KNOWLEDGE OF OSTEOPOROSIS RISK FACTORS IN FEMALE COLLEGE STUDENTS AT THE UNIVERSITY OF JORDAN

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DEDICATION

To my pride and joy

My inner strength

My son

To Yousef

A loving and caring partner in this life

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List of Abbreviations

Abbreviation	Detail
BMC	Bone Mineral Content
BMD	Bone Mineral Density
BMI	Body Mass Index
DHS	Demographic and Health Survey
DXA	Central Dual Energy x-ray absorptiometry
FOOQ	Facts on Osteoporosis Quiz
IOF	International Osteoporosis Foundation
NHANES	National Health and Nutrition Examination Survey
NIH	National Institute of Health
NOF	National Osteoporosis Foundation
OP	Osteoporosis
PBM	Peak Bone Mass
UJ	University of Jordan
WBE	Weight Bearing Exercise
WHO	World Health Organization

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ABSTRACT

This was a cross sectional descriptive study that primarily aimed to determine the level of knowledge of osteoporosis risk factors among female university students. Secondary objectives included assessment of perceived attitudes and preventive practices toward osteoporosis.

A convenience sample of all female university students enrolled in the second term of the scholastic year 2004/2005 was taken from a compulsory university course at the University of Jordan. A questionnaire was distributed to all female students attending the Jordan University Compulsory course (1000); a response rate of 89.7% was yielded and the analysis of the respondents' characteristics showed a homogenous distribution reflecting Jordan University enrollment for females.

Descriptive analysis showed that high awareness (96%) is not mirrored by high knowledge. Female university students had a low level of knowledge on osteoporosis using the published Facts on Osteoporosis Quiz as a prime determinant of (median score of 12 on a scale of 23). Deficits of knowledge were most in areas pertaining to non-modifiable risk factors (heredity, race, early menopause, body frame) as well as modifiable risk factors such as practice of specific weight bearing exercises.

Respondents were also unaware of the required daily amount of milk for their age group.

In addition there was a low personal susceptibility perception to osteoporosis among the subjects (mean perception score 2.7 of 5.0) and only 23% of subjects ranked osteoporosis within the top 3 ranks relating to important diseases. They also believed that it is less serious than other common causes of morbidity and mortality in women, such as heart disease and breast cancer although they believed that it should be society concern and that the condition could be prevented. However, based on their responses to other questions, they did not practice or were not aware of preventive health behaviors (77%). Yet the majority had interest to learn more about osteoporosis and its risk factors (80%).

Significant association at the ($p \leq 0.05$) level was found between knowledge score as per the Facts on Osteoporosis Quiz mean score and faculty type, university Level, father educational level, consumption of milk and practice of regular exercise. No significant association was found between knowledge and presence of family history of osteoporosis.

In summary, and despite a high level of awareness of osteoporosis, young women who are at risk for this potentially disabling disease know little about osteoporosis and take even less action to prevent it. There is an overwhelming need for wider dissemination of information about osteoporosis, especially targeting younger women, to halt the progression of this silent disease.

Introduction and Study Objectives

Introduction

Osteoporosis is a major public health concern worldwide, that has reached epidemic proportions affecting one in 3 women and 1 in 8 men over 50 years of age (IOF 2000, Woolf et al., 2003). It is projected that this public health problem will escalate over the next 30 to 50 years (Woolf et al., 2003). Osteoporosis is a serious condition in health care because of potentially severe consequences for both the patient and the health care system. More severe complications include fractures—particularly of the spine, wrist, hip, pelvis, and upper arm—after minimal bone trauma, and even mortality (IOF 2000, Woolf et al., 2003). The quality of life after an osteoporotic fracture may also be affected as there may be pain, loss of independence, problems with adaptation, and greater fears about the future (Delmas 2002). Furthermore, the cost of treating osteoporosis and its associated fractures may amount to more than a few billion dollars each year in the United States alone (Orsini et al, 2004).

Once thought to be a natural part of aging, osteoporosis is no longer considered to be so and this disorder is largely preventable (Delmas 2002, Wolf et al., 2000). Osteoporosis is a multifactorial disease. Predisposition to osteoporosis can be explained by a low peak bone mass and by factors underlying excessive postmenopausal and ageing-associated bone loss (NIH, 2001).

Numerous non modifiable risk factors have been implicated in the pathogenesis of osteoporosis, including sex, ethnicity, body frame, advanced age, certain diseases, and heredity. Despite these non modifiable risk factors, the disease is largely preventable through modification of unhealthy lifestyle behaviors. These behaviors include adequate calcium consumption either through dietary sources or supplementation, adequate

amounts of vitamin D attainable via sun exposure or supplementation, weight-bearing exercise, and refraining from smoking and excessive alcohol consumption (Kanis 1994).

Efforts to decrease the incidence of osteoporosis include population-based intervention strategies targeted at decreasing the risk factors for osteoporosis (IOF 2000, Wolf et al., 2000).Thus, public awareness of the seriousness, preventive measures, and treatment of osteoporosis is important (Lindsay et al., 1998). Unfortunately, many individuals are either unaware of their risk(s) for developing osteoporosis, uninformed of preventive behaviors, or have failed to engage in preventive behaviors as they view osteoporosis as a distant threat (Hamdy 2002, Sedlack et al., 2002).

One of the first steps for raising awareness is to examine how much is known about the disease by all parties involved in its prevention and treatment, particularly in those affected by the disease and by the lay public. Such knowledge provides professionals, patients and the lay public with the information needed to make informed decisions about health practices (Sedlack et al., 2002, Brecher et al., 2002)

The majority of the studies on knowledge of osteoporosis conducted have examined healthy peri- and post-menopausal women (with mean ages ranging from 40 to 70 years). The importance of examining this population is understandable in light of its increased risk of developing osteoporosis, but at this age risk modification becomes directed more towards immediate risk of fracture and prevention activities should focus on this above and beyond activities to maximize bone mass (Lindsay et al., 1998). However, given the preventable nature of the disease, the limited number of studies examining the knowledge about osteoporosis in young populations is surprising considering that peak bone mass is not reached until the third decade (Metkovic et al., 1994). Osteoporosis prevention programs for young women have the potential to reduce

osteoporosis risk and thus prevent or delay the development of the disease (Sedlack et al., 2002., Kasper et al., 1994, Kasper et al., 2001).

A key component in developing successful educational interventions by health care professionals is understanding what young women know about the disease, what resources they would utilize to increase their knowledge about the disease, and to what extent they practice preventive behaviors such as adequate calcium intake and physical activity. Therefore, more research needs to be targeted at young women to identify gaps in knowledge about osteoporosis and its associated risk factors (Sedlack et al., 2002., Kasper et al., 1994, Kasper et al., 2001)..

This study will be the first large scale study in Jordan to assess the level of knowledge regarding osteoporosis, its risk factors using a structured questionnaire, and to be able to assess correlates of such knowledge solely in young female university students, whom still have the opportunity to maximize their peak bone mass through healthy life style behaviors in order to decrease their chances of developing osteoporosis and its consequences in the future. Such information is crucial when designing educational programs that would be tailored to meet the needs of a target population.

Study objectives

To determine level of knowledge of risk factors, preventive health behaviors, and attitudes for osteoporosis among young women attending the University of Jordan (UJ)

Primary Objective:

- Assessment of level of knowledge about osteoporosis and its risk factors.

Secondary Objectives

- Assessment of degree of perceived level of osteoporosis disease seriousness
- Assessment of degree of perceived susceptibility to development of osteoporosis
- Identify variables associated with knowledge about osteoporosis.
- Verify self reported assessment and practice of osteoporosis preventive strategies
- Determine level of interest of young women to learn about osteoporosis

Study variables and their operational definitions

Independent variables:

1. Income: defined as the total monthly family income in Jordanian Dinars (JDs) by earning groups.
2. Enrollment faculty: classified by category as Humanities, Scientific and Medical
3. Class standing: defined as the current university level of the respondent (freshman, sophomore, junior, or senior level).
4. Formal school education by high school proprietorship: defined as the ownership category of the last 3 years in school (private, public).
5. Level of parental education: Measured by level of education attained by parents segmented by highest schooling level attained.
6. Family history of osteoporosis: defined as self reported presence of osteoporosis in immediate family member or relative being (First Degree Relative; Mother, aunt or grandmother).
7. Life style behaviors; parameters defining healthy lifestyle behaviors – presence or absence of -

- Exercise: Planned and structured repetitive movements designed specifically to improve fitness and health. {90 minutes or more per week as a regular routine not confined to or limited to participation in gym}, includes activities such as brisk walking, steps, aerobic dance, running and tennis.
- Calcium intake {number of daily servings of dairy products}
- Smoking – defined as current smoker, non smoker
- Daily consumption of caffeinated beverages (coffee & soft drinks – cola)

8. Preferred health education sources: defined as the source where information on health is regularly obtained (Physician, nurse, pharmacist, magazines, newspaper, internet, brochures, radio, TV , or others defined by respondent)

Dependent variables – outcome measures

1. Osteoporosis knowledge

Knowledge has been defined as the awareness and understanding of facts, truths or information gained in the form of experience or learning. In this study, knowledge is defined as an awareness or perception of risk factors for osteoporosis and knowledge of strategies for prevention in terms of increased calcium intake, and weight-bearing exercise.

2. Perceived susceptibility:

Defined as the person's judgment of his or her risk of contracting the condition; in this study the measured perceived susceptibility pertains to perceived risk of developing osteoporosis in the future by respondent.

3. Perceived seriousness:

Defined as threat and impact of disease or condition on life style; in this study perceived seriousness defined by measurement of the rank of osteoporosis threat on health and life versus 4 other chronic diseases (breast cancer, diabetes, heart disease, stroke).

Literature Review

History of Osteoporosis

Although British surgeon Sir Astley Cooper wrote in 1824 that the skeleton seemed to become more fragile with age, osteoporosis was not fully described in medical texts until the mid 1920's. After the discovery of X-rays in 1895 by the German physicist, Wilhelm Roentgen, treatises on fractures in weakened bones began appearing in the German medical literature. In 1941, Boston endocrinologist Fuller Albright explored the increased bone breakdown after menopause, but his findings drew little attention since the American medical community, like the public at large, was focused on more immediate issues: fear of polio epidemics was rampant; pneumonia was a lethal killer; and syphilis and tuberculosis were medically uncontrollable cripplers (Petlack and Teitelbaum., n.d). Even after the discovery of antibiotics, public attention was directed toward two other dramatic killers, cancer and heart disease. The incidence of osteoporosis was increasing right along with life expectancy, but an awareness of its seriousness didn't keep pace with the threat it posed to the health and well being of the elderly (Petlack and Teitelbaum., n.d).

