for perceived barriers of exercise and calcium intake subscales, the others increased at short-term and intermediate periods of the study (Table 11). Additional analysis showed a high percentage of correct scores of perceived motivation (83.61%), perceived benefits of exercise (81.46%), and perceived benefits of calcium intake (79.31%) at the baseline.

Table 11

Osteoporosis Health Belief Scores (OHBS) (n = 48)

Variable	Baseline $\bar{X}$ ± SD (range)	Immediately after class $\bar{X}$ ± SD (range)	3-month $\bar{X}$ ± SD (range)	6-month $\bar{X}$ ± SD (range)
Total OHBS	145.0 ± 11.3 (120-176)	148.7 ± 17.8 (71-180)	149.4 ± 14.2 (113-177)	147.6 ± 12.4 (121-175)
Perceived Susceptibility	19.1 ± 3.0 (8-23)	20.6 ± 5.2 (8-29)	21.6 ± 4.7 (9-30)	21.8 ± 5.0 (9-30)
Perceived Seriousness	21.9 ± 3.4 (12-27)	23.3 ± 5.4 (7-30)	23.0 ± 4.9 (7-30)	23.0 ± 5.4 (7-30)
Perceived Benefits of Exercise	24.4 ± 1.8 (18-28)	26.4 ± 3.8 (6-30)	26.2 ± 3.0 (12-30)	26.1 ± 2.5 (19-30)
Perceived Benefits of Calcium Intake	23.7 ± 4.0 (8-30)	25.2 ± 3.7 (6-30)	25.2 ± 3.5 (8-30)	25.0 ± 2.4 (18-30)
Perceived Barriers to Exercise	14.8 ± 4.7 (6-27)	12.9 ± 3.6 (6-22)	13.1 ± 4.5 (6-30)	11.7 ± 2.5 (6-18)
Perceived Barriers to Calcium Intake	15.7 ± 3.7 (8-26)	14.0 ± 4.0 (6-26)	14.0 ± 3.4 (6-23)	13.5 ± 3.8 (6-22)
Perceived Motivation	25.0 ± 2.9 (16-30)	26.0 ± 2.7 (18-30)	26.1 ± 2.6 (18-30)	26.2 ± 2.2 (22-30)

One factor repeated measures ANOVA (Table 12) and Friedman Test (Table 13) display the test statistics of total and subscales of OHBS over time. There was no significant difference of the total OHBS over time, while the significant difference was observed from OHBS subscales. Interestingly, when the pairwise comparisons analysis using the Bonferroni procedure was applied to examine the changes among periods of time, perceived susceptibility was significantly different at immediately after class, 3 and 6-months after enrollment, compared with baseline ($\rho < .05$). In addition, results from Wilcoxon Signed Rank Test revealed that perceived benefits of exercise, perceived barriers to exercise, and perceived barriers to calcium intake were significantly different at 3 and 6-months after enrollment, compared with baseline.

Table 12

Changes in Osteoporosis Health Belief Scores (OHBS) over Time (n = 48)

Source	SS	df	MS	F	Sig.
OHBS	553.30	2.77[a]	199.62	1.60	.194
Error	16190.94	122.44[a]	132.23		
Perceived Susceptibility[b]	10.12	3	3.37	8.91	.000
Error	53.38	141	.37		
Perceived Seriousness[b]	5.52	3	1.84	4.31	.006
Error	60.22	141	.42		
Perceived Benefits of Calcium Intake[b]	4.89	3	1.63	3.68	.014
Error	62.37	141	.44		
Perceived Motivation	41.34	3	13.78	3.12	.028
Error	621.40	141	4.40		

Note: Evaluated by using one-factor repeated measures ANOVA

[a] Epsilon, Huynh-Feldt, was used to adjust the degrees of freedom.

[b] Analyzed by using transformation scores.

Table 13

Changes in Osteoporosis Health Belief Scores (OHBS) over Time (n = 48)

Variables	Chi-Square	df	Sig.
Perceived Benefits of Exercise	33.94	3	.000
Perceived Barriers to Exercise	9.99	3	.019
Perceived Barriers to Calcium Intake	17.14	3	.001

Note: Evaluated by using Friedman Test

The differences in participants' mean scores of osteoporosis self-efficacy at the baseline, immediately after class, 3, and 6-months after enrollment were investigated. Higher scores represent higher self-efficacy. Overall, participants rated their self-efficacy at post-intervention as higher than at baseline (Table 14). Additional analysis revealed a high percentage of correct scores at the baseline with the total self-efficacy scores (78.77%), self-efficacy of exercise subscale (75.13%), and self-efficacy of calcium intake (82.41%) as illustrated in Table 15.

Table 14

Osteoporosis Self- Efficacy Scores (OSES) (n = 48)

Variable	Possible Score	Baseline $\bar{X} \pm SD$	Immediately after class $\bar{X} \pm SD$	3-month $\bar{X} \pm SD$	6-month $\bar{X} \pm SD$
Total of OSES	1-120	94.1 ± 23.9	104.4 ± 17.0	104.5 ± 11.9	105.1 ± 11.6
OSES of Exercising	1-60	44.8 ± 15.1	51.4 ± 9.8	50.9 ± 8.0	51.1 ± 8.0
OSES of Consuming Calcium-Rich Food	1-60	49.2 ± 12.3	53.0 ± 9.0	53.5 ± 5.9	54.0 ± 6.0

Table 15

Correct Responses of Osteoporosis Self- Efficacy (n = 48)

Variable	Baseline % correct ($\bar{X}$ ± SD)	Immediately after class % correct ($\bar{X}$ ± SD)	3-month % correct ($\bar{X}$ ± SD)	6-month % correct ($\bar{X}$ ± SD)
Total of OSES	78.77 ± 19.78	87.46 ± 14.05	86.90 ± 10.36	87.62 ± 9.74
OSES of Exercising	75.13 ± 24.89	85.81 ± 16.46	84.96 ± 13.39	85.24 ± 13.41
OSES of Consuming Calcium-Rich Food	82.41 ± 20.35	89.11 ± 14.88	89.50 ± 9.88	90.00 ± 10.05

There was significant difference of OSES over time demonstrated by repeated measure analysis (Non-parametric test: Friedman Test, Table 16). A curious finding is noted in Wilcoxon Signed Ranks Test, from which there was not any significant difference over time of self-efficacy subscales, while the difference was observed in total OSES at immediately after class, 3 and 6-months after enrollment, compared with at baseline.

