CHAPTER 2

PROJECT DESCRIPTION

2.1 Rational

2.1.1 Osteoporosis

Osteoporosis is a disease in which characterized by the progressive loss of bone density and thinning of bone tissue, leading to weakness of the spine, wrist, hip, pelvis and upper arm.

Epidemiology

Results of epidemiological studies predict a large increase in the future incidence of osteoporosis related fractures. One recent estimate projects approximately 6.3 million hip fractures world-wide by 2050. Underlying this increase was world-wide aging. The most rapidly expanding population cohort was 85 years and older. In the United States current life expectancy for women was 78.6 years, as compared to 45 years in 1900. Current life expectancy for Thai women was 71 years as compared to 68.05 years in 1985 (Ratchatanawin, 1999). Advanced life expectancy was attributed by improved public health and reduced mortality among the young, through better nutrition and advances methods for treating and preventing infectious diseases. An increase in the age-specific incidence of osteoporosis had been reported for many countries. In Thailand according to the demographic study of Mahidol University in July 1999, the number of aging people in Thailand was expected to increase 1 time

(14.7%) or around 10 million people by the year 2019. In the United States, researcher estimate that about 23% of american women over the age of 50 had osteoporosis. The data of Lerdsin hospital was shown that the number of osteoporosis was increased every year. There was 129 cases in 1995, 175 cases in 1996, 193 case in 1997, 261 cases in 1998 and 279 cases in 1999). From these figures, we could predict that bone problems were going to become a major Thai public health in the future.

Causes

Osteoporosis is the most common type of metabolic bone disease in the United States (Farley, 1998). It occurs when the body fails to form enough new bone or when too much of the old bone is reabsorbed by the body, or both. Calcium and phosphate are two minerals that are essential for normal bone formation. Throughout youth, the body uses these minerals to produce bones. If calcium intake is not sufficient, or if the body does not absorb enough calcium from the diet, bone production and bone tissues may suffer. Calcium and phosphate may be reabsorbed back into the body from the bones, in which case the bone tissue is made weaker. Both situations can result in brittle, fragile bones that were subject to fractures.

Usually, the loss occur gradually over an extended period of time (years) and most of the time, a person will sustain a fracture before becoming aware that the disease is present. By the time this occurs, the disease is in its advanced stages and damage is profound. There are a number of causes of osteoporosis,

however hormone deficiencies (estrogen in women and androgen in men) are the leading causes (Xiaowei, 1993). Women, especially over the age of 60, are the most frequent sufferers of the disease. This is due to the loss of ovarian function and subsequent reduction in estrogen production that occurs around the time of menopause. Other causes include corticosteroid excess (Cushing 's syndrome), hyperthyroidism, hyperparathyroidism, immobilization, bone malignancies, certain genetic disorders, and other miscellaneous problems such as low calcium in diet.

Type of osteoporosis

Osteoporosis may be either a primary or a secondary form (Suwanvalaikorn, 1996). Primary osteoporosis is the more common form and is due to the typical age-related loss of bone from skeleton. It is classified as type 1 and type 2. Secondary osteoporosis resulted from the presence of other disorders or conditions that predispose to bone and classified as type 3.

Type 1: Type 1 or postmenopausal osteoporosis occurs in 5% to 20% of women, affecting those within 15 to 20 years of menopause, with peak incidence in the 60 and early 70. The incidence in women is eight times higher than that in men. The frequency of postmenopausal osteoporosis accounts for the overall female-male of 2:1 to 3:1. Estrogen deficiency is though to underlie this form of osteoporosis, rendering the skeleton more sensitive to parathyroid hormone, resulting in increased calcium resorption from bone. This in turn decreases

parathyroid hormone secretion 1,25 dihydroxyvitamin D production, and calcium absorption.

Women can lose around 2% to 3% of their bone per year for the first 5 years after menopause. Because of the drop in estrogen production, women lost nearly 50% of their trabecular bone and 35% of both types of bone. At least 75% of the bone loss that occurs in women during the first two decades after menopause can be attributed to lack of estrogen rather to aging. Bone loss associated with menopause does not begin with the onset of amenorrhea but may occur 1 to 3 years before the actual cessation of menstrual periods.