Post menopausal osteoporosis was first described in the 1940s but financial backing for research projects was slow to come. In 1965, a landmark conference, sponsored by the World Health Organization (WHO) and the National Institutes of Health (NIH), formulated a worldwide epidemiological study of osteoporosis giving recognition to the seriousness of the problem. In 1984, the National Institutes of Health publicized this disease, citing it as a significant threat to health and emphasizing that bone loss could be reduced by estrogen therapy, calcium, good nutrition and exercise (Kalu, 1995).

Definition

Osteoporosis has been defined as "a disease characterised by low bone mass and microarchitectural deterioration of bone tissue, leading to enhanced bone fragility and a consequent increase in fracture risk" (Alexeeva et al., 1994) i.e. a condition with low bone biomechanical competence leading to an increased risk of fracture even with minute load on the bone (Kanis, 1994).

Numerous factors, such as bone mineral content (BMC), non-mineralised matrix, and architecture are associated with bone strength (Aloia et al., 1985). As can be seen from figure1, bone mineral density (BMD) changes throughout life in women. Fig. 1 shows a concept of the development in spinal bone mineral density in women from early age to the age of 85 years (Dempster, 1995). After accretion of a peak bone mass around the age of 30 years a gradual loss continues until the more abrupt loss around the menopause and a more gradual loss later in life (Metkovic 1994). However, fig. 1 illustrates the problem of defining one general normal range for BMD (Dempster, 1995) for all age groups. The idea of a "normal range" is based on one of two concepts, namely 1) what is representative of the population (i.e. a state characterising most of the subjects in the population), or 2) what is the optimal state (i.e. what is "good" or "best" for the individual subject). As most subjects lose bone mineral from the age of 30 years and onwards, most elderly subjects will sooner or later fall below the normal range of a 30-year old individual (the optimal point at the curve) but still be well within what is characteristic for most of the population in the actual age group. From this point of view two measures of actual BMD has been developed:

1) *The T-score*. This is a measure of the deviation of the actual BMD from the mean BMD of a 30 year old female, i.e. the deviation from the peak bone mineral. T-score = (actual BMD - mean BMD at 30 years)/ standard deviation of BMD in a 30 year old

2) *The Z-score*. This is a measure of the deviation of the actual BMD from the mean BMD in a population of the same age, i.e. an age-adjusted normal range. Z-score = (actual BMD - mean BMD of the same age group)/ standard deviation of BMD in actual age group.

Based on these concepts a working group associated to WHO (Aleexeva et al., 1994) has defined osteoporosis in women as: "a condition in which the measured bone mineral content or density is below 2.5 standard deviations from the mean value in young healthy women (30 years of age - also named - 2.5 SD in T-score)". No definition was established for men (Alexeeva et al., 1994).

It may thus be suggested to subdivide osteoporosis into two groups: **asymptomatic osteoporosis** (BMC or BMD below -2.5 SD of T score but - as of yet - no low-energy fractures), i.e. osteoporosis according to the WHO definition, and **symptomatic osteoporosis** (severe osteoporosis: BMC or BMD below -2.5 SD of T score and present or previous low-energy fracture). Osteopenia (Alexeeva *et al.,* 1994) is defined as a state of reduced bone mineral content but not to a degree as mentioned above (between 1 and 2.5 standard deviations below the mean value in young individuals) in the same way as osteoporosis.

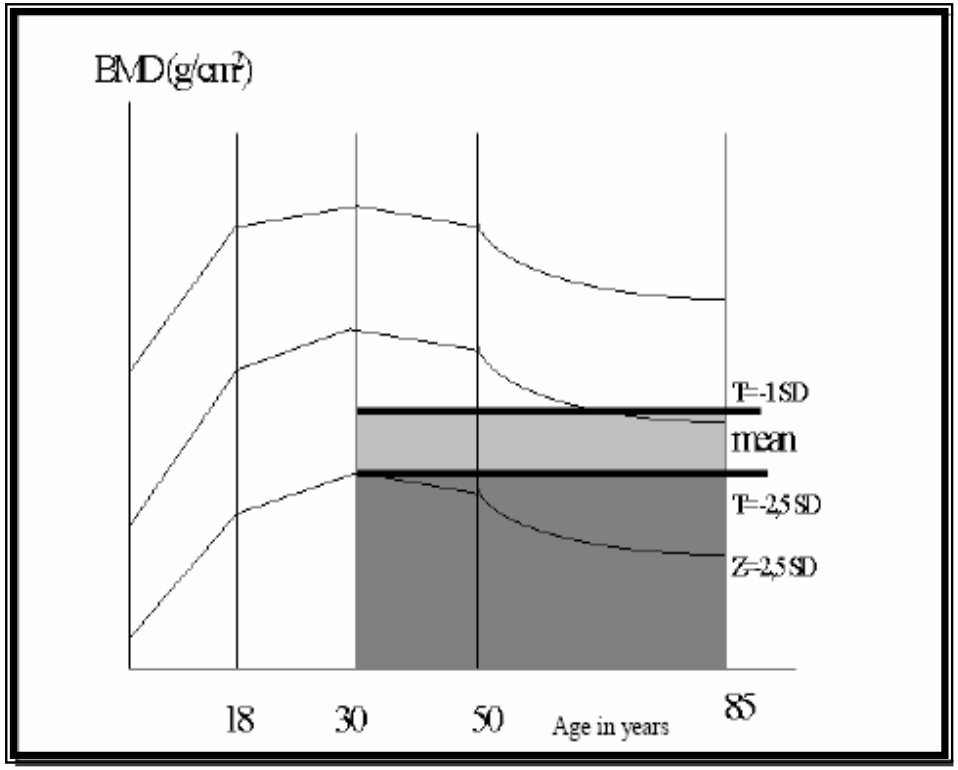

Fig. 1

Bone mineral density throughout life in women - reconstructed from cross-sectional studies (Dempster 1995). From a low level in adolescence, a peak bone density is reached around the age of 30 years, and from menopause (around the age of 50 years) an accelerated bone loss takes place followed by a more gradual bone loss. The solid lines represent cut-off values at 1 standard-deviation and 2.5 standard-deviations below the mean BMD of a 30 year old woman (the cut-off value for osteopenia and osteoporosis respectively (Aleexeva et al., 1994)

Prevalence

Around the world, it is estimated that osteoporosis affects one out of every three women and one out of eight men over the age of 50 (Woolfe et al., 2003, Wolf et al., 2000). It affects the majority of elderly people, and the population of the world is ageing in the developing world as much as in industrialized countries (Wolf et al., 2000).

Demographic studies also indicate that osteoporosis may soon reach epidemic proportions in the developing world. By the year 2050, it is estimated that one in two hip fractures resulting from osteoporosis will occur in Asia and Latin America (Gullberg et al., 1997).

In Europe the increase in the ageing population will result in a doubling of the number of osteoporosis patients in the next 50 years. In the United Kingdom, around 23% of women aged ≥50 years are estimated to have osteoporosis as defined by WHO (Wolf et al., 2000).

In the US and according to the WHO criteria, 13% to 18% of women aged 50 years or more had osteoporosis and another 37% to 50% had osteopenia (Wolf et al., 2000).
In the region, studies conducted in Saudi Arabia & United Arab Emirates have shown that 30 – 40% of women over 45 had low bone mass (Sadat et al., 2004, Saadi et al., 2001).

In Jordan and according to the Jordanian Department of Statistics (DOS, 2002), women of age 50 and older are estimated to be 11.5% of the Jordanian population which is almost double that of the 1994 estimates of 6% (DOS, 2002). In the largest epidemiology Osteoporosis study in Jordan yet by Shilbayeh (2003), an overall rate of osteoporosis of 30% was found among the Jordanian women involved in this study (irrespective of menopausal status), and prevalence of 43.3% among postmenopausal women. This was in line with 2 local community and facility based surveys that

indicated a range between 13%–28% and 40%– 46%, respectively (Qotob et al., 2001, Qotob et al., 2000).

Normal Bone Physiology, Peak bone mass and Remodeling

As shown in Figure 2, there are considerable changes in skeletal mass throughout the life cycle. Two mechanisms principally determine adult bone health: (1) the maximum attainment of peak bone mass (PBM) which is achieved during growth and early adulthood; (2) the rate of bone loss with advancing age, with the menopausal years being a time of considerable concern for women. Throughout early childhood bone mass increases linearly with skeletal growth and this time point is clearly critical for bone health (Fig.2; Specker et al. 1987; Glastree et al. 1990). There is a rapid increase in bone density during the pubertal years (by as much as 40–70 %; Bonjour et al. 1991), although this increase is known to vary according to skeletal site (Francis et al. 1998). The pubertal stage is an all-important time for skeletal development, and careful consideration should be given to the design of studies examining the influences of the 'modifiable' factors (such as nutrition and exercise interventions) on bone health during this period. The optimum time (i.e. pre-, peri- or post-pubertally) for intervention with such exogenous factors remains unclarified.