Table 16

Changes in Osteoporosis Self-Efficacy Scores (OSES) over Time (n = 48)

Variable	Chi-Square	df	Sig.
OSES	13.755	3	.003
OSES of Exercising	4.233	3	.237
OSES of Consuming Calcium-Rich Food	6.123	3	.106

Note: Evaluated by using Friedman Test

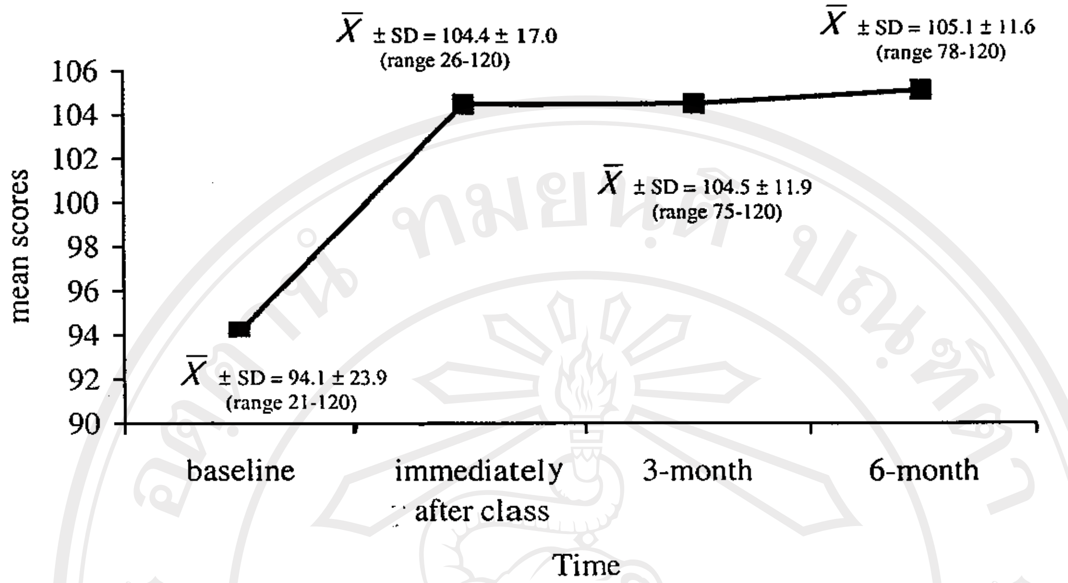

Figure 5. The mean ($\bar{X}$ ± SD) and range of osteoporosis self-efficacy scores over time

Question # 3. Is there any effect of osteoporosis prevention program on intermediate (3 and 6-months after enrollment) osteoporosis preventive behavior in older adults?

Calcium dietary intake and walking were evaluated as osteoporosis preventive behaviors. Completed calcium intake data were available for 48 participants. Table 17 summarizes the mean of dietary calcium intake over time. It was of interest that 68.75% (n = 33) of participants reported increased calcium intake from baseline to 3-month after enrollment, and 75% (n = 32) from baseline to 6-month after enrollment. In addition, the percentage of participants who met the recommendation of calcium intake (800 mg/d for Thai older adults) was 3.92% (n = 2), 8.16% (n = 4), and 33.33% (n 16) at the baseline, 3 and 6-months after enrollment, respectively.

Table 17

Calcium Intake Scores (n = 48)

Variable	Baseline	3-month	6-month
Calcium Intake (mg/day) $\bar{X}$ ± SD (range)	496.44 ± 195.88 (108.12-874.95)	572.23 ± 201.74 (207.85-1169.85)	653.39 ± 300.40 (85.50-1296.43)
Increased Calcium Intake n (%)	-	33 (68.75)	36 (75.00)
Calcium Intake 800 mg/day n (%)	2 (3.92)	4 (8.16)	16 (33.33)

Results from a repeated measure ANOVA showed a significant difference of dietary calcium intake over time (Table 18). Additionally, findings from pairwise comparison using the Bonferroni procedure indicated that calcium dietary intake significantly increased from baseline to 3-month after enrollment ($\rho = .001$), and from baseline to 6-month after enrollment ($\rho = .002$).

Table 18

Changes in Calcium Intake over Time (n = 48)

Source	SS	df	MS	F	Sig.
Calcium Intake	591403.21	1.57[a]	376349.52	8.976	.001
Error	3096739.02	73.85[a]	41928.99		

Note: Evaluated by using one factor repeated measures ANOVA
[a]Epsilon, Huynh-Feldt, was used to adjust the degrees of freedom.

Additional analysis was done to compare the difference of calcium intake among participants with different bone mass conditions. Participants were assigned to one of two groups: severe low bone mass group (bone mass T-score over 2.5 SD below normal mean) and normal or low bone mass group (bone mass T-score between 0 and –2.5 SD). As shown in Table 19, the mean of calcium intake increased in both groups, but a two-factor split-plot ANOVA analysis revealed only a main effect for bone mass; participants with severe low bone mass reported higher calcium-rich food intake scores than normal or low bone mass did, $F_{1,45} = 4.12$, $\rho < .05$, as shown in Table 20.

Table 19

Calcium Intake Scores of Participants with Severe Low Bone Mass and Normal or Low Bone Mass (n = 48)

Variable	Baseline $\bar{X} \pm SD$ (range)	3-month $\bar{X} \pm SD$ (range)	6-month $\bar{X} \pm SD$ (range)	Total $\bar{X} \pm SD$ (range)
Severe low bone mass (n = 25)	505.6 ± 191.7 (135.8 - 874.9)	595.4 ± 198.2 (266.3- 1169.8)	738.5 ± 309.8 (91.2- 1296.4)	613.2 ± 178.7 (193.5 - 890.7)
Normal or low bone mass (n = 23)	486.4 ± 204.1 (108.1 - 788.9)	546.9 ± 206.9 (207.8- 1030.7)	560.8 ± 266.2 (85.5- 1039.8)	531.4 ± 187.4 (145.0- 862.39)

Note: severe low bone mass group (bone mass T-score > - 2.5
normal or low bone mass group (bone mass T-score between 0 and –2.5)

Table 20

The Mean Difference of Calcium Intake between and within Groups (n = 48)

Source	SS	df	MS	F	Sig.
Between Group					
Bone mass	247891.65	1	247891.65	4.12	.048
Error	2704618.75	45	60102.63		
Within Group					
Calcium intake (time)	58273.17	1	58273.17	1.45	.234
Bone mass x Calcium intake	103001.26	1	103001.26	2.56	.116
Error (Calcium intake)	1805454.36	45	40121.20		

Note: Evaluated by using two-factor split-plot or mixed design ANOVA at covariates appeared in the model: Calcium intake at the baseline = 496.45