Type 2: Type 2 or senile osteoporosis occur in women or men more than 70 years of age and is usually associated with decreased calcium absorption, which increase the PTH level and therefore bone resorption, In type 2 osteoporosis, cortical and trabecular bone are lost, primarily leading to increased risk of hip, long bone, and vertebral fractures.

Type 3: Type 3 or secondary osteoporosis occurs equally in men and women and at any age. In men, most cases were due to disease or to drug therapy, but in 30% to 45% of affected individuals no cause could be identified. In various series of osteoporotic patients, secondary osteoporosis accounts for about 40% of the total number of osteoporotic fractures seen by physicians.

Risk factors

There are several factors that increase individual chances of developing osteoporosis, including a thin, small-boned frame; previous fracture or family history of osteoporotic fracture; estrogen deficiency resulting from early menopause (before age 45), either naturally or from surgical removal of the ovaries or as a result of prolonged amenorrhea in younger women; advanced age; a diet low in calcium; Caucasian and Asian ancestry (African American and Hispanic women are at lower but significant risk); cigarette smoking; excessive use of alcohol; and prolonged use of certain medications. They are divided into 2 groups, some risk factors that individual can not change and others that individual can change. Risk factors individual can not change include gender, age, body size and family history. Gender: individual chances of developing osteoporosis are greater if individuals are a woman. Women have less bone tissue and lose bone more rapidly than men because of the changes involved in menopause. One in four women over the age of 50 has five times greater risk than men. Age: the older people are, the greater risk of osteoporosis. Individuals' bones become less dense and weaker as people age. Body size: small, thin boned women are at high risk. Family history: people whose parents have a history of fractures also seemed to have reduced bone mass and may be at risk for fractures.

Risk factors individual can change are sex hormone : abnormal absence of menstrual periods (amenorrhea); low estrogen level (menopause), low calcium intake and vitamin D; lack of weight bearing exercise or extended bed rest.;

cigarette smoking; excessive use of alcohol and caffeine; use of certain medications and race. African-American females tend to achieve higher peak bone mass than caucasian females. Underlying reasons are still under investigated. These difference in bone density were apparent even during youth. These risk factors can affect the chances of developing osteoporosis.

Prevention

Throughout life, dietary intake of calcium is essential for bone formation and maintenance. Vitamin D, which aids in the absorption of calcium, is also essential. Maintaining a healthy diet as recommended by the Food and Drug Associate (FDA), (which includes a sufficient amount of calcium, phosphorous, and vitamin D), is very important. Preventive strategies which are prevention in earlier ages, especially before the age of 30, can be the best defense against developing osteoporosis. After age 30, there tend to be minimal change in total bone mass but in the first few years after menopausal, women may lose up to 15 percent of their bone, which is about one third of the bone they will lose in their lifetime. Osteoporosis is more likely to develop if you did not reach optimal bone mass during your bone building years. For example a women who enters menopause with a high bone density will be less likely to develop osteoporosis because she has more bone to start with.

Therefore, prevention of this disease is very important because, while there are treatments for osteoporosis but there is no cure. Prevention in earlier ages is the best way to avoid osteoporosis in the later life. Prevention of

osteoporosis are based on achieving and maintaining optimal bone mass through dietary, exercise, avoid smoking, limit alcohol and caffeine taking, use of hormone replacement. Calcium is an essential nutrient for bone health. It has been suggested that calcium deficiencies in the young can account for a 5-10 percent difference in peak bone and can significantly increase the risk for hip fracture in later life. Depending on the age, an appropriate calcium intake falls between 1000-1300 mg a day may include low fat dairy product, dark green leafy vegetables, sardines and salmon with bones.