Bone density continues to increase for several years after the cessation of growth until maximum bone mass is achieved, known as PBM (Johnson and Slemenda, 1998). The exact age at which PBM is attained remains controversial, but is generally believed be about the late 2nd–early 3rd decade, although it is known to vary between the sexes and according to skeletal site (Recker et al. 1992; Metkovic et al., 1994)

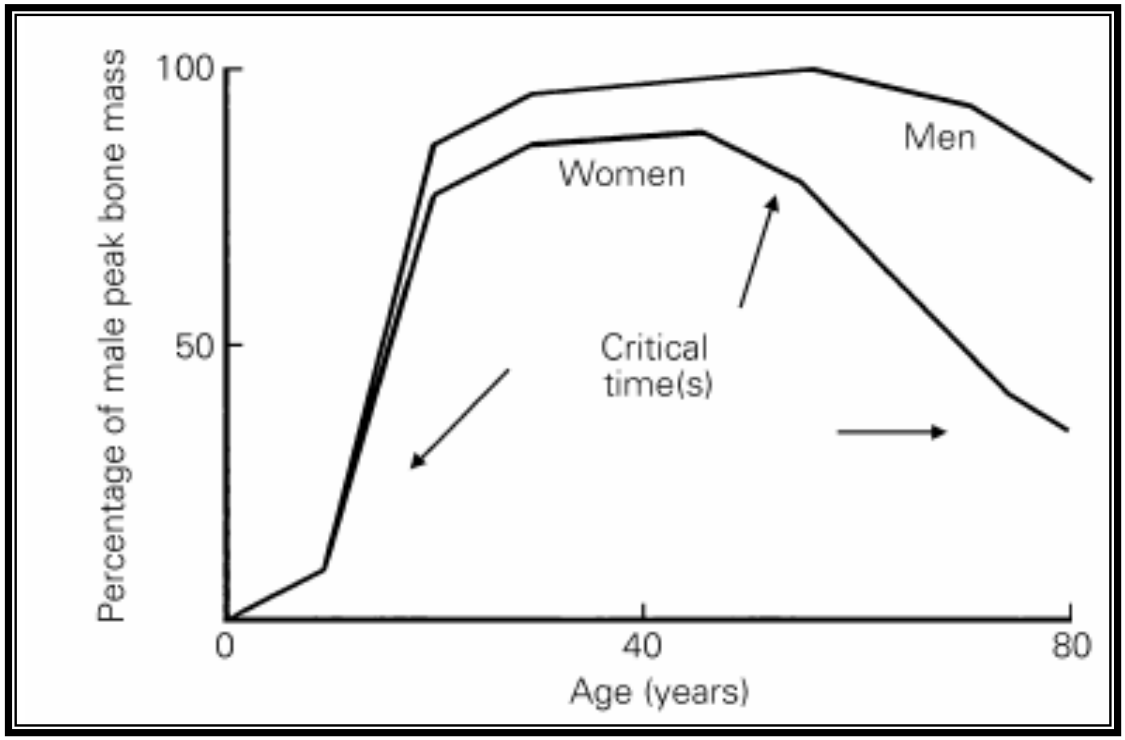

Fig. 2.

Changes in skeletal mass throughout the life cycle.

There are two types of bone in the body, cortical (compact) and trabecular (cancellous). Cortical bone makes up approximately 80% of the skeleton (primarily, the appendicular skeleton) and forms a compact shell around bone (Woolf et al., 1998). While trabecular bone constitutes only 20% of the skeleton, it has a much larger surface area than cortical bone because of its honeycomb-like structure. It is found in the distal ends of long bones and in the axial skeleton. Areas rich in trabecular bone (e.g., the vertebral bodies, the distal radius, and the intertrochanter of the hip) have high metabolic activity and show the greatest bone turnover or remodeling.

Bone remodelling is the process by which bone tissue (mineral and non-mineral) is renewed and degraded. The basis for this is the bone remodelling unit, involving the complex interaction between bone degrading osteoclasts and bone forming osteoblasts (Riggs et al., 1995). Throughout development, bone mass propagates by means of linear growth, cancellous modification, and cortical apposition (Parfitt 1987). These processes are often referred to as modeling. Bone modeling during development and remodeling throughout life are dependent upon factors that regulate the number and activity of both bone- forming osteoblasts and bone-resorbing multinucleated osteoclasts. During the process of continued bone formation, the osteoblasts encase themselves within the bone matrix and become osteocytes. The osteocytes have direct connections to the outer bone surface through microcaniculi (Buckwalter et al., 1995). The osteoclast is believed to degrade bone matrix by releasing hydrolytic enzymes, superoxide radicals and protons into what can best be described as an extracellular phagolysosome (Karsenty 2000). In the adult, after termination of linear growth, bone formation and resorption are coupled in a process called remodeling. Bone remodeling is the process by which bone mass is maintained at a virtually constant value between the end of skeletal growth and gonadal failure (Riggs et al., 1995).

In every remodeling cycle in the young adult, bone formation matches the quantity of bone removed during resorption. However, as aging continues, bone formation lags behind bone resorption, bringing about a net loss of BMD with each remodeling cycle (Kleerekoper, 2001). This loss of BMD with aging may be accelerated or progress at a normal pace, depending on medical status, hormonal status, and other lifestyle factors.

Pathopysiology of Osteoporosis

Bone loss represents an ongoing process with changes in bone mineral, that can be transient remodelling or permanent loss of bone e.g. following menopause (Alexeeva et al.,1994). Previous studies have claimed, that women with a high bone loss rate could be readily identified using biochemical variables and life-style variables (Christiansen et al., 1987). Based on the group with high bone loss the existence of a specific group of "fast losers" has been proposed (Ross et al., 1994, Christiansen et al., 1994).

Reginster et al. (1997) defined fast losers as those who lost more than 10% of spine BMD over 3 years, slow losers as those who lost from 3.4 to 10 % of spine BMD over 3 years, and no losers as those whose loss was lower than the minimal change detectable with a 1% level of confidence (< 3.4 % over 3 years). The 10 % loss over 3 years equals a 3.5 % loss per year, while the 3.4 % equals an annual loss of 1.1%.

From the discussion above it can be concluded and stated in the literature, that there are three fundamental pathogenetic mechanisms of osteoporosis (Lawrence and Raisz, 2001):

1. Failure to achieve optimal peak bone mass during skeletal growth.
2. Excessive resorption of bone once peak bone mass has been achieved.
3. Impaired bone formation responses during remodeling.

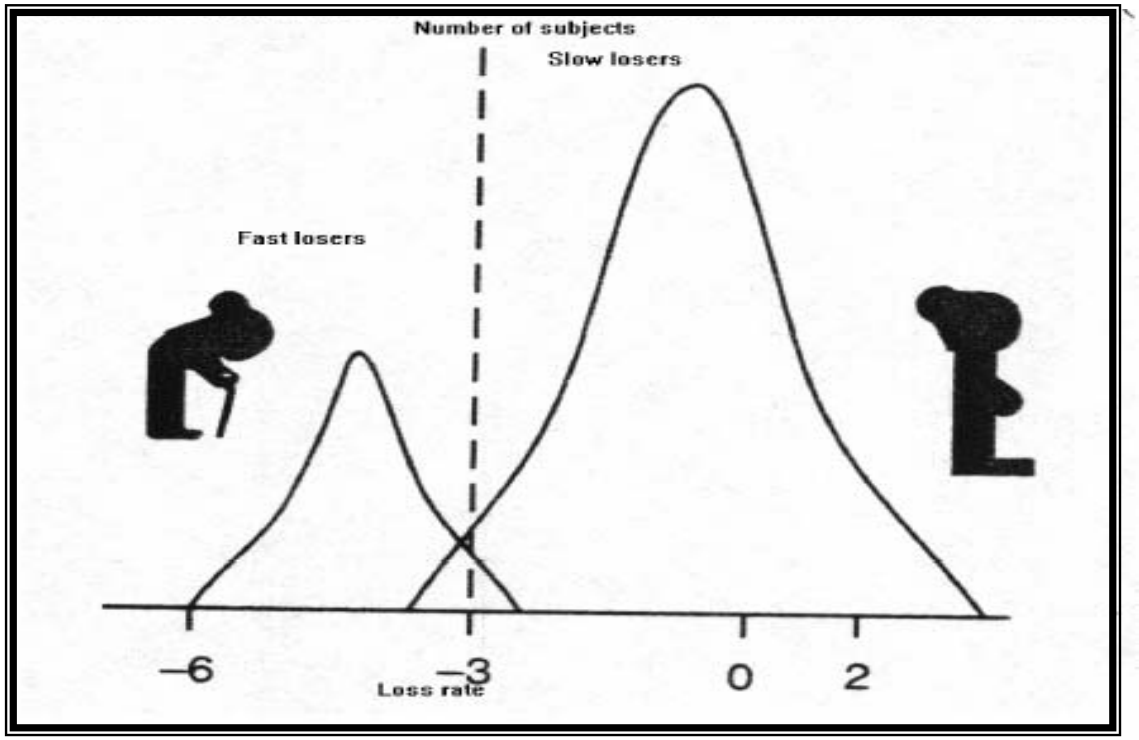

Figure 3

Bone mass Loss in Fast and slow losers post menopause: A) Distribution of loss rates in fast losers (the curve on the left) and normal/slow losers (the curve on the right) -. The X-axis is the loss rate per year and the ordinate is number. Modified from Christiansen et al. 1994

"Osteoporosis" is a term that encompasses both a risk factor for fragility (low bone density) and a condition of fragility (fractures). Osteoporotic fractures are frequently referred to as fragility fractures or low-trauma fractures, since they occur with minimal or no trauma. The development of osteoporosis and osteoporotic fractures is multifactorial, with skeletal strength factors, such as low bone density and impaired bone quality, and nonskeletal factors, such as falls, playing important roles.

Bone density is by far the greatest predictor of fracture risk, as it accounts for 70% of bone strength (Miller 1999). Low bone density occurs as a result of bone loss or failure of bone to reach an adequate peak mass during growth. Peak bone density is the maximum level of bone mass achieved for any one individual. It is nearly complete by the age of 18 years and is fully attained by the third decade (Metkovic et al., 1994). Peak bone density is determined by both genetic and environmental factors. Genetics accounts for 70-85% of the variation in peak bone mass. Nutrition, exercise, lifestyle, hormonal status, disease, and medications also play important roles (Ralston 2002).

Achieving a high peak bone mass is essential for the prevention of fractures. The higher the peak bone mass, the greater the bone loss needed to reach the fracture threshold, or the point where individual fracture risk increases significantly (Hansen et al., 1991).

Classification of Osteoporosis

Osteoporosis is not always a result of bone loss and can be characterized as either primary or secondary in nature. Primary osteoporosis can occur in both genders at all ages but often follows menopause in women and occurs late in life in men (NIH, 2001).

Postmenopausal osteoporosis is known as primary osteoporosis Type I, and is characterized by an increased bone resorption that primarily affects trabecular bone. Type I primary osteoporosis is directly linked to the decreased production of estrogen that coincides with menopause (Peterson, 2001; Wardlaw, 1993). Rapid bone loss is osteoclast-mediated and occurs in women within the first 5 to 10 years after menopause (Peterson, 2001).