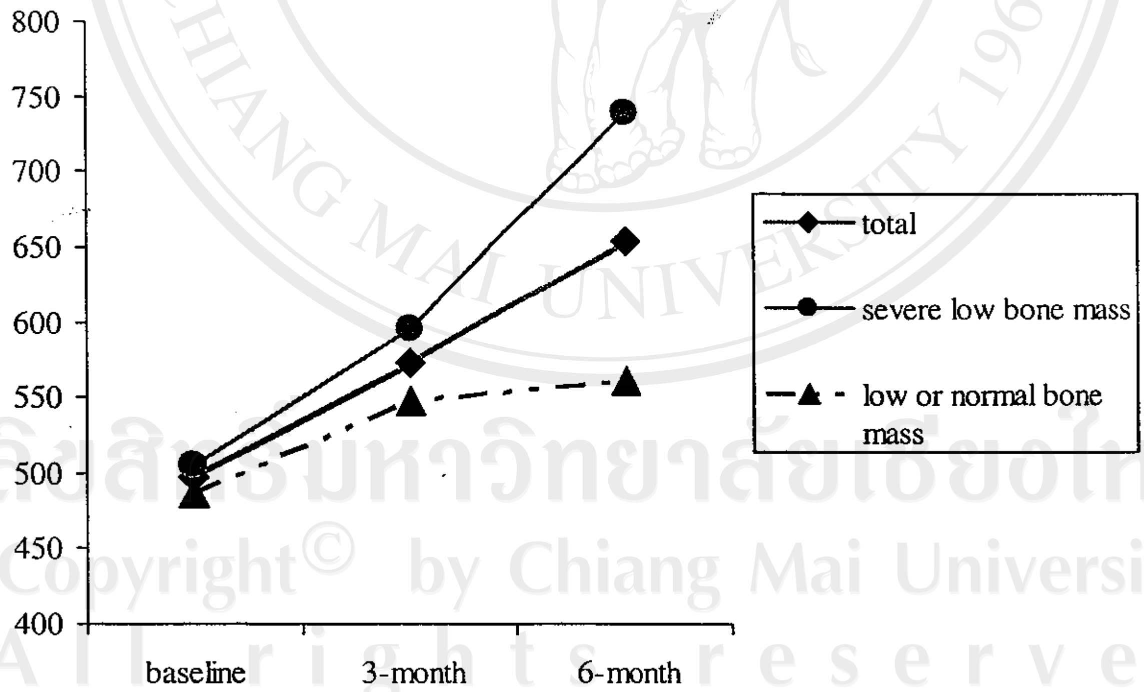

Figure 6. Changes in dietary calcium intake of all participants and groups over time

Of the 48 participants who completed all follow-up measures, five were excluded from the analysis of walking exercise due to problems with the pedometer records. Completed walking data was obtained for 43 participants. The mean scores of walking values were summarized in Table 21. It should be noted that the mean of all walking exercise values decreased from 3 to 6-month after enrollment.

Table 21

Brisk Walking Exercise Values (n = 43)

Variable	Baseline $\bar{X}$ ± SD (range)	3-month $\bar{X}$ ± SD (range)	6-month $\bar{X}$ ± SD (range)
Steps (per wk)	18181.4 ± 10955.4 (1335.0 - 59511.0)	29523.4 ± 18440.2 (6033.0-94829.0)	28540.6 ± 19251.2 (4568.0-95484.0)
Speed (mile/hr)	1.6 ± 0.6 (0.6-2.5)	2.0 ± 0.5 (1.2-3.29)	2.0 ± 0.6 (0.9-3.6)
Distance (mile/ wk)	7.0 ± 5.3 (0.3-26.7)	10.4 ± 6.6 (2.5-37.8)	10.3 ± 8.2 (1.7-42.2)
Energy (Kcal/wk)	625.2 ± 478.4 (31.1-2521.9)	990.1 ± 707.1 (191.4-3536.7)	909.8 ± 563.0 (144.0-2298.9)
Time (min/wk)	167.8 ± 110.7 (14.36 – 610.4)	259.6 ± 159.8 (55.86 – 858.0)	250.2 ± 159.0 (46.1 - 800.1)

One factor repeated measures ANOVA indicated that there was a significant difference in all walking values over time (Table 22). When pairwise comparisons using Bonferroni procedure was employed to test the mean difference in walking values at different time periods, all walking values were significantly increased from baseline to 3-month, and from baseline to 6-month after enrollment.

Table 22

Changes in Walking Exercise Values over Time (n = 43)

Source	SS	df	MS	F	Sig.
Step	3395839710	2	1697919855	17.521	.000
Error	8140182518	84	96906934.7		
Speed	3.65	2	1.82	7.067	.001
Error	21.71	84	.25		
Distance	324.31	2	162.15	12.359	.000
Error	1102.15	84	13.12		
Energy	3163594.02	2	1581797.01	10.915	.000
Error	12172894.94	84	144915.41		
Time	219560.14	2	109780.07	15.350	.000
Error	600741.02	84	7151.67		

Note: Evaluated by using One factor repeated measures ANOVA

Additional analysis revealed important results. Overall, 39.9%, 63.1%, and 57.8% of participants, reported doing walking exercise with duration of 30 minutes or more at the baseline, 3 and 6-months after enrollment, respectively. Considering the number of days that walking exercise was performed in a week included less than 3 days (11.1%, 0%, and 0% at the baseline, 3 and 6-months after enrollment, respectively), 3 to 5 days (33.3%, 19.5%, and 33.3% at the baseline, 3 and 6-months after enrollment, respectively), and 5 to 7 days (55.6%, 80.4%, and 66.7% at the baseline, 3 and 6- months after enrollment, respectively).

Once again, it was of interest to evaluate the difference in walking exercise values among participants with different bone mass conditions. A notation in Table

23 revealed walking exercise values of a group with normal or low bone mass condition were increasing over time, while a decrease was observed in a group with severe low bone mass condition from 3 to 6-month after enrollment. However, a two-factor split plot analysis while walking values at the baseline as covariate in the model revealed that there was no significant effect for groups (bone mass conditions) or time (walking exercise values) or for the group by time interaction.

Table 23

Walking Exercise Values of Participants with Severe Low Bone Mass and Normal or Low Bone Mass (n=43)

Bone mass condition	Baseline $\bar{X}$ ± SD	3-month $\bar{X}$ ± SD	6-month $\bar{X}$ ± SD
Walking Steps (per wk)			
Severe low (n = 22)	18861.3 ± 12104.0	28578.2 ± 19185.1	24168.5 ± 18644.8
Normal or low (n = 21)	17469.1 ± 9857.4	30513.5 ± 18044.5	33120.9 ± 19240.9
Walking Speed (mile/hr)			
Severe low (n = 22)	1.45 ± 0.63	2.03 ± 0.55	1.84 ± 0.56
Normal or low (n = 21)	1.88 ± 0.53	2.04 ± 0.50	2.16 ± 0.79
Walking distance (mile/ wk)			
Severe low (n = 22)	7.01 ± 5.55	10.36 ± 7.25	9.00 ± 8.27
Normal or low (n = 21)	6.99 ± 5.23	10.45 ± 6.15	11.70 ± 8.28
Walking Energy (kcal/wk)			
Severe low (n = 22)	668.21 ± 578.40	936.56 ± 710.56	751.56 ± 489.62
Normal or low (n = 21)	580.13 ± 354.04	1046.37 ± 716.52	1075.76 ± 598.06
Walking Time (minute/wk)			
Severe low (n = 22)	181.42 ± 122.91	258.98 ± 171.77	219.86 ± 154.78
Normal or low (n = 21)	153.60 ± 97.44	260.36 ± 150.61	282.18 ± 160.88