Vitamin D is needed for the body to absorb calcium. Without enough vitamin D, the body will not be able to absorb calcium from the foods we eat, and have to take calcium from bones. Vitamin D comes from two sources, through the skin following direct exposure to sunlight and from the diet. While many people are able to obtain enough vitamin D naturally, studies show that vitamin D production decreases in the elderly and people who are housebound or patient who cannot go outside. Experts recommend a daily intake between 400 and 800 I.U. per day, which also can be obtained from fortified dairy products, egg yolks, saltwater fish and liver. Thus vitamin D plays an important role in calcium absorption and in bone health.

In term of exercise, like muscle, bone is living tissue that responds to exercise by becoming stronger. The best exercise for bones is weight bearing exercise, that forces you to work against gravity. These exercise include running, jogging, stair climbing, lifting weight, tennis and dancing. Regular exercise may reduce bone fractures. Researchers found that athletic participation during high

school increased the mineral content of the hip bone by about seven percent, overall bone mineral content raised five percent and the only bone that didn't seem affected was the radius, an arm bone between the wrist and elbow (Teegarden, 1997).

Smoking is bad for bones as well as for heart and lungs. Women who smoke have lower levels of estrogen compared to nonsmokers and frequency go through menopause earlier. Postmenopausal women who smoke may require higher doses of hormone replacement therapy and may have more side effects. Smokers also may absorb less calcium from their diets. In term of alcohol intake, drinking heavily is more prone to bone loss and fractures, because of poor nutrition as well as increased risk of falling. Caffeine is contained in many beverages, including coffee, tea and cola. Recent studies show that caffeine increase calcium loss through the urine.

Symptoms

There are no symptoms associated with the early stage of the disease. Symptoms occurring late in the disease are fractures of the vertebrae, wrists, or hips (usually the first indication), low back pain, neck pain, bone pain or tenderness, loss of height over time, stooped posture.

Test

Osteoporosis is often known as the "silent epidemic" because the first time that a patient knows that he or she has osteoporosis is when a fracture occurs. This is not true anymore as now, there are very good ways of detecting it early before fractures occur to reduce the risk of fractures. Currently Bone Mineral Density (BMD) test by Dual Energy X-ray Absorptionmetry (DEXA) is the best method of assessing osteoporosis. Bone Densitometer is able to determine from these differences how much bone mineral is present. The spine, hip and forearm are measured where osteoporosis fracture occur most. Measurement using a dual energy X-ray absorptionmetry which is safe, useful and affordable. The radiation the patient is exposed to is six times less than a chest X-ray. The predictation for future fractures risk is excellent. It is better than doing a blood cholesterol to predict the risk of getting heart attack (Visitsunthorn, 1996). New screening techniques and treatments for osteoporosis are mostly now available for older women.

Treatment

Treatment for osteoporosis focuses on slowing down or stopping the demineralization process, preventing bone fractures, and controlling pain associated with the disease.

Estrogen: estrogen can slow or stop bone loss and, if estrogen treatment begins at menopause, it can reduce the risk of hip fractures up to 50 percent

(Suwamvalaikorn, 1996). Many postmenopausal women choose estrogen replacement therapy (ERT) because of its proven usefulness in slowing the progress of or preventing osteoporosis, and in alleviating some of the irritating symptoms of menopause.

Some women hesitate to use estrogen supplements because of the numerous consequences that have been associated with long-term use. If estrogen replacement therapy is discontinued, bone loss will resume. Studies show that women who take estrogen for at least seven years, the onset of menopause and the age of 75 have a 50 percent reduction in risk of fractures, however after age 75, the risk is about the same as for those who did not take estrogen at all. In the 75 years and older group, bone mass only differs by about two percent between women who have take estrogen for 10 years and those who have never taken it. Thus before beginning ERT, the benefits and consequences of the treatment should be weighed and discussed thoroughly with a health care provider.

Calcitonin: Calcitonin slows the rate of bone loss and it relieves bone pain. There are, however, many drawbacks associated with the use of calcitonin. The drawbacks include: calcitonin must be injected daily; it causes nausea in many patients; and it is very expensive in comparison to ERT.