Primary osteoporosis Type II is a slow bone loss resulting from a proportionate loss of trabecular and cortical bone usually due to a decrease in bone cell activity accompanying aging. This type of osteoporosis predominately afflicts men and women over the age of 70 years and is called senile osteoporosis (Glaser & Kaplan, 1997; Peterson, 2001; Wardlaw,1993).

Secondary osteoporosis usually occurs as a result of another disease or medication. The most common medical conditions include chronic renal disease, hypogonadism, hyperthyroidism, Cushing's disease, and some forms of cancer (Wardlaw, 1993). Surgical procedures such as an early oophorectomy or total gastrectomy, can lead to bone loss. Additionally, some medications including anticonvulsants, corticosteroids, Depo-Provera, and Heparin, have toxic effects on bone and increase bone loss (Glaser & Kaplan, 1997; Kulak et al., 2000; Peterson, 2001).

Diagnosis

Several technologies are available for measuring BMD. These techniques vary in the sites they measure, with central devices measuring BMD at the vertebrae and hips and peripheral devices measuring BMD at the heels, fingers, and forearms (Miller et al., 1999,

Miller et al., 1998). Central dual-energy x-ray absorptiometry (DXA) is considered the standard for measuring spine and hip BMD because of its high precision, short scan time, and low radiation dose (NIH 2001).

Rates of bone loss can vary among anatomical sites, especially in the early postmenopausal period. Therefore, it is possible for BMD in the peripheral skeleton (e.g., the heels) to be normal, but low in the spine and hip (Miller et al., 1998). Three key pieces of information obtained from a bone densitometry report are the actual bone density, the T score, and the Z score.

There is little evidence to show that healthy young women lose bone or that those with low bone density have an increased risk of fractures (Miller 1999). A low BMD does not necessarily represent loss, but it may indicate a low peak bone mass. Peak bone mass is normally distributed. Approximately 15% of the young healthy population will have a T score below -1.0, and 0.5% will have a T score below -2.5 (Kanis 2002). Therefore, young healthy premenopausal women should not routinely have BMD testing unless there is a reason to suspect secondary osteoporosis.

Cost of Osteoporosis

Worldwide, the lifetime risk for osteoporotic fractures in women may be as high as 40%; in men it is 13%, and the population of the world is ageing in the developing world as much as in industrialized countries. Worldwide, the ageing of the population means that the overall prevalence of osteoporosis and related fractures will increase substantially, with concomitant increases in healthcare costs and human suffering (Gullberg et al., 1997).

Economic cost

Although few accurate global or local estimates are available, the financial cost of osteoporosis is undoubtedly high. Within the European Union, over 3500 million Euro (approximately US$ 3976 million) each year are needed for the direct hospital costs of hip fractures alone. The hospital costs following hip fracture in some non-European countries in 1996 include approximately US$ 60 million in Hungary, US$ 500 million in Australia, US$ 5700 million in the United States, and an astonishing US$ 9359 million in Japan (Gullberg et. al., 1997).

The cost per person also varies, for instance from US$ 12,000 in Australia to US$ 8700 in the Lebanon. It should also be borne in mind that these figures only represent the direct hospital costs; primary, outpatient and institutional care may multiply the real cost of hip fractures by 2.5. A recurring theme in the stories is that sufferers experience years of pain, and even multiple fractures, before their condition is properly diagnosed. In many parts of the world, unfortunately, osteoporotic symptoms are still considered to be a natural result of growing old. It needs to be made much more widely known that osteoporosis is a disease which can be successfully prevented, diagnosed, treated and managed by means of relatively simple interventions. Experts agree that prevention, and the education of professionals and the public about these interventions, are priorities (IOF, 2000).

Additionally, “a woman’s risk of developing an osteoporosis-related fracture is equal to her combined risk of developing breast, uterine, and ovarian cancer” (Chrischilles, 1996).

Human cost of osteoporosis

A financial evaluation should not divert attention from the human cost of osteoporosis, which can include years of debilitating pain, deformity, loss of height, and diminishing quality of life (Delmas, 2002).

Prevention of Osteoporosis

The following categories of osteoporosis prevention can be defined (Bellantoni 1996): 1) **Primary prevention**: Preventing the loss of bone mineral (and thus fractures) in the general population. This would be the case if e.g. a general recommendation of changes of life-style in premenopausal women or implementation of oestrogen prophylaxis in all postmenopausal women was issued irrespective of their bone mineral. 2) **Secondary prevention**: Preventing further loss of bone mineral in subjects with low bone mineral. I.e. treating otherwise asymptomatic individuals who upon screening or by chance had been shown to have low bone mineral. 3) **Tertiary prevention**: Preventing recurrence of low-energy fractures in individuals with low bone biomechanical competence who have already suffered at least one low- energy fracture. This would be the case in e.g. a subject with an osteoporotic hip fracture. Secondary prevention would be reserved for individuals with osteopenia or asymptomatic osteoporosis and tertiary prevention would be reserved for patients with symptomatic osteoporosis (NIH, 2001).

Primary prevention of osteoporosis is linked to strong bones being built during childhood and adolescence and being maintained throughout adult life (Mark and Link, 1999). Since clinical manifestations of osteoporosis often do not appear until later in life,

one of the most important factors in preventing osteoporosis is the attainment of an optimal peak bone mass during adolescence and young adulthood (Cromer and Harel, 2000).

The achievement of peak bone mass occurs in the third decade of life; at about the age of 30 (Metkovic et al., 1994). During the next 10-15 years, the bone structure stays relatively stable with slight reductions in mass if certain lifestyles are practiced. However, at the age of menopause, dramatic decreases in bone mass are lost due to changes in hormone production. Regardless of these hormonal changes, debilitating bone loss in not inevitable. The physiologic processes that lead to osteoporosis occur over much of a patient's lifespan and are amenable to interventions throughout that lifetime (Katz, Sherman and DiNubile, 1998).

The optimization of bone health is a process that must occur throughout the lifespan because once a woman experiences a fracture due to bone fragility, no known therapy can rebuild the damaged bone to a healthy level. Therefore, measures taken to prevent bone fragility are of vital importance (Anderson and Metz, 1993; Blalock, et al., 1996). Evidence indicates that young women can increase their peak bone mineral density, promote long-term bone health, and reduce the risk of disease later in life by following effective dietary, exercise and lifestyle practices (Mark and Link, 1999). Because there is currently no medical intervention to completely reverse the effects of osteoporosis, the most powerful tool to reduce the incidence of osteoporosis is prevention through health education (Mark and Link, 1999).

Osteoporosis prevention programs have traditionally been marketed toward women later in life (postmenopause). As a result, programs have emphasized nutritional changes, exercise programs, and hormone replacement therapy to prevent further bone loss.

Few, if any, programs have been developed specifically for younger women as a means of preventing this debilitating disease (Blalock et al., 1996; Jamal et al., 1999). This may be due to the seeming contradiction of young women having osteoporosis. However, if young women are to prevent or delay the development and onset of osteoporosis in later life, then osteoporosis prevention needs to begin decades before women experience menopause (Kasper et al 1994). A major component of such a prevention effort is education about behaviors that impact skeletal growth, the importance of regular menstrual cycles, proper nutrition, adequate physical activity, and cautions about medication use, smoking, and excessive alcohol intake.

Osteoporosis risk factors

A number of epidemiologic studies in osteoporotic populations have attempted to determine what factors predispose some individuals to osteoporosis and other studies on risk factors leading to high risk of fracture. Risks for osteoporosis (reflected by low bone mineral density (BMD) and for fracture overlap but are not identical (NIH, 2001). The review in this section will focus on risk factors for primary osteoporosis as well as the relationship between some eating disorders that are prevalent in young women and osteoporosis. Table 1 summarizes risk factors for osteoporosis and fragility fractures as stated by the Physician's Guide to Prevention and Treatment of Osteoporosis in the United States (NOF, 1998).

In the year 2000 in the United States , an expert , 13-member panel was convened to clarify the factors associated with prevention, diagnosis, and treatment of osteoporosis. The consequent recommendations were known as the The National Institutes of Health (NIH) Consensus Development Panel on Osteoporosis Prevention, Diagnosis, and therapy.

According to the panel, predictors of low bone mass include female sex, increased age, estrogen deficiency, white race, low weight and body mass index (BMI), family history of osteoporosis, smoking, and history of prior fracture. Use of alcohol and caffeine containing beverages is inconsistently associated with decreased bone mass. In contrast, some measures of physical function and activity have been associated with increased bone mass, including grip strength and current exercise. Late menarche, early menopause, and low endogenous estrogen levels are also associated with low BMD in several studies (NIH 2001).

Results from the largest study of osteoporosis in the United States, the National Osteoporosis Risk Assessment (NORA), published in the Journal of the American Medical Association (JAMA) by Siris et al., (2001), indicated that approximately 40% of the women had osteopenia and about 7% had osteoporosis, according to the WHO standards. Aging was the strongest predictor of BMD, independent of all other risk factors. The odds of osteoporosis increased from 1.79 (95% CI, 1.56 -- 2.06) for women 55 to 59 years old to 22.56 (95% CI, 19.82 -- 25.67) for women ages 80 and older. Other characteristics that increased the likelihood of osteoporosis included poor health, personal history of fracture, maternal history of osteoporosis, and maternal history of a fracture after age 45. Compared with white women, osteoporosis risk was slightly higher in Asian women (odds ratio = OR, 1.56) and Hispanic women (OR, 1.31), while African-American women were at less risk (OR, 0.55). Increasing body mass index (BMI) decreased osteoporosis risk (OR, 0.27 for BMI 26.00 -- 29.99 compared with BMI <23). Other protective factors were exercise, estrogen and diuretic use, and, somewhat surprisingly, consumption of alcoholic beverages.

Table 1: Risk factors for Osteoporosis Fractures as highlighted by the "Physicians Guide to Prevention and Treatment of Osteoporosis (1998)
Low bone mineral Density
White Race
Advanced Age
Estrogen Deficiency
Early Menopause (< 45) or bilateral ovariectomy
Prolonged premenopausal amenorrhea (> 1year)
Female Sex
Current Smoking
Low Body Weight (< 127 lb)
Personal History of Fracture as an adult
History of fracture in first degree relative
Dementia
Low Calcium intake
Alcoholism
Impaired eyesight despite adequate correction
Recurrent falls
Inadequate physical activity
Poor health/ frailty

* Reproduced from (NOF, 1998).