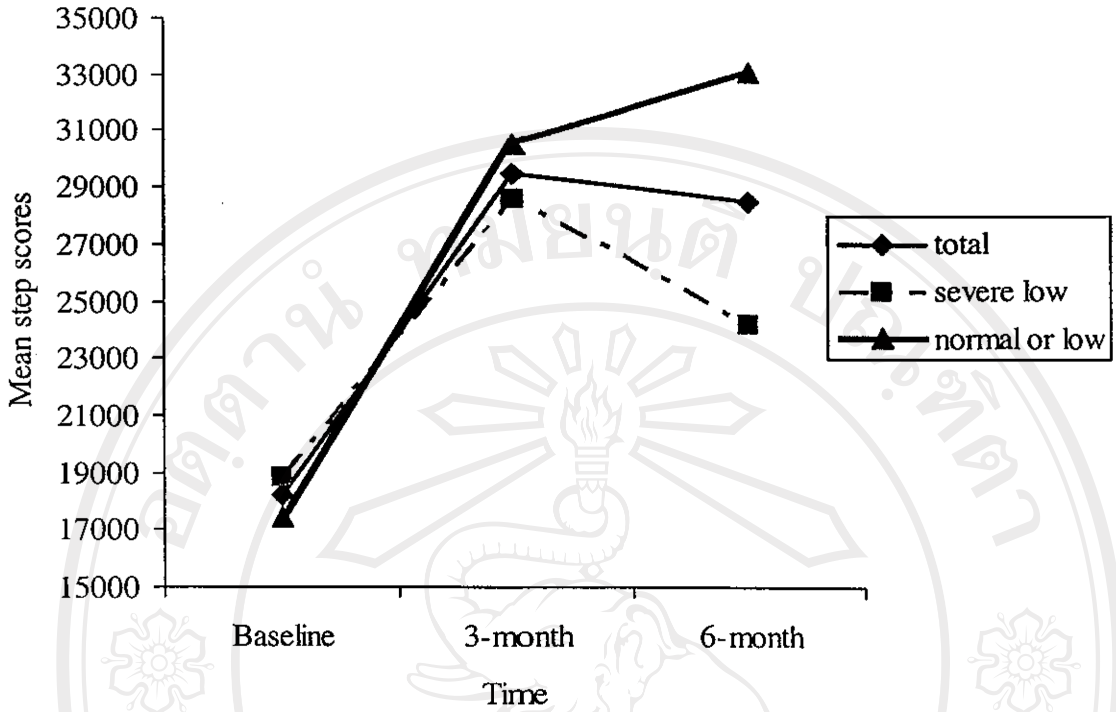

Figure 7. Changes in walking steps of all participants and groups over time

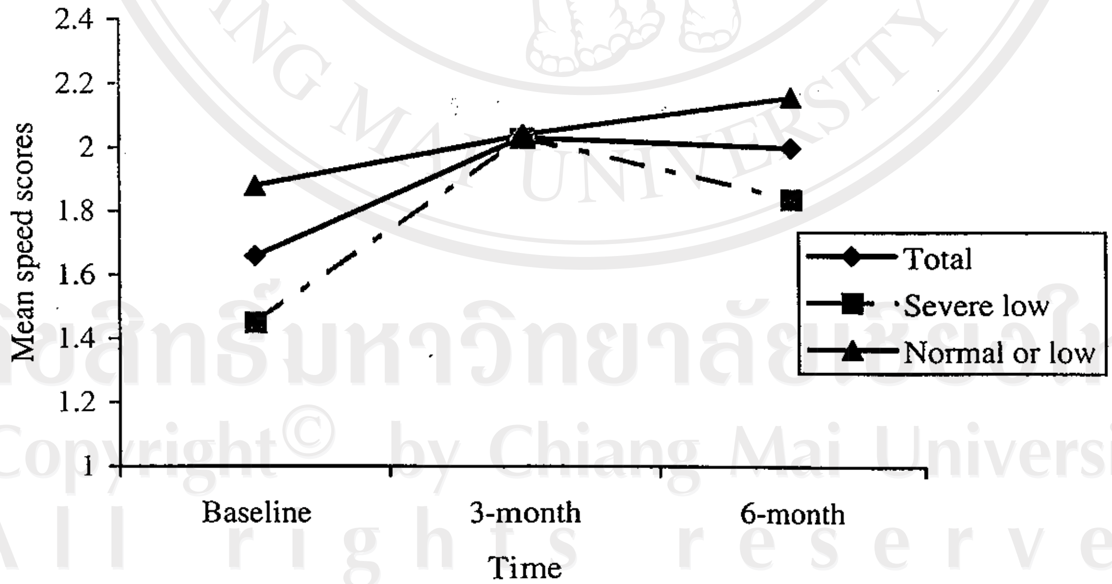

Figure 8. Changes in walking speed of all participants and groups over time

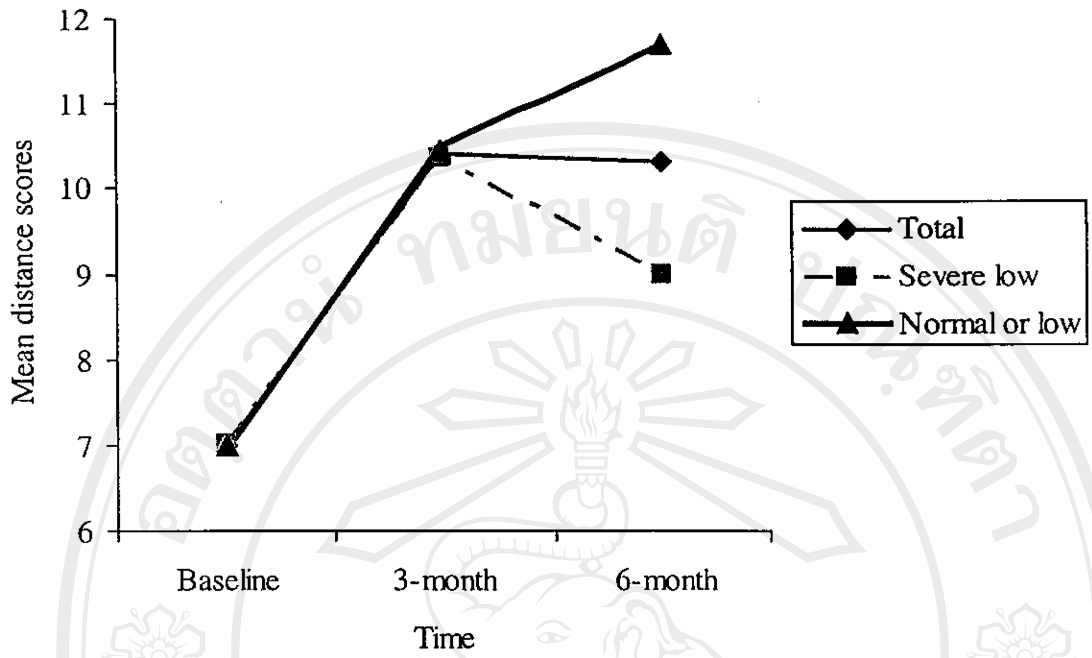

Figure 9. Changes in walking distance of all participants and groups over time

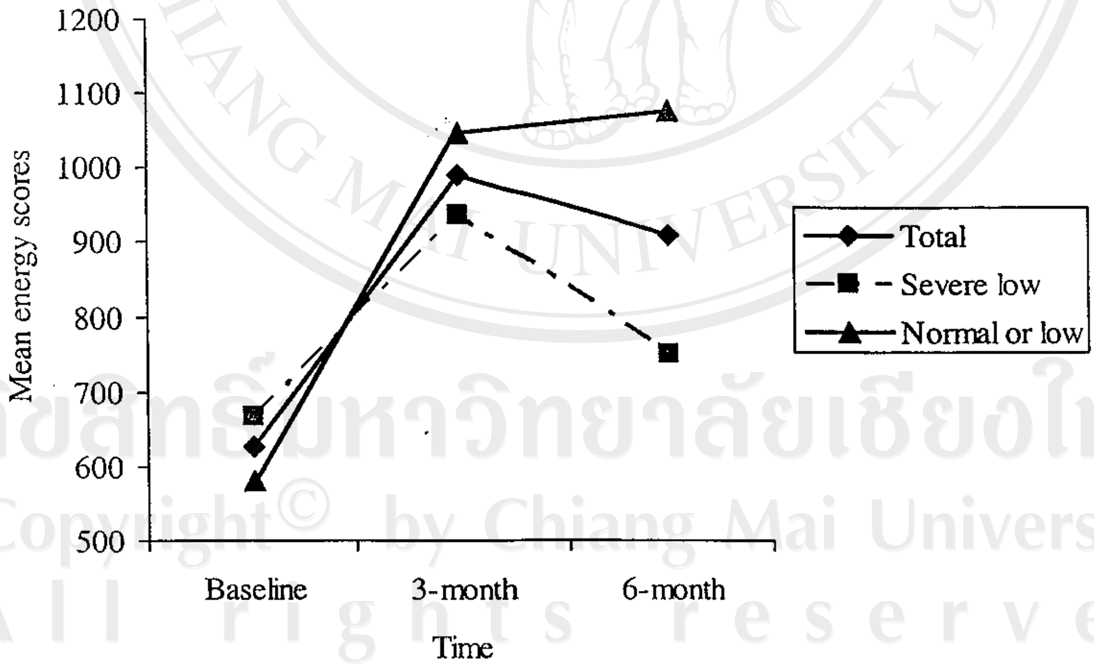

Figure 10. Changes in walking energy of all participants and groups over time

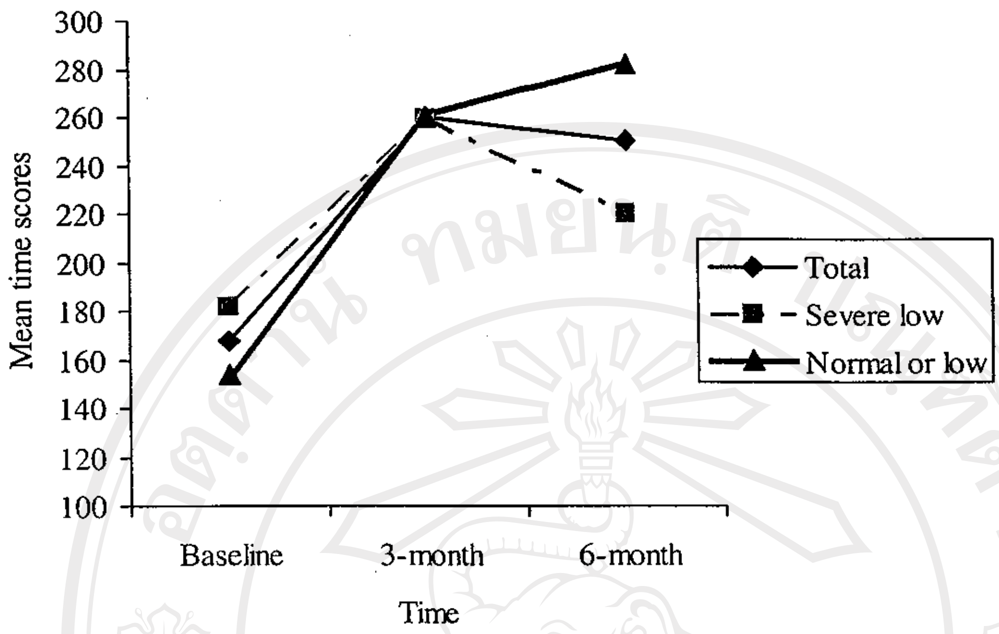

Figure 11. Changes in walking time of all participants and group over time

Discussion

The aims of this study were to evaluate the feasibility and acceptability of an osteoporosis prevention program for Thai older adults and to investigate the effects of the program on knowledge, health beliefs, self-efficacy, and preventive behavior with regard to osteoporosis. This part discusses specific topics as follows:

Feasibility and Acceptability of Osteoporosis Prevention Program for Thai Older Adults

Results from this study demonstrated the feasibility and acceptability of the JHBP for Thai older adults. Some reasonable explanations of these findings were based on three criteria: retention of study participants, burden of outcome measures, and program implemented problems. The retention of study participants was high. This was supported by the low percentage of older adults dropped out during program implementation (10.53%), at the 3-month after enrollment (3.92%), and at the 6-month after enrollment (2.04%). Additionally, overall drop out rate from this study (15.79%) was less than the extra number of participants added to compensate the attrition (34%). In general, the attrition would decrease a statistical power because of reduced sample size, and also consequently, threat to external validity can occur. The remaining participants who completed all follow-up measures were still larger than the number of participants needed in this study (48 participants vs 42 initially sampled). Older adults were willing to participate in this study. This is supported by the evidence that there was not any one who lost interest and refused to continue participating in the program.

The time required for completion of questionnaires seemed to be reasonable. A fundamental reason is that participants did not need to complete questionnaires at the same time. During class sessions, participants completed only the questionnaires that related to specific topic although they needed to complete the FOOQ, OHBS, OSES, and the Dietary Calcium Food-Frequency Questionnaire at the 3-month after enrollment. For the 6-month after enrollment, they were asked to complete all questionnaires used at the 3-month after enrollment plus the Program Evaluation Questionnaire. With this trial, the time required for completion of questionnaires was less than 60 minutes; this was a reasonable amount of time for older adults to physically and mentally participate (Davis & White, 2000).

Specific evidence of program implemented problems was considerable, namely the participant recruitment and educational methods. As known, older adults are a vulnerable group to develop related diseases. Older adults, therefore, were curious about all diseases. In addition, the JHBP was set up at the senior center with the intent to provide as much information as possible to the greatest number of older adults. The senior center, as opposed to other locations, was recommended as an appropriate place for health education for older adults since older adults have easy access to the senior center (Curry et al., 2002). With this reason, many older adults would like to join the JHBP. However, not all the older adults were selected. This may cause an ethical problem since some older adults who would like to gain benefits from the program could not get this benefits.