Fosamax The risk of spinal fractures in postmenopausal women who take Fosamax is reduced by nearly 50 percent (Suwanvalaikorn. 1996).

Studies on Osteoporosis

Regular exercise can reduce the likelihood of bone fractures associated with osteoporosis. Studies show that exercises requiring muscles to pull on bones, cause the bones to retain and perhaps even gain density. Researchers found that women who walk a mile a day have four to seven more years of bone in reserve than women who don't. Some of the recommended exercises include: weight-bearing exercises; riding stationary bicycles; using rowing machines; walking and jogging.

It was known that calcium and other nutrients in dairy products contribute to the development of a healthy skeletal. However, when looking at the constant dieting of today's adolescences and their exercise, too many adolescent are smoking, dieting, drinking cola rather than milk, and regular weight bearing exercise because they are dissatisfied with their body image. Their concerns about body weight lead them to substitute low-calorie drinks for dairy products in their diet (Marble, 1997).

In addition, results from United States Department of Agriculture 's study (USDA) indicated that the average adolescence girl consume calcium less than the recommended by the Food Nutrition Research Council that recommend about 1200 milligrams of calcium each day. The average adolescent girl consumed only about 800 mg of calcium per day. Moreover, Nutrition Education and Training (NET) indicated a decline of about 100 milligrams in mean daily calcium intake in male and female children 6 to 11 years old. In Thailand, a study of calcium supplementation in Thai people, (20-80 vears of

ages) had indicated that dietary intake of calcium approximately 361 milligram per day which was lower than the Recommended Daily Allowance as shown in Table 2.1 (Komin, 1997). The prevalence of low calcium intake would not be apparent for years. Recent evidences suggested that a low calcium intake, a mineral essential for bone growth, may be a serious problem because it can result in decreased peak bone mass in early adulthood, increasing the risk for development of osteoporosis (Chapman, 1996). All behaviors that directly or indirectly limit bone formation were risk factors to have a chance of osteoporosis.

Table 2.1: Thai Recommended Dietary Allowances (RDA)

Age	Gender	Intake
1 to 10	male & female	800 mg.
10 to 18	male & female	1200 mg.
Adult	male & female	800 mg.
Pregnancy and Breast feeding		1200 mg.
60+	male & female	1000-1200 mg.

Source: Nutrient and osteoporosis disease

In 1997, Tsukahara et al, studied the effects of physical characteristics and dieting habit, on bone mineral density in adolescent girls in healthy adolescent girls (Japanese students at a junior high school, aged 12-15 years) focusing on the nutritional state, energy, calcium, and iron intakes. Results suggested that maintenance of an appropriate physique and adequate intake of nutrients such as calcium were important for bone growth during adolescents.

The majority of osteoporosis research finding had been on premenopausal and postmenopausal women with little focus on prevention research for young women (Hamerman, 1997). In 1998, Carol A Sedlak et al., studied osteoporosis prevention in young women based on the Health Belief Model (HBM) and Self-Efficacy Models (Denison, 1996). The study conducted in young college women aged between 18-19 who were divided into 2 groups, control and experimental group. Subjects in the experimental group received an osteoporosis prevention program, and the control group completed the osteoporosis knowledge test, the osteoporosis Health Belief Scales at two times. The result showed osteoporosis prevention was effective in increasing awareness of osteoporosis prevention in this group of young women.

In Thailand, one study was conducted by Nonglux Prosiphol in 1999 on osteoporosis prevention in premenopausal women aged between 40-55, sample consists of 60 females. The sample was divided equally into two groups participated in group work once a week for three weeks, and meet again on week sixth of the study. Participants of the experimental group also received a handbook and exercise record in order to keep records of exercise. The

comparison group received normal services from the health clinics. The results showed that the application of Health Belief Model could cause a significant increase in perceived susceptibility to osteoporosis, perceived severity of osteoporosis and perceived benefit minus the barrier of osteoporosis prevention behavior.

2.1.2 Conceptual framework for the intervention

This study was a health education to empower the individual to make informed health decisions and to promote good health practice and to prevent disease. It was developed from the Health Belief Model (HBM).