Being the largest study of postmenopausal osteoporosis conducted in the United States, it offers further support of previously-noted risk factors such as low BMI, physical inactivity, age, history of fractures, and smoking.

Gynecologic Variables

Menopause and female hormone are the most identified factors associated with osteoporosis (Seeman & Allen 1989). Estrogen deficiency occurring after natural or surgically induced menopause leads to an uncoupling between osteoclasts and osteoblasts, which is responsible for accelerated loss of bone. This menopausal bone loss is predominantly trabecular (Horowitz 1993) and also can occur in women before the menopause if estrogen levels fall before the final menstrual period. It has been suggested that estrogen deficiency increases bone resorption partly by causing increased paracrine production of bone resorbing cytokines. These cytokines appear to increase bone resorption by stimulating the development of osteoclast progenitors and increasing the activity of mature osteoclasts (Bertolini et al., 1986).

Hormones other than estrogen have been reported to influence bone formation and resorption. Adequate androgen levels are most likely necessary for attainment of peak BMD and maximization of mechanical bone strength (Davis 1997). Although androgen levels do start to decline in women with increasing age, there is no definite conclusion about the role of androgens in menopausal bone loss.

The majority of studies that have dealt with postmenopausal bone loss indicate that BMD depends on the number of years since menopause and not on chronologic age (Stevenson et al., 1989, Kritz-Silverstein et al., 1993). Postmenopausal women who have

experienced an early menopause have significantly lower BMD than those whose age of menopause was normal.

Gynecologic variables, such as oral contraceptive (OCP) use, parity, breast feeding, age of menarche, and menstrual cycle irregularities, have all been associated with BMD. Oral contraceptive use has been associated with an increase or no effect on BMD, so it is not a risk factor for osteoporosis and will not be discussed further.

Studies of the relationship between parity and BMD have been conflicting: Parity has been determined to have a positive association (Aloia et al., 1983, Elders et al., 1989, Feldman et al., 1992), a negative association, (Hreshchyshyn et al., 1988, Lissner et al., 1991) and no association with BMD (Frisancho et al., 1971, Stevenson et al., 1989).

Similar discrepancies have been found in relation to breast feeding and BMD. BMD has been reported to decrease (Kolthoff et al., 1998, Sowers et al., 1996, Smith et al., 1998, Phillips et al., 2000), remain unchanged [Sowers et al., 1991] or increase (Drinkwater et al., 1991) during pregnancy. The changes may be reversible (Phillips et al., 2000, Rillo et al., 1994). Kritz-Silverstein and associates (1992) examined the independent association of number of pregnancies and breast feeding in a large community-based sample of older postmenopausal women who would have completed their pregnancies and menopause before there was widespread use of calcium supplements. They reported that unadjusted BMD values at the wrist, radius, and hip increased with increasing number of pregnancies, and women who had breast fed had higher BMD at these sites. However, after adjustment for age, age at menopause, obesity, cigarette smoking, and estrogen and thiazide use, these associations were no longer significant. They concluded that reproductive history is not a long-term determinant of BMD.

A recent longitudinal study by Karlsson et al., (2001) showed neither an extended lactation period nor multiple pregnancies could be used as a risk factor when predicting women at risk for future osteoporosis.

Women with late onset of menarche have been reported to have significantly reduced peak bone mass (Cooper et al., 1997) and increased fracture risk. Ito and colleagues (1995) showed that BMD of the lumbar spine in postmenopausal women was strongly associated with the length of reproductive years, so that women who had an early menarche and late menopause were advantaged. Women with high BMD and early menarche usually have higher body weight, so it is difficult to separate the effects of anthropometric factors and age of menarche on BMD.

Menstrual cycle irregularities may also have an effect on BMD. The effects on bone of oligomenorrhea and periods of amenorrhea have been documented mainly in cross-sectional studies (Myerson et al., 1992, Snead et al.,), which reported lower values for BMD than in control populations. Relatively little is known about the relationship between menstrual cycle characteristics (cycle length, variability, and bleeding duration) and BMD in the general population of pre- and postmenopausal women. Long cycles may reflect relatively low estrogen levels, as they represent a larger proportion of time spent in the early part of the follicular phase during which estrogen and progesterone levels are low (Harlow & Matanoski 1991).

Anthropometric Variables

Various measures of body size have been shown to be associated with BMD, in particular body weight and height, which have been positively associated with BMD (Pocock 1989), but there is controversy as to which features of body size are the most

important for women in the pre-, peri- and postmenopause. Cross-sectional data have found that both total body fat (Reid, Ames, Evans, et al., 1992) and lean tissue mass explain a large percentage of the variation in BMD in postmenopausal women. The positive relationship between increased weight and increased BMD is probably the result of increased mechanical forces on the bone. Because lean and fat mass are the 2 major components of body weight, it is not surprising that fat and lean mass have both been found to be positively related to BMD (Reid, Plank, Evans, et al., 1992).

Lifestyle Variables:

1. Physical activity - Bone is living tissue that responds to exercise by becoming stronger and denser. There are two types of exercises that are important for building and maintaining bone strength and density: weight-bearing and resistance exercises (NOF, 2000). The specific characteristics of physical activity that are most important for influencing bone are not completely understood, but research indicates that high mechanical loads may be more osteotropic than low-intensity loads (Taaffe, Robinson, Snow, & Marcus, 1997).

As with other areas of osteoporosis research, a lot of information is available for older populations. The few studies that exist for younger, premenopausal women lend support to the information that has been acquired while studying older populations.

More than 20 randomized, controlled trials suggest that regular physical exercise can reduce the risk of osteoporosis and delay the physiologic decrease of BMD (Ernst 1998). Short-term and long-term (measured up to 12 months) exercise training such as walking, jogging and stair climbing in healthy, sedentary postmenopausal women resulted in improved bone mineral content (Dalsky et al., 1988). Bone mineral content increased more than 5 percent above baseline after short-term weight-bearing exercise training. With

reduced weight-bearing exercise, bone mass soon reverted to baseline levels (Chow , Harrison & Notarius 1987, Kohrt et al., 1985). Recommended activities include walking and jogging, weight training, aerobics, stair climbing, field sports, racquet sports, court sports and dancing. Swimming is of questionable value in terms of bone density (because it is not a weight bearing activity), and there are no data on cycling, skating or skiing. Any increase in physical activity may have a positive effect on bone mass in women who have been sedentary. To be beneficial, the duration of exercise should be between 30 and 60 minutes and the frequency at least three times per week (South-Paul, 2001).

In a study conducted by Turner and colleagues (1998), women who participated in the NHANES III study over the age of 50 were reviewed. The study identified physical activity as a greater predictor for fracture than heredity, smoking status, alcohol use, and dairy product intake. The study revealed that inactive women were 84% more likely to suffer a fracture than females who were active 2 or more times per week.

Most of the data related to young adult women between the ages of 18-35 comes from cross-sectional studies comparing BMD of female athletes to that of a sedentary group. Direct measurements of bone mass have shown a positive correlation between spinal BMD and reported leisure time activity in healthy young women (Kanders, Dempster, & Lindsay, 1988). In this study, calcium and physical activity were independent determinants of BMD.

There have been few prospective studies of an exercise effect on bone mass in this age group. In a study conducted by Snow-Harter and colleagues (1992), jogging or aerobic exercise for 20-30 minutes three times a week increased lumbar spinal bone mineral density by 1 percent in premenopausal women. Although these increases may seem to be small, any increase in bone mineral density that can delay the onset of osteoporosis or the

complications of low bone density are important to consider and should not be discarded as being without merit. Studies of athletes show that the BMD of loaded bones can be more than 30% higher in most studies and between 5% and 20% higher in most sites than that of unloaded bone or of the same bones in non-athletic control subjects (Vuori, 1996). However, for young women who are high-performance athletes, physical activity may increase their risk of osteoporosis. Intensive training that results in an extreme loss of body fat, disordered eating and estrogen deficiency can lead to bone loss (Vuori, 1996). The combination of osteoporosis, menstrual irregularities, and disordered eating is known as the female athlete triad (Sabatini, 2001). Many young female athletes experience a cessation in their menstrual cycles (amenorrhea).

Gutin and Kasper (1992) concluded that in general it seems bone mass can be enhanced by both strenuous aerobic exercise and strength training. It seems that mild general exercise such as walking is not effective in preventing postmenopausal bone loss or enhancing bone mass in younger age periods.

Expert panels such as the American College of Sports Medicine, recommend weight-bearing activity and activities that improve strength, flexibility, and coordination to prevent osteoporosis and falls respectively (ACSM, 1995).

2. Calcium - The roles of calcium in nature are numerous. This is also true when reviewing its roles in the human body. Calcium's most notorious role is that of structure or mechanics and is expressed in the mass, hardness, and strength of the bones and teeth (Weaver & Heaney, 1999). This is further evident with more than 99% of the calcium in the body being used and present in bones and teeth (Wardlaw, 1997). Overall, calcium accounts for 1-2% of a person's body weight (Weaver & Heaney, 1999).

The most documented and accepted health benefit of calcium is its role in bone health. The skeleton has an obvious structural role and also serves as a reservoir for calcium. Deficiency is the most widely known issue associated with calcium intake. A chronic inadequate calcium intake through diet or supplementation is one factor in the etiology of several disorders. The disorder given the most attention is osteoporosis. This disease is multifaceted with many correlated risk factors such as smoking, glucocorticoid use, and physical inactivity (Swaminathan, 1999). However, many of these risk factors influence calcium uptake and utilization. Yet the role of calcium intake in the prevention of osteoporosis can be reduced to two basic principles: build the highest peak bone mass possible and protect the bone mass that has accumulated (Heaney,1992).

A comprehensive review on the role of Calcium, dairy products and osteoporosis was made by Heaney (2000). Heaney's review cited 139 studies that examined the relationship between calcium (including supplemental sources) intake and bone status of children and adults and concluded that the evidence supports a role for calcium, especially from dairy products, in bone health.