In case of educational methods, osteoporosis-related content, length of sessions and teaching-leaning environments were discussed. Participants were pleased with not only osteoporosis-related content, but also a large font size. For written materials, one participant said: " Pamphlets helped me to select calcium-rich foods. I recalled osteoporosis knowledge from not only the pamphlet but also the booklet." Comments like this provided support to the fact that the written material used in this study was easily understood and reinforced verbal instructions. The content and context in which it is delivered was a factor contributing to the effectiveness of the educational program (Taggart & Connor, 1995)

Sessions were planned for 90 minutes duration. Before starting each session, participants were assigned to complete pretest questionnaires. Participants did not complete assigned questionnaires at the same time, and some reached the class late on some occasions. In addition, a few participants (2-3 persons) needed visual aids while reading and writing documents and times required for completing questionnaires among these participants were longer due to declined visual acuity. These problems, sometimes, caused time required for class sessions to be extended. However, the participants did not see this as a major problem, and they accepted the conditions. There was no participant who dropped out because of a length of a session. Considering teaching-learning environment, a group size and a class-room was specified. In this study, the group consisted of 15 to 20 individuals. It was a large group since some participants who were close friends wanted to share the same class. This limited the participants who were timid from actively participating in learning sessions. In light of results from another study it could be extrapolated that a group size of 10 or fewer older participants was appropriate for more individualized assessment of learning needs and individual attention (Davis & White, 2000). However, a group size of 15-20 in this study was accepted. Furthermore, the classroom was at the HPCE where was easily accessible and had plenty of space to maneuver the teaching materials. Additionally, the HPCE provided opportunities for toileting and taking care of basic comfort needs, such as a quiet room, comfortable room temperature, and comfortable chairs which contributed to a high attendance.

In relation to program acceptability, it is obvious that the program was acceptable for Thai older adults. The participants' rating of program acceptability was very high from 72.70% to 93.93% for either subscales or entire program. Issues emerged during the post interview supporting the acceptability of the program, especially the usefulness of the program. The participants perceived they gained more osteoporosis information, had guidelines for preventive behavior practice, and got appropriate learning method. As the fact that older adults are at greatest risk for osteoporosis, there is a need for a multidisciplinary education model that could be implemented with groups of older adults. The program in this study carried out strategies that enhance learning including use of written material, illustrations, oral presentations, and practice sessions. Using a combination of a variety of media to present the material was well documented to enhance the amount of information the older individual retains (Beare, 1999; Phillips, 1999). This was supported by an example from anecdotal data. "The program really motivated me to learn about osteoporosis, especially learning and getting information week by week was appropriate for my age to remember that information. I enjoyed learning by watching videotape where I could see the moving pictures and could listen to the voice at the same time. Also, I liked power point presentation and small group discussion in which I could share my ideas and ask questions." More importantly, the JHBP provided gradual steps of learning and changing, and reinforcement and discussion of the problems throughout the program were offered.

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

There is substantial evidence that the osteoporosis prevention program is effective in increasing knowledge, health beliefs, and self-efficacy. As in other studies, the baseline data assessment indicated that participants were not knowledgeable about osteoporosis, especially its risk factors (Ailinger & Emerson, 1998; Ribeiro, Blakeley, & Laryea, 2000). They only answered correctly approximately 53.17% of the osteoporosis content, and only 47.64% of them were able to identify osteoporosis risk factors. This finding is quite surprising. The investigator anticipated that the participants had more knowledge about osteoporosis than general population because they regularly attend the HPCE and always meet health care providers who may provide information about osteoporosis to them. The fact that participants did not have enough information about osteoporosis risk factors and osteoporosis preventive behavior may be due to the nature of this health problem. Osteoporosis is a silent disease, which might not cause any symptoms until fractures occur. Older adults, therefore, might not perceive a personal susceptibility to osteoporosis leading to a lack of concern on developing this disease. This notation was supported by the findings from another study that women were more concerned about other diseases, such as cancer, heart disease, or neurologic disease despite the large potential impact of osteoporosis on their health and functional capacity (Hsieh, Novielli, Dimond, & Cheruva, 2001)

However, after participating in the JHBP, participants increased their knowledge about osteoporosis both overall knowledge scores and subscale knowledge scores (the fact on osteoporosis, osteoporosis preventive behavior, and osteoporosis risk factors). In addition, the positive effect appears to be long lasting since the increase in knowledge was still evident at the 6-month assessment. These findings were comparable to those reported by Ribeiro and Blakeley (2001), who indicated that increased knowledge was maintained at the 6-month session. In addition, similar findings were noted by Sedlak et al. (1998), who found an increase in knowledge three weeks after educational intervention. Also, Cook et al. (1991) reported that an educational program could increase women's knowledge of osteoporosis and contribute lifestyle changes. There are some possible explanations of this positive finding. A fundamental reason is that knowledge was clearly the easiest factor to change through an education program even though it did not guarantee a persistent change of behavior (Sedlak, Doheny, & Jones, 2000). Alternatively, participants in this study, all attended the HPCE, and were seeking information about their health and willingly came to participate in the JHBP. The JHBP offered information about osteoporosis to participants by using a variety of media: VDO, power point presentation, food models, and reading materials. This was based on adult learning theory suggested by Best (2001) that individuals remember about three-fourths of what they see, only one- tenth of what they hear, and about nine-tenths of what is communicated to them by both sight and sound. Thus, a combination of a variety method of learning styles may enhance the success of an education intervention.

With regards to osteoporosis health beliefs, older adults who participated in the JHBP increased some aspects of their health beliefs about osteoporosis. Interestingly, results of osteoporosis health belief subscales indicated perceived susceptibility, perceived benefits of exercise, perceived barriers of exercise, and perceived barriers of calcium intake were significantly changed over time ($\rho < .05$). This was supported by some parts of findings reported by Janz and Becker's (1984), who did a meta-analysis that revealed perceived barriers was the most powerful dimension, followed by perceived susceptibility. Additionally, an increase in perceived benefits of exercise over time was consistent with that reported by Sedlak et al. (1998), who reported perceived benefits of exercise was a significant aspect of osteoporosis prevention activities. A possible reason to explain an increase of perceived susceptibility over time after enrollment is that the JHBP provided knowledge of osteoporosis occurrence and offered bone mass screening to older adults participating in this study; interpretation and discussion of the results may increase participants' perceived susceptibility to osteoporosis. Knowing that osteoporosis related to hormone deficiency makes the older adults perceived their susceptibility to osteoporosis. This finding was consistent with other studies, which reported that the coupling of print-based education related to osteoporosis content with the use of bone density screening contributed to changes in behavior (Cook et al., 1991; Jamal et al., 1999; Peterson et al., 2000). In addition, Rubin and Cummings (1992) found that bone mineral density screening increased women's sense of personal susceptibility to osteoporosis. However, the perceived susceptibility in this study differed from that reported by Piaseu, Belza et al. (2001), who found that perceived toward osteoporosis was lowest in young Thai women. This reflects the fact that young adults may not be concerned about potential problems since osteoporosis is a disease contributed to health problem in later life. Also noted are findings reported by Taggart and Connor (1995), who found that the perception of susceptibility to osteoporosis in younger participants was less than the perceptions of older participants.