Scott (1999) indicated that health behavior is heavily influenced by one's health beliefs. The HBM focuses on one's perceptions of his or her susceptibility to a disease as predictors of one's health actions. The key to behavioral intervention with a client is to identify which behaviors (health and non-health related) are most important and changeable (Schwarzer, 1995) the HBM may provide a viable framework for understanding individual beliefs in relation to genetic couselling decisions. The model's theoretical foundations emanate from a core of well-established psychological and behavioral theory (Denison, 1996).

The HBM emphasizes the effects of beliefs on a decision-making process carried out within the realms of interaction with other individuals and events (Dennison, 1996). Behavior or decision-making may be predicted from the value

of the outcome of an action and from the expectation that the action will proven or ameliorate the health problem (Schwarzer, 1995).

As figure 2.1 shown, the core components of the HBM are;

1. **Perceived Susceptibility**: one 's subjective perception of the risk of contracting a health condition;
2. **Perceived Severity**: feelings concerning the seriousness of contracting an illness or of leaving it untreated (including evaluation of both medical and clinical consequences and possible social consequences);
3. **Perceived Benefits**: the believed effectiveness of strategies designed to reduce the threat of illness;
4. **Perceived Barriers**: the potential negative consequences that may results from taking particular health actions, including physical, psychological, and finance demands. In addition to these four original dimensions, later works with the HBM has included other factors in the model, such as demographics (i.e. age, sex, race, socio-economic status), and knowledge of the disease (Denison, 1996).

A public health oriented approach developed are based on the HBM. The HBM suggested that among other factors, the probability that an individual undertook a particular preventive action (e.g. calcium and weight bearing exercise) was linked to a number of personal perceptions, including susceptibility to the problem, the seriousness of developing or contracting the

problem, and the benefits and costs of undertaking the recommended prevention action.

Using the HBM as the conceptual framework, I developed and pilot-tested an experiment curriculum. This novel approach was intended to increase teenagers' awareness of the probability of personally becoming osteoporosis, the serious negative personal consequence of osteoporosis, the personal and interpersonal benefits of weight bearing exercise and adequate daily intake of calcium and smoking cessation, reduction of alcohol and caffeine intake. It was also designed to decrease the psychological, interpersonal and logistical barriers to abstinence of consistent weight bearing exercise and dietary intake. See Figure 2.1 for the study 's conceptual framework.