The World Health Organization's recommendations for preventing osteoporosis, published in 2003 (WHO 2003), recommends a minimum intake of 400 to 500 mg/day of calcium from all sources for individuals who live in countries with a high fracture incidence and are 50 years of age and older. This report did not include a recommended minimum intake for children and adolescents. These findings contrast with other dairy-consuming nations' calcium recommendations. The Standing Committee on the Scientific Evaluation of Dietary Reference Intakes (DRI Committee) of the Food and Nutrition Board,

Institute of Medicine, National Academy of Science published a report in 1997 report regarding calcium and related nutrients that presents dietary reference values for the intake of nutrients for Americans and Canadians (NAS 1997). Table 2 shows the Dietary Reference Intakes for calcium at different stages of life.

Table 2: Criteria and Dietary Reference Intake Values for Calcium by Life Stage Group

Life Stage Group*	Adequate Intake (mg/d)
Infants	
0 – 6 months	210
7 through 12 months	270
Children	
1 through 3 years	500
4 through 8 years	800
9 through 18 years	1300
Adults	
19 through 50 years	1000
51 through 70 years	1200
> 70	1200
Pregnancy	
≤ 18 years	1300
19 through 50 years	1000
Lactation	
≤ 18 years	1300
19 through 50 years	1000

* All groups except Pregnancy and Lactation are males and females.
Reproduced from (NAS 1997)

3. Vitamin D. Vitamin D plays an important role in calcium metabolism, calcium absorption, and bone health. The National Osteoporosis Foundation describes the relationship between calcium absorption and vitamin D as being similar to that of a locked door and key (NOF, n.d.). Vitamin D is the key that unlocks the door and allows calcium to leave the intestine and enter the bloodstream. Vitamin D also works in the kidneys to help resorb calcium that otherwise would be excreted (NOF, n.d.). Vitamin D is a fat soluble vitamin that has been associated with bone-related disorders for centuries.

Vitamin D deficiency is associated with rickets in children, osteomalacia in adults, and secondary hyperparathyroidism (Combs, 1998). The daily requirement for this vitamin is met from the diet or from synthesis in the skin. From either of these sources, vitamin D is metabolized to 25-hydroxy vitamin D (25OHD) in the liver and is then converted to the active metabolite 1,25 dihydroxyvitamin D (1,25 [OH2 D) in the kidney (Combs, 1998; Swaminathan, 1999). Recommendations for vitamin D intake are 20 international units (IU) for women under the age of 50, 400 IU for women 51-70 years of age, and 600 IU for women over 70 years of age (Willhite, 1998). The increase in vitamin D intake recommendations indicates that ageing affects vitamin D metabolism. The conversion of 25OHD to the active metabolite 1,25(OH)2D is reduced because of an age- related decline in renal function (Swaminathan, 1999). Additionally, as adults age, the ability to make vitamin D through the skin decreases (NOF, n.d.). There are many sources of vitamin D available, however sunshine is the major source. One study indicated that total body sun exposure could provide the equivalent of 10,000 IU of vitamin D without a person experiencing toxicity (Vieth, 1999).

It may be important to note that sources of vitamin D may be managed differently in the body and therefore, the body can handle a greater amount of sunlight produced vitamin D than vitamin D from dietary sources. However, dietary sources of vitamin D are necessary to utilize by people who do not get adequate sun exposure due to latitude, season, work environment, etc.

Vitamin D has a vital role in the health of bone. The role of this fat soluble vitamin is important for the absorption and utilization of calcium which is the primary mineral in bone. Therefore, it is important for individuals to be knowledgeable about the interaction of this vitamin and mineral for total bone health. Young women run the risk of being deficient in vitamin D if they avoid the sun or fail to consume adequate dietary sources. In other words, if women avoid consuming dairy products, they not only lose out on the calcium content but also the possibility for vitamin D consumption.

4. Caffeine. The consumption of caffeine and its relationship to bone health is a controversial topic. Caffeine is the most widely consumed psychoactive substance in the world (Barone & Grice, 1994). Numerous studies have reported on caffeine as a possible risk factor for bone loss in adult women. The results however have been contradictory.

Several studies have reported no association between caffeine intake and fracture frequency or changes in bone density (Johansson, et al., 1992; Lloyd, et al., 1997). Others, however, have reported small but significant increases in either fracture frequency or bone loss. The most notable of these studies is the Framingham study that reported a 53% greater incidence of hip fracture in those who consumed more than two cups of coffee or four cups of tea after controlling for weight, sex, age, estrogen use, smoking and alcohol (Kiel, et al., 1990).

Caffeine ingestion causes a short-term (within 1—3 hours) increase in urinary calcium loss, but studies have failed to document sustained effects of caffeine on urinary or fecal calcium excretion (Krall & Dawson-Hughes, 1999). Among people who have low calcium intakes the effect may be of great importance as the body fails to adequately compensate for the additional calcium loss. The effects of caffeine on bone mass in young women have also been a controversial topic. A study conducted by Packard and Recker (1996) indicated that a moderate caffeine intake (one cup of coffee per day or 103 mg) appeared to be a safe level with respect to bone health. However, another study conducted by Conlisk and Galuska (2000) did find that caffeine consumption decreased bone mineral density at various skeletal sites. The study indicated that for every 100 mg of caffeine consumed, femoral neck BMD decreased 0.0069 g/cm2, and lumbar spine decreased 0.0119 g/cm2 (Conlisk & Galuska, 2000). Although there was no significant difference between those who consumed low levels of calcium and those who consumed high levels of calcium in this study, it stands to reason that such decreases over many years can increase a woman's risk of osteoporosis significantly.

Although sustained effects of caffeine on calcium excretion have not been observed in these studies, there is another aspect of this consumption that needs consideration; beverage replacement. Although there are no national level studies in Jordan about the daily intake of carbonated beverages in individuals, data from other countries like the United States show that there is a tremendous rise in consumption of carbonated beverages. United States per capita consumption of regular carbonated soft drinks increased from 22 gallons in 1970 to 40 gallons in 1994 and to 41 gallons in 1997 (Gerrior et al., 1998). The issue in these carbonated beverages lies in their caffeine content. Whether caffeine affects over all calcium excretion is important, but

the fact that carbonated beverages are replacing calcium-rich drinks needs consideration.

Long-term effects of frequent caffeinated beverage intake must be conducted before a consensus about the true relationship between caffeine and calcium can be decided upon. If caffeine increases calcium excretion for 1-3 hours, it stands to reason that a person who consumes 3-4 caffeinated beverages a day will have a significant loss of calcium in their urine.

5. Smoking- Smoking puts women at risk for osteoporosis because smoking decreases serum estrogen (Thomas, 1997). A loss of estrogen leads to a decreased osteoblastic action progressing to an imbalance between resorption and formation. Estrogen also plays a role in the absorption of calcium, an essential nutrient in the formation of strong bones (Wardlaw & Weese, 1995). Additionally, smokers tend to have leaner body masses perhaps because of the interference of smoking with eating (Mazess & Barden, 1991). This combination of low estrogen and low body weight can lead to an increase in risk for osteoporosis. Hooper and Seeman (1994) showed that smoking is also known to produce an earlier menopause, and an early menopause is a risk factor for osteoporosis.

6. Alcohol Intake - Studies have indicated that alcohol suppresses bone formation. Since women are more prone to osteoporosis than men, the effects of alcohol may have a greater effect on their bones (Laitinen, et al., 1993). Alcohol is capable of increasing one's risk of osteoporosis or fracture through several different methods. First, alcohol abuse may bring about hypoestrogenism with consequent menstrual irregularities and amenorrhea (Mello, Mendelson, & Teoh, 1989). These irregularities can depress osteoblastic activity . This can lead to an imbalance between the resorptive osteoclastic

activity and the formative osteoblastic activity progressing to decreased bone mineral density .

Alcohol can also lead to interference with proper nutrition, especially calcium and vitamin D intake. Individuals who consume moderate to excessive amounts of alcohol often have an imbalanced diet with a decreased consumption of calcium (Wardlaw & Weese, 1995). Additionally, research has revealed that alcoholics have a reduced ability to produce 1,25 dihydroxyvitamin D in the renal tubules (Wardlaw & Weese, 1995). By consuming a calcium deficient diet and not having an adequate capacity to produce vitamin D, which is necessary for calcium absorption, the consumption of alcohol can lead to an inability of the bone to reach its maximum strength.

Non Modifiable Variables

1. Heredity

Studies in twins and families indicate that genetic factors play an important role in the regulation of BMD and other determinants of osteoporotic fracture risk. The heritability of BMD has been estimated to lie between 50% and 85% in twin studies, with the strongest effects in the axial skeleton (Pocock et al. 1987, Christian et al. 1989, Slemenda et al. 1991, Flicker et al. 1995). Family-based studies have also yielded strong heritability estimates for BMD (Gueguen et al. 1995), with effects that are maximal in young adults and persist even after adjusting for lifestyle factors that are known to regulate BMD. It should be noted that the heritability estimates cited in twin studies and family studies may not accurately reflect the actual percentage of BMD that is due to genetic factors but, rather, reflect the proportion of total variance in BMD attributable to genetic factors. Moreover, the assumptions made in the twin model do not take account of gene–gene or gene–environment interactions and can result in artificially inflated estimates of a genetic contribution due to greater sharing of environmental influences in

monozygotic twins (Slemenda et al. 1991, Seeman & Hopper 1997). Despite these caveats, there is little doubt that genetic factors are extremely important in the pathogenesis of osteoporosis and, in keeping with this, several population based studies have shown that a family history of fracture is a significant risk factor for fracture by mechanisms that are partly independent of bone density (Torgerson et al. 1996, Keen et al. 1999).

Although women with a family history of osteoporosis should be advised to care for themselves and to practice osteoporosis prevention behaviors, women without a family history should not consider themselves safe. Measures of family resemblance often do not clearly differentiate the relative contributions of shared environmental factors and genetic factors (Tudor-Locke & McColl, 2000). Additionally, in trying to assess one's risk of osteoporosis, simply considering the maternal side of the family tree may not be adequate.

An offspring is a combination of genes from two parents and a combination of behaviors from two parents. As a result, a person may be susceptible to the development of osteoporosis independent of family history. Consequently, every woman should be aware of her familial history related to osteoporosis, but she should also assume personal responsibility in her prevention of developing this disease.