Regarding the increase of perceived benefits of exercise, one possible reason is the fact that either exercise or physical activity in today culture is an individual's responsibility and a proactive stance toward health promotion. When the JHBP provided a pedometer to each individual participant to monitor their walking exercise, participants were happy to see their gradual change leading to maintaining walking. This notation was supported by anecdotal data. For examples "I really enjoyed walking whenever I saw my walking step increase; I set goal to increase my walking exercise, and I observed my progress on my pedometer." "I walk every day with my pedometer on. I was interested in finding out how many steps per day that I did." Most importantly, the JHBP provided a booklet emphasized the importance of weight-bearing exercise in building strong bones as well as videotape showed the impact of brisk walking on bone health. These may contribute to an increase in participants' perception of benefits of exercise in this study. Not surprisingly, the JHBP led participants to decrease their perception of barriers. The explanation for this finding is that the JHBP provided available times for persuasion and considerations of how to overcome barriers to share with participants by discussing and giving alternative choices of performance.

Considering other aspects of health beliefs including perceived seriousness, perceived benefits of calcium intake, and perceived motivation, the increase after intervention was not significant over time. A possible explanation for perceived seriousness is that even if 52.9% of participants in this study had severe low bone mass reported by quantitative ultrasound screening, only 13.7% of all older adults reported having bone fractures. Therefore, they may not be concerned about the seriousness of developing osteoporosis since osteoporosis did not have any clinical symptoms. As noted in a study conducted by Kasper, Peterson, and Allegrante (2001), although women were worried about developing osteoporosis, they were much more concerned about and believed that they were much more susceptible to heart disease and breast cancer, which are more serious than osteoporosis. A possible explanation for no statistical significant difference over time of perceived benefits of calcium intake and perceived motivation is that the mean scores of those aspects were very high at the baseline (79.3% of correct response for perceived benefits of calcium intake and 83.61% of correct response for perceived motivation). Therefore, the increase in the mean scores of those components after intervention was difficult to observe. However, the increase of the perception of susceptibility and the decrease in the perception of barriers signified the JHBP be apparently successful as Salazar

(1991) recommended that development of an educational program should focus on perceived barriers and perceived susceptibility.

In view of self-efficacy, the JHBP showed a significant increase in overall self-efficacy ($\rho < .001$) and subscales of self-efficacy ($\rho < .05$), with greater high scores of total self-efficacy than previous study conducted on young Thai women (Piaseu, Belza et al., 2001). Compared with the same study, more confidence in calcium intake and weigh-bearing exercise of participants in this study were observed. A possible explanation for these findings is that the participants in this study were highly physically active with 88.2% of participants supported doing exercise at baseline. The consumption of dietary calcium in this study was reported as higher than previous studies, 496.45 mg/day compared with 361 mg/day (Komindr et al., 1994) and 300-400 mg/day (Rajatanavin, 2000). This explanation supports the SE theory, which suggested that the performance accomplishments are the most influential source of enhancing SE led through they can perform activities. Enhanced self-efficacy is related to initial performance attainment (Bandura, 1977).

Another explanation for an increase in osteoporosis self-efficacy is that the JHBP, which was based on using the SE model as a framework, provided several strategies to enhance osteoporosis self-efficacy of participants. For example, during class-sessions, calcium-rich food examples were displayed to help participants learn how to determine calcium-rich foods. In addition, they were encouraged to consume daily foods which are a wonderful source of calcium. Regarding self-efficacy on weight-bearing exercise, the participants in this study saw the VDO showing an older adult who was successful in maintaining healthy bone by walking, which was one type of weight-bearing exercise recommended for older adults. Moreover, participants were taught how to monitor their walking exercise by using pedometers. They participated in practicing walking exercise with pedometer and reading the pedometer record. More importantly, throughout the small group discussions, the participants discussed barriers to walking exercise and calcium intake, and group persuasion and reinforcement were used to eliminate those barriers. The modalities used to enhance self-efficacy as stated earlier were vicarious learning experience (learning from role models), verbal persuasion, practicing and mastering a behavior, and emotional/physiologic states. These supported the effectiveness of applying the SE model in older adults.

Of special note are the findings that the JHBP is apparently effective for enhancing knowledge, health beliefs, and self-efficacy associated with osteoporosis of older populations over time, on short-term (immediately after class) and intermediate period (3 and 6-months after enrollment). As noted earlier, having certain beliefs, confidence, and knowledge were documented as key elements to carry out a behavior.

The Effects of Osteoporosis Prevention Program on Intermediate (3 and 6-Months after Enrollment) Osteoporosis Preventive Behavior in Older Adults

This study revealed a significant intervention effect on main behavior outcomes, dietary calcium intake and walking exercise. Of special note for dietary calcium intake is that participants reported increasing their dietary calcium intake significantly from baseline to 3-month and 6-months after enrollment although the average of calcium intake was slightly lower in comparison to another study (Peterson et al., 2000). However, the percentage of participants who reported an increase in calcium intake at the 3-month (68.75%) and 6-month (75%) after enrollment was somewhat higher proportions than a previous study (62%) (Brecher et al., 2002). When looking solely at studies conducted among Thais, the average daily calcium intake of participants in this study at baseline, 3 and 6-month follow-ups was higher than that found by Komindr et al. (1994) and that reported by Rajata (2000).

Interestingly, when participants with different bone mass conditions were compared, an increase in dietary calcium intake of participants was higher in participants with severe low bone mass conditions than those with normal or low bone mass conditions. Similarly, Cook et al. (1991) reported that 85% of women with osteopenia and 69% of women with normal bone mass increased their calcium intake after one year participating in osteoporosis education and screening program. Also, Jamal et al. (1999) found that at one year post educational intervention plus bone mass testing program, women with low bone mass were more likely to increase calcium intake, compared with women with normal BMD. In addition, Rolnick et al. (2001) supported aforementioned findings that 61% of women with normal bone mass, 63% of women with osteopenia, and 89% of women with osteoporosis increased their calcium intake after they participated in the osteoporosis education and bone mass testing program.

There are some possible reasons to explain an increase in calcium intake in this study. One explanation is that the JHBP employed in this study provided several strategies to encourage participants to engage in changing behavior by using efficacy-based intervention as stated earlier. Self-efficacy about calcium intake of participants in this study was very high; they attempted to change their behavior if they perceived themselves were personally capable of adopting such behavior. This supports Bandura's (Bandura, 1977) notation that self-efficacy is the most important aspect of a person's sense that determines one's effort to change behavior. Alternatively, perceived benefits of calcium intake were higher nearly twofold, compared with perceived barriers to calcium intake of older adults. These may result in taking action of increasing dietary calcium intake of older adults. Becker et al. (1977) stated that the person's likelihood to take action is determined by the individual's perceived benefits to take action weighed against the perceived barriers involved. The perceived likelihood of successfully achieving the goal of action is a function of perceived benefits of taking action and less barriers of that action. Regarding a high calcium intake in participants with severe low bone mass compared to that in those with other bone mass condition, a possible reason is that as the older adults received information about the importance of calcium in building strong bone and about sources of daily calcium-rich foods; those with severe low bone mass may be easily continued to engage in calcium intake to improve or maintain their healthy bone.