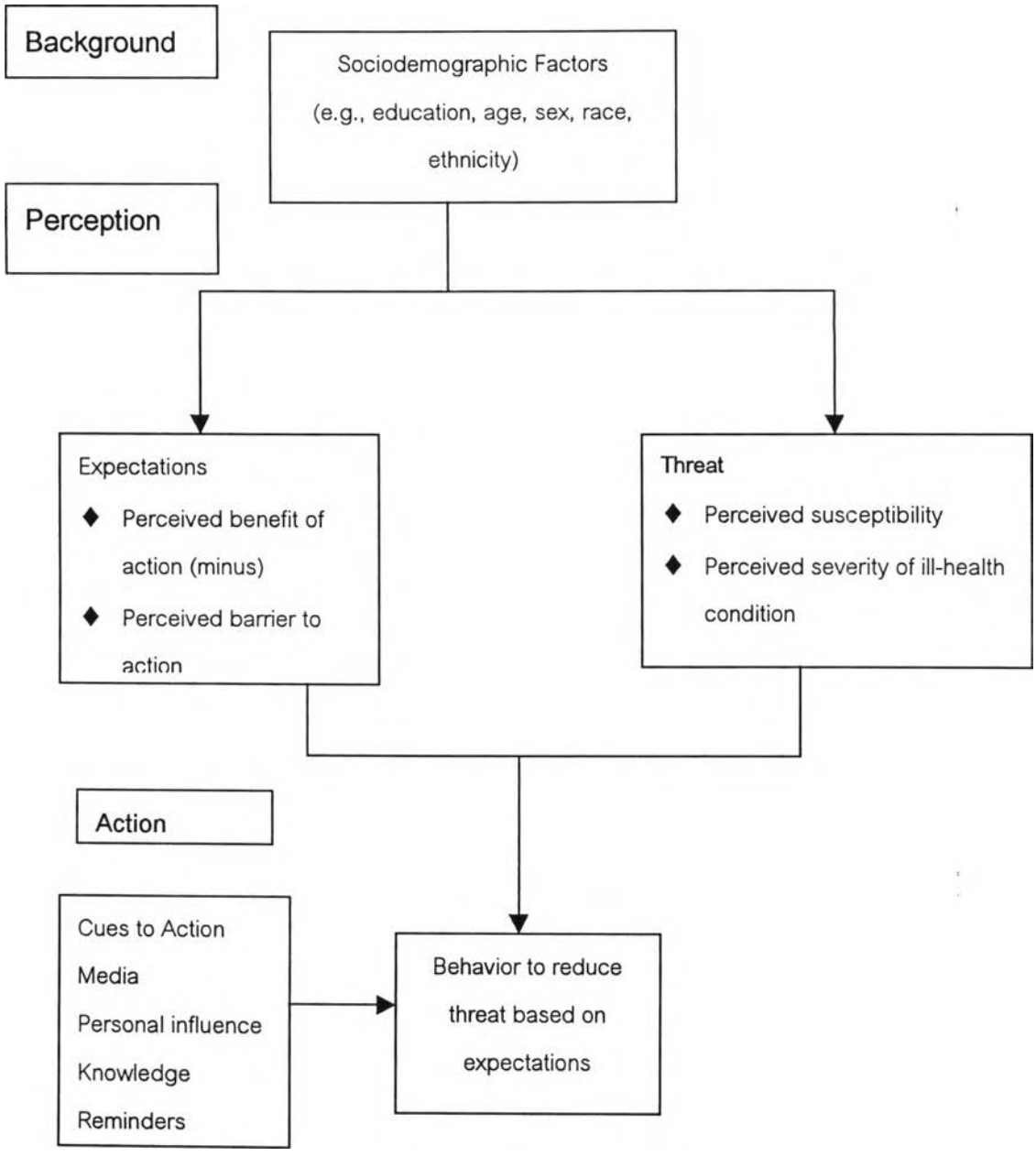

Figure 2.1 The Health Belief Model

From Becker, M.H.,D.P., Kasl, S.V.e.t al. (1977).

2.2 Goals and Objective

The goal of this program was intended to increase knowledge of osteoporosis, increased health beliefs, and increased frequency of osteoporosis prevention behaviors in teenagers.

The main objectives of the project were:

1. To measure the effect of changes in knowledge and motivation on changes in dietary intake of calcium and weight bearing exercise, and limiting caffeine intake behavior over two-month follow-up period; and

2. To evaluate the importance of concepts from the health believe model immediate the young female participants' subsequent dietary intake of calcium, weight bearing exercise, and limiting caffeine intake.

2.3 Methods

2.3.1 Setting and Participants

In August 2000, 70 young female student in two-mathayom six classes in a high school in Bangkok, Thailand participated in the study. One class was assigned as experimental group, the other was control group. There were 35 students in each class. Intervention program was conducted in the experimental group. The student in control group completed pretest and posttest measure but did not participate in the program. An assistance who had osteoporosis knowledge was trained for one day to handle questions about osteoporosis, amount of calcium in the food and was demonstrated weight bearing exercises.

This program included instructional material and slides presentation titled "osteoporosis across the life span". Teaching providing included didactic information to increase knowledge of dietary and focus on physical outcome more than on disease. Osteoporosis manual was composed of osteoporosis knowledge, seriousness, prevention and treatment, that the subjects could later study by themselves at home to gain more knowledge and understanding.