2. Ethnicity

The prevalence of osteoporosis and the incidence of fracture vary by sex and race/ethnicity. White postmenopausal women experience almost three quarters of all hip fractures and have the highest age adjusted incidence of fracture. Most of the information regarding diagnosis and treatment is derived from research on this population. However, women of other ages, races, and ethnicities, as well as men and

children, are also affected. Much of the difference in fracture rates among these groups appears to be explained by differences in peak bone mass and rate of bone loss; however, differences in bone geometry, frequency of falls, and prevalence of other risk factors appear to play a role as well (NIH 2001).

Although research indicates that certain ethnicities are at a greater risk for osteoporosis than others, adherence to known osteoporosis prevention behaviors should be practiced. Ethnicity is not merely one's skin color. Ethnicity involves traditions, practices, and environmental influences (Tudor-Locke & McColl, 2000). Overall, osteoporosis is a multifaceted disease in which ethnicity is just a small fraction of the puzzle.

3. Peak Bone Density

Peak bone mass of premenopausal women is a major determinant of subsequent risk of osteoporotic fracture. So maximizing bone mass during skeletal growth and development and maintaining it during the premenopausal years are important strategies in the prevention of osteoporosis. Low peak BMD and a high rate of bone loss have been shown to significantly predispose to fractures to the same extent, with an odds ratio of about 2. If both of these conditions were present, the odds ratio was about 3 (Riis et al., 1996).

4. Aging

With aging in both sexes, the balance between resorption and formation is offset such that more bone is removed than replaced. Although bone loss in women slows after the early postmenopausal years, loss continues throughout the latter decades of life, and rates of loss increase again in very old age. Age-related bone loss is dependent in part on endogenous estrogen production in both women and in men, who have an age-associated decline in their ability to aromatize androgens to estrogens. Age-related

bone loss is also in part due to reduced renal calcium conservation efficiency, a decreased vitamin D supply, absorption or skin production, and decreased renal activation of vitamin D, all contributing to increases in PTH with age (Cosman F., 2005).

5. Female Gender

Osteoporosis is clearly more common in females than it is in males; affecting 1 in 3 women over 50 years of age as opposed to 1 in 8 men within the same age group (IOF 2000, Woolfe et al., 2003). A number of factors may be important. Women have less bone mass at maturity and more rapid rates of loss than men due to the abrupt cessation of ovarian function which occurs at the menopause. Bone loss occurs at the rate of 3-5%/ year during the first 3 years after menopause and although it then slows a little, it is still greater than in men 10 years after menopause (Mundy, 2001).

Eating Disorders

Disordered eating refers to the spectrum of abnormal and harmful eating patterns used in a misguided attempt to lose weight or maintain a lowered body weight (Beals, Brey, & Gonyou, 1999). Because lower bone mineral density is one potential physiological consequence of eating disorders, the risk for osteoporosis among women afflicted with these diseases is greater. Both anorexia nervosa and bulimia nervosa and their associated behaviors increase a woman's risk for the development of osteoporosis.

Anorexia nervosa is a chronic illness that affects 1% of adolescent females and is characterized by a fear of fatness, self-imposed semistarvation and weight loss. Additionally, the illness has a high morbidity and is eventually fatal in 10-15% of cases (Seeman, et al., 1992). Common clinical features of anorexia nervosa are estrogen deficiency (accompanied by amenorrhea) and a significant reduction in body weight

(Treasure & Serpell, 2001). Chronic anorexia nervosa is known to lead to osteopenia and osteoporosis in adults (Seeman et al., 1992).

Estrogen status is likely to be a major cause of osteopenia and osteoporosis in patients with anorexia nervosa (Treasure & Serpell, 2001). The occurrence of estrogen deficiency during the first three decades of life can increase the risk of osteoporosis by preventing the attainment of peak bone density and by causing accelerated bone loss (Seeman et al., 1992).

Other factors that may be related to the development of osteoporosis in women with anorexia nervosa are nutritional intake and physical activity. Due to the intense fear of being fat, many anorexics strictly limit their caloric intake. To limit their caloric intake they consume foods that are low calorie which oftentimes excludes foods rich in calcium such as dairy products (Treasure and Serpell, 2001). This extreme dietary limitation often limits their intake of other necessary nutritional components for bone health such as protein and vitamin D.

Besides severely limiting dietary intake, anorexics participate in excessive physical activity (Seeman et al., 1992). Although weight-bearing exercise can help protect against osteoporosis, excessive exercising can be associated with leanness and amenorrhea. The risk of osteoporosis occurring in other eating disorders has also been investigated. Studies reviewing women formally diagnosed with bulimia nervosa and other nonspecified eating disorders have been found to have significantly lower bone mineral densities than expected when compared to control data (Anderson, Woodward, & Lafrance, 1995).

These results are not completely surprising because between 50%-60% of patients with a current diagnosis of bulimia nervosa have a previous history of anorexia nervosa. While amenorrhea is a diagnostic criterion for anorexia, menstrual irregularities occur in

only about half of patients with bulimia. Although menstrual irregularities may not be enough to increase risk of osteoporosis in bulimic patients, the compensatory behaviors of self-inducing vomiting, abuse of laxatives and diuretics, abuse of diet pill, and caloric restriction can all affect bone health. Not consuming adequate calcium and other nutritional components necessary for bone health may influence the density and strength of bones later in life. However, at this time, no studies have identified an increased risk of osteoporosis fractures in previous or current bulimia nervosa patients (Seidenfeld & Rickert, 2001).

Osteoporosis treatment

1. Pharmacological treatment

In general, pharmacological agents either decrease bone resorption to produce secondary gains in bone mass or are anabolic and produce direct increases in bone mass. Ideally, such drugs also should increase bone strength and bone quality. As the turnover of bone is slow, the time between starting treatment and assessing its effect on bone mass or fracture takes several years. Because this makes it difficult to show the effect of treatments on the dichotomous and uncommon key outcome of fracture, the continuous variable bone mass is often used as a surrogate measure. An increasing number of randomized controlled trials of several anti-osteoporotic drugs have fracture as an endpoint, however, and show reductions in the incidence of fractures within 1–3 years (Delmas 2002).

In addition to estrogen, drugs with specific anti-resorptive actions are available for the treatment of osteoporosis, including bisphosphonates, calcitonin, and selective estrogen receptor modulators. Parathyroid hormone (PTH [1-34]), which stimulates bone formation, has also been shown to increase BMD, improve bone structure, and decrease the risk of vertebral and non-vertebral fractures (Neer et al., 2001).

Furthermore, calcium and vitamin D act on bone by decreasing resorption, while calcium also is regarded as an essential building block for bone (Delmas 2002).

2. Non pharmacological treatment

Good nutrition and a balanced diet with adequate calories are important for normal growth. Calcium is the most important nutrient for attaining adequate peak bone mass, but there is no universal consensus about the daily calcium requirement by age. The 1994 consensus development conference on optimum calcium intake recommended 1200–1500 mg daily for adolescents, 1000 mg daily for adults up to age 65 years, and 1500 mg daily for postmenopausal women not receiving oestrogen and for elderly people.

Vitamin D is essential for the intestinal absorption of calcium and, as discussed above, serum concentrations of 25-hydroxyvitamin D decline with age.

Physical activity early in life contributes to high peak bone mass. The results of clinical trials and observational studies suggest that load bearing exercise is more effective for increasing bone mass than other types of exercise (Taaffe, et al., 1997).

Osteoporosis knowledge Studies

Osteoporosis knowledge in various populations

Internationally, multiple descriptive and experimental studies have been conducted which have assessed knowledge of osteoporosis in women of various age groups stemming from the vast majority of the studies conducted in peri & post menopausal women with a mean age range of 40 – 80 (Werner 2004). The majority of these studies have examined populations in the United States, a few in East Asia, one in Turkey and in Australia (Werner 2004).

The majority of studies conducted to date are surveys based on convenience samples, i.e. sample where the participants are selected at the convenience of the researcher and not randomly.

Studies assessing knowledge among healthy and diagnosed populations are summarized in Table 3 and 4 . The instruments used by these studies vary on a number of dimensions:

a) the conceptual framework of the instruments, that is, the theoretical base guiding the development and goals of the instrument; b) detail and degree of comprehensiveness, referring to the areas of knowledge included and to the level of detail provided by the rating scale used; c) population, namely, the demographic and health characteristics of the samples examined; and d) level of knowledge, which refers to the findings of the different studies regarding the level of knowledge in the various areas examined.

In Table 3 are summarized instruments characterized by a structured format, i.e. asking the same questions to a large number of respondents while using the same set of possible responses. In Table 4 instruments using an unstructured format, i.e. missing at least one of the characteristics of the structured format, are presented.

The only instrument explicitly based on a conceptual framework is the Facts on Osteoporosis Quiz (FOOQ) (Allinger and Emerson 1998; Ailinger, Lasus & Braun, 2003), the FOOQ assumes that "...a person's knowledge of potential health problems is a prerequisite for promoting self-care behaviors to prevent disease".

The majority of the instruments assess awareness by asking participants only one question in regards to whether they have ever heard about osteoporosis. The risk factors most commonly assessed include: lack of exercise, a diet low in calcium, and family history of fractures or osteoporosis. Only a few instruments assess knowledge regarding diagnosis, treatment, and consequences of osteoporosis (Werner 2004).

Results from these studies indicate that individuals have poor knowledge of osteoporosis, do not perceive themselves as susceptible to the disease, and are unaware of preventive behaviors.

Within the region, no published studies on osteoporosis knowledge were found, in any population. On a local level, 3 studies have been conducted to date. A study done in a Masters Degree dissertation by Sabha (2000), Knowledge Attitudes and Practices towards Osteoporosis was assessed on a sample of Doctors and Female nurses in Amman. In this study all physicians were knowledgeable about Osteoporosis and preventive methods but were not fully aware about some risk factors of the gold standard diagnosis method – utilizing the DXA. Nurses Osteoporosis knowledge was fair regarding the size of problem but they had poor knowledge about risk factors and they did not perceive themselves to be at risk.