As noted, changes in calcium intake were observed over time in this study, but the mean dietary calcium intake (mg/d) of participants was different from those studies conducted in different countries. This discrepancy may be explained by the way calcium intake was measured. And also, sources of calcium-rich foods and dietary intake lifestyles across diverse cultures may result in the aforementioned difference. However, even the average calcium intake in this study is only about 496 mg/d, which did not meet the 800 mg/d recommendation for Thai older adults (Nutrition Division of the Public Health Ministry, n.d.), the percentage of participants who met the recommendation was increasing from 3.92% of participants at the baseline to 8.16% of those at the 3-month, and 33.33% of those at the 6-month after enrollment. The average amounts of calcium intake in this study may be beneficial to promote healthy bone in older Thai population since Bauer et al. (1993) reported that each 400 mg/d increase in dietary calcium was associated with a 1.1% increase in distal radius bone mass of elderly women.

The other gratifying outcome of this study is change in walking exercise behavior. It should be noted that this is the first published study that presents data on pedometer-determined walking exercise in older adults to promote bone health. The participants in this study reported an increase in their walking exercise values (steps, speed, distance, energy, and time) over times. Additionally, 63.17% (at the 3-month after enrollment) and 57.5% (at the 6-month after enrollment) of participants reported the duration of walking exercise 30 minutes or more, compared with 39.9% for the baseline. Moreover, the number of days that walking exercise was performed 3 times or more in a week was 100%, compared with 88.9% for the baseline. This finding of an increase in exercise after receiving educational intervention was consistent with those reported by some other studies. Cook et al. (1991) found that at the one-year follow-up of the osteoporosis educational intervention, the participants increased in daily exercise. Also, Ribeiro et al. (2000) reported that at the 6-month post-osteoporosis educational workshop, 68% of women in their study increased weight-bearing exercises at least 4 times per week. Contrastingly, Brecher et al. (2002) reported women participating in the multidisciplinary educational intervention program did not significantly increase their exercises. However, they concluded that the lack of significant findings resulted from a great number of participants (73%) having had exercise at least 1 hour per week before participating in their study.

Several possible reasons were used to explain an increase in walking exercise in this study. Since some studies reported the imperative relationship between self-efficacy and long-term exercise behavior (McAuley et al., 1993; McAuley, Jerome, Elavssky, Marquez, & Ramsey, 2003), the high self-efficacy of exercise in this study may be the predominant reason. In addition, perceived barriers to exercise in this study was low, and significantly decreased over time ($\rho < .05$). As McAuley et al. (1993) recommended that overcoming barriers and enhancing self-efficacy resulted in health behavior changes, therefore, intervention with self-efficacy beliefs and barrier-management education for older adults could substantially encourage older adults to engage in exercising. Once again, the JHBP provided several modalities to enhance self-efficacy and to eliminate barriers to exercise. For example, the interactive barriers-counseling component of intervention derived from the HBM conjunction with the reinforcement exposure derived from the SE was provided for participants.

Walking exercise increased from baseline to 3-month after enrollment and from baseline to 6-month after enrollment. It was surprising to find that participants in this study reported a decrease in walking exercise from 3-month to 6-month after enrollment, but there was no a significant difference of the decrease. One possible explanation may be that the 6-month assessment during rainy season. Rain may keep older participants away from walking exercise as seen from anecdotal data. "I did not get out and walk more during this week because of rain. I think that it was a good time for gardening." "It was often cloudy in the evening. I guessed it will be raining, so I did not go out to walk" Seasons affecting walking exercise was also supported by Krall et al. (1994), who found that the mean distance walked varied from 6.1 ± 6.5 miles/wk in the fall to 4.4 ± 5.8 miles/wk in the spring. Alternatively, results from additional analysis revealed a different amount of walking between participants with normal or low bone mass condition and participants with severe low bone mass although the difference was not statistically significant. The participants with normal or low bone mass condition increased in walking exercise, while a decrease was observed in participants with severe low bone mass. The proportion of increasing in walking exercise was less than that of decreasing in walking exercise. For example, the percentage of increasing in walking steps of participants with normal or low bone mass from 3-month to 6-month after enrollment was 5.17%, compared to 15.69% of decreasing in walking steps of older adults with severe low bone mass.

These findings differed from other studies. Cook et al. (1991) found osteopenic women increased their daily exercise compared to women with normal bone mass (53.8% vs 39.6%). Also, Jamal et al. (1999) reported that women with low bone mass reported greater physical activity compared with women with normal BMD. Participants with severe low bone mass in this study might perceive that a person with osteoporosis should be less active to prevent falls since fall prevention was one topic associated with osteoporosis prevention discussed at the 3-month after enrollment. However, in light of results from another study it could be extrapolated that worry about falling was one of the barriers associated with exercise behavior of older adults (Resnick & Spellbring, 2000).

As noted, walking speed at the 3-month (2.04 ± .53 mile/hr) and 6-month (2.00 ± .69 miles/hr) after enrollment in this study did not meet the criterion of brisk walking exercise (3-4 miles/hr), which was equal to moderate intensity exercise (Pate et al., 1995) that was accepted to promote bone health (Brooke-Wavell et al., 1997; Chien, Wu, Hsu, Yang, & Lai, 2000). However, Feskanich et al. (2002) reported that every 1 hr/wk of walking exercise at an average pace (2-2.9 miles/hr) showed a 6% decrease in risk of hip fractures in postmenopausal women. Women reporting an average pace had 49% lower and women reporting a brisk (3-3.9 miles/hr) to very brisk ($\geq$ 4 mile/hr) had 65% lower risk of hip fractures, compared with women reporting walking with an easy pace (< 2 miles/hr).

Krall et al. (1994) found that postmenopausal women who habitually walked more than 7.5 miles per week, or about one mile each day, increased their whole body BMD, leg BMD, and trunk BMD. Walking was also associated with a retardation of bone loss at the leg region. A study conducted by Ebrahim et al. (1997) reported that postmenopausal women who participated in intervention group walking with faster speed than usual walking with duration of 40 minutes three times a week showed less decrease of femoral neck BMD than that of a placebo group. Harris, Caspersen, DeFriese, and Estes (1989) concluded from several controlled intervention trials that postmenopausal women may retard their bone loss by doing any types of physical activity for 30-60 minutes three times a week. For this study, walking distance (10.41$\pm$ 6.67 and 10.32 $\pm$ 8.29 miles/wk), walking speed (2.04 $\pm$ .53 and 2.00 $\pm$ .69 miles/hr), and walking time (259.66 $\pm$ 159.86 and 250.30 $\pm$ 159.05 min/wk) at the 3 and 6-months after enrollment, respectively were consistent with aforementioned findings, which should be accepted.

Changes in osteoporosis preventive behavior (calcium intake and walking exercise) that is known to reduce the risk for osteoporosis were followed in this study. Making appropriate life-style changes may ultimately reduce the risk for osteoporosis or fractures in later life.