2.3.2 Intervention program

The intervention program was divided into 3 sessions; The first session set on Aug 21, 2000. My assistance and I introduced ourselves to the group members and explained activity for learning in osteoporosis, susceptibility, seriousness, benefit and barrier of osteoporosis prevention. The participants completed the pretest questionnaire which focus on their knowledge of osteoporosis, susceptibility, seriousness, benefit and barrier of prevention osteoporosis. Then discussion about their dietary, for example how many glasses of milk did you take in one day, what kind of food do you like, do you know the best time to defense the osteoporosis was aged 20-25 years, etc.

After discussion, osteoporosis education program was taught to them with the content "what is osteoporosis disease, cause, risk factor, symptom, test, treatment, and prevention?". In addition, calcium rich foods, milk, fish, green leafy vegetables were shown during the teaching session.

Then, the participants were divided into small group of 10-12 persons and they were asked to set a menu which was composed of high calcium. For example, menu in the morning composed of boiled rice with egg (calcium =156

mg) and milk 250 cc (calcium =302 mg), thus the participants could get calcium in the morning around 450 mg. For the rest of the afternoon and for dinner, they tried to calculate to make up of 1200 mg of calcium in one day.

In this session, participants asked question regarding calcium, such as the amount of calcium in egg is around 156 mg etc. My assistance and I answered and explained them again. In addition, we demonstrated the correct weight bearing exercise that forced to work against gravity such as walking, dancing and climbing the stair but not swimming. The first sessions was spent for 90 minutes and appointed in 2 weeks for the next activity.

The second session, after two weeks of the intervention, the participants were retested on their knowledge of osteoporosis, susceptibility, seriousness, benefit and barrier of osteoporosis prevention. After they finished their test, they were also asked to record how much calcium and how long for exercise they did in one day for the next meeting in two-month. This time the program spent for 50 minutes and appointed in 2 months to follow up their behavior.

The third session assessed the importance of concept from the HBM that participants' subsequent dietary intake of calcium and weight bearing exercise, and limiting caffeine intake 2 months after the schedule date of program completion. Participants completed only part three of the questionnaire. This was to collect information on the impact of the program. Then the osteoporosis manual was given to them and intervention program was conducted for 50 minutes. (See Appendix C).

The control group had met me three times within two-month, once at the beginning of the study, two-weeks after the beginning to complete three parts and the last time after 2 months follow-up. They were retested on the behavior section. There was no osteoporosis didactic information given to subjects in this group. However, after completion of the posttest at two-month follow-up, the participants in this group had the opportunity to get osteoporosis knowledge from the manual.

2.4 Activities with time table

To operate the program, I had prepared equipment, manual and then selected one assistance who had osteoporosis knowledge to help me. After I got certified letter from the college of public Health, I submitted the letter to the school. After permission from the school teacher, I implemented the program and analyzed the data during 6 months (see Table 2.2).

Table 2.2: Time table and activities

Activities	5/00	6/00	7/00	8/00	9/00	10/0	11/0	12/0	1/01	2/01	3/01	4/01	5/01	6/01
1. Prepared equipment														
2. Trained the trainee														
3.Certified letter from the CU														
4.Summited letter to the school														
5.Implemented the data														
6. Analysed the data														
7.Wrote the report														

2.5 Problems

In this study we found the problems as following

Sample: At first, I planned to implement the program in different schools. However, after submitting the letter to three schools, two of them did not allow their students to participate the program. Thus, the study was changed to implement in a public female school with 2 classrooms in Bangkok area. The school served a student population of approximately 2519 persons. All of them were women and had a class M1-M6. In addition, the sampling of the program was designed as randomized study in the first time. When starting the program, the head of teacher himself set the class on Monday was experimental group, the other on Wednesday. Both of them had no experience in the similar study. Therefore, this study was nonrandomized and the teenagers who participated in the study were not representative of all teenagers.

Validity of the students' responds on their behavior: In assessing participants' behavior, questionnaires applied from Prasipol (1999) who studied the effect on the application of Health Belief Model on osteoporosis prevention behavior among premenopausal women were used validity and reliability of the questionnaire have been tested. It was shown a high validity and reliability. Even though, I could not recheck student's behavior that they had whether or not really behaved. I assumed them to be honest.