Table 3 Structured instruments to assess knowledge about osteoporosis in populations with mean age above 25years

Name	Reference	Areas assessed	Number of items	Population	Findings
Osteoporosis Knowledge Test (OKT)	Kim, Horan, Gendler [1991].	Risk factors and strategies for osteoporosis prevention	24 divided into two subscales: OKT calcium (15 items); OKT exercise (4 items)+5 common items. Multiple choice. Possible range 0–24	Various populations such as healthy men , and healthy women	Poor to moderate levels of knowledge were found among men, and women (mean=15.1–17.8)
Facts on Osteoporosis Quiz (FOOQ)	Ailinger, Emerson[1998]. Ailinger, Lasus, Braun[2003].	Prevalence, risk factors, preventive behaviors	25 true/false/don't know items Total possible score=25. Higher score indicates higher knowledge	Various populations	Mean knowledge 13–19
Osteoporosis questionnaire (OPQ)	Pande, Takats, Kanis et al. [2000].	General information, risk factors, consequences and treatment	20 multiple choice	Convenience sample of 50 first time attendees of an out-patient clinic aged 50+	No results reported on level of knowledge.
Knowledge score on Osteoporosis (KOS)	Ungan and Tumer[2001].	Risk factors, outcomes of the disease	20 rated on a 5-point Likert type scale. Total possible score=100	270 women who attended a family practice department in Ankara (mean age=45, range=21–61)	The majority were familiar with the disease, but were unaware of its disabling consequences. Low knowledge regarding certain risk factors
The Osteoporosis Patient Knowledge Questionnaire (an adapted version for health persons)	Williams, Cullen, Barlow[2002].	General knowledge about osteoporosis, bone density scan, hormone replacement therapy, calcium, vitamin D, diet, exercise, and pain	69 true/false/don't know. Possible score=0–69	Convenience sample of 163 women. Mean age=40, range=18 – 73. Four participants had osteoporosis	Mean level=20.19 (SD=10.4) High level of awareness. Low level of knowledge, especially regarding bone scan, HRT, and vitamin D
The Scale of Osteoporosis Knowledge	Yu, Huang [2003].	Physiopathology, incidence, signs and symptoms, diagnosis and treatment, high-risk factors, prevention	44 correct/incorrect/unknown. Total score from 0–44	Random sample of 447 women aged 40+ in a district area. Mean age=53 (SD=12)	Low level of knowledge (mean=15). Highest knowledge in incidence and prevention areas, lowest in diagnosis, treatment and risk factors
Osteoporosis Knowledge Assessment Tool (OKAT)	Winzenberg et al. [2003].	–	20 true/false/don't know (range 0–20)	Random sample of 467 women (mean age=38; range=25–44)	Low levels of knowledge (mean=9)

Table 4 Unstructured instruments to assess knowledge about osteoporosis in populations with mean age above 25 years

Reference	Areas assessed	Number of items	Population	Findings
Ribeiro, Blakeley[2001].	Definition, distribution and consequences, symptoms, diagnosis, risk factors, prevention and treatment practices	35. True/false	Convenience sample of 138 women (59 in treatment and 79 in control group (aged 45–69)	Knowledge was moderate, although increased significantly after participating in a workshop
Juby, Davis[2001].	Background (awareness, definition, osteoporosis in men, preventable disease). Risk factors (importance of diet)	15. Yes/no	Convenience sample of 102 seniors attending hospital's clinic and 43 seniors attending a local community day program. 26.9% M; 73.1% W. Mean age=75.2	The majority had heard about the disease, but only 2/3 knew definition. Good knowledge about diet. Women better knowledge than men
Larkey et al. [2003].	Definition, risk factors	13. Yes/no	Random sample of 200 women, age range=25–55	Moderate knowledge. Better regarding calcium rich foods and supplements and lower about exercise
Saw et al. [2003].	Background (awareness, consequences). Risk factors	13. Rated on a 5-point Likert-type scale	Random sample of 1376 Chinese women aged 45+ (mean age=57)	Awareness not high. Fair knowledge about low calcium intake, family history and lack of exercise) was fair

This finding regarding lack of personal perception of risk is in line with the second study conducted in Jordan which was a survey commissioned by the International Osteoporosis Foundation (IOF) in 2000 and covered 11 countries including Jordan (IOF 2000). The IOF study was designed to provide insights into current attitudes towards osteoporosis, and to confirm the critical role of patient and physician awareness in management of the disease. This survey was in the manner of face to face interviews where 100 interviews conducted amongst GPs and 50 amongst postmenopausal women in Amman. Women were 41 years & above and menopausal (mean age 58); 24% were suffering from osteoporosis.

This survey showed that, although patient and physician awareness of osteoporosis is high, women do not understand that they personally are at risk, and this is likely to result in under-management and unnecessary pain, disability, mortality and cost. The percentage of women aware of their risk of developing osteoporosis varied widely between countries, ranging from 48% in France to virtually no awareness reported in Jordan. In addition only 17% of those survey reported osteoporosis to be a main health concern.

Recently Abu Teen (2005) assessed knowledge of osteoporosis in a voluntary sample of males and females attending UJ *(n = 400).* Findings showed that there was a relatively good awareness of osteoporosis but knowledge of risk factors ranged from 20% - 80% of sample providing correct answers. The highest level of knowledge was that pertaining to low life long calcium intake. According to the author, the limitations of this study which were study use of voluntary sample and possible overrepresentation of students from scientific and medical faculties (70% of sample) may have created an upward bias in the results.

Osteoporosis knowledge in young women

There is limited number of studies in the literature on young women's knowledge of osteoporosis. Results from these studies indicate that individuals have poor knowledge of osteoporosis, do not perceive themselves as susceptible to the disease, and are unaware of preventive behaviors.

Kasper et al., (1994) first documented lack of knowledge of osteoporosis in young women in a study published in 1994. In the Multiple Osteoporosis Prevention Survey (MOPS), the investigators assessed the knowledge, beliefs, and behaviors of 127 college women enrolled in a required undergraduate health course at a midwestern state university in the United States; (mean age 19.6 years) concerning the prevention of osteoporosis. This study showed a lack of knowledge about risk factors, inadequate dietary and exercise behaviors, and the perceptions of low risk for developing osteoporosis among young women . Respondents believed that it was unlikely that osteoporosis would develop in them.

In a follow up study by the same author, Kasper et al (2001) targeted 321 female college students-(mean age 21.6 years) with a more comprehensive questionnaire. Although respondents had "heard" about Osteoporosis, only 3.8% of respondents reported getting both adequate exercise and the recommended 1,200 mg of calcium per day. Respondents believed that they were unlikely to develop osteoporosis and that osteoporosis is less serious than other common causes of morbidity and mortality in women, such as heart disease and breast cancer ($P < 0.0001$).

The literature also cites 2 studies assessing awareness in young women in particular college students before & after osteoporosis education programs or sessions – Intervention type studies. Table 5 summarizes these studies. Sedlack et al., (1998) utilized an intervention approach using a pre-experimental, one-group pretest–post-test

design. This type of design involves observing or measuring a group of subjects (the pretest), introducing a treatment (or on this case information on osteoporosis through educational sessions), and observing or assessing the subjects again (the post-test).

Another type of intervention studies is on where it is an experimental design, meaning that subjects are randomly assigned to two groups, one of which (i.e. the experimental group) is exposed to the intervention or experimental treatment, while the second group (i.e. the control group) is not. In this case the experimental group were those subjects that received osteoporosis information. Both groups are assessed at pretest and post-test times , in addition to the change in health behaviors after receipt of information on Osteoporosis. Piaseu et al., (2001) used this approach and assessed osteoporosis health related behavior through Calcium & exercise self efficacy scales. Participants showed an increase in knowledge, health belief attitudes & self efficacy after the intervention in the experimental arm group. In all these studies related knowledge deficits were noted regarding osteoporosis-preventive, lifestyle behaviors.

Table 5: Studies assessing relationships between knowledge and osteoporosis health-related behaviors in young women

Reference	Type of study	Characteristic of the intervention	Population	Health-related behavior assessed	Findings
Intervention studies					
Sedlak et al. [1998].	Experimental design. Pretest-post-test. 3 weeks	Educational program about susceptibility and barriers to osteoporosis prevention (didactic instruction with group discussion, verbal persuasion and role modeling)	31 college women: 13 in the control group and 18 in the experimental group (65% aged 18–19)	Confidence in conducting activities related to osteoporosis prevention, especially exercise and dietary intake of calcium	Greater increase of knowledge in the experimental group than in the control group, and greater increase in the benefits of exercise
Piaseu et al. [2001].	Experimental design. Pretest–post-test. 2 weeks	Osteoporosis Educational Program (OEP), including a 3-h course including information about identification of potential consequences of the disease; identification of risk factors; preventive strategies including effective exercise and maintenance of daily calcium requirements. The course include didactic instruction with group discussion	100 first-year nursing student (mean age=19; range=17–21	Calcium intake, exercise	Significant increases in knowledge, health belief attitudes and self efficacy in participants in the treatment group

Subjects and Methods

Subjects

The target population was defined as the all Bachelor study level female students enrolled at UJ during the second semester of 2004/2005; according to the Ministry of Higher Education annual statistic bulletin, the total number of such was 18911 [Appendix 2]. (MHE, 2005)

A convenience sample of all female students attending a compulsory university course (Military Education) from its 5 sections (n = 1000), were targeted for the study. This sample size was deemed sufficient enough for the desired study outcomes (Qauod, personal communications). In addition this sample size is larger than that required for a representative sample for the given universe according to statistic textbooks as stated in Appendix 3 (Sekeran 2003).

As the outcome measures are latent variables, use of convenience sample is warranted (Qaoud, personal communication.) Since this course is a compulsory course for all UJ students and has been documented in another study (Petro-Nustas, 2000) to comprise various university class standing levels and faculties in the university it was considered representative of the female enrollment in UJ for the second semester 2004/2005 and chosen as the sampling approach for this study . In addition, the other international studies assessing osteoporosis knowledge among female university students have used the same approach of a convenience sample from a compulsory university course in similar studies assessing osteoporosis knowledge in young female college students (Kasper, Peterson, & Allegrante, 2001; Sharp and Tombs 2003).

Inclusion criteria:

18-24 years of age

Exclusion criteria

Non Jordanian students

Post graduate study student

Methodology

Design

Cross-sectional design

Data collection:

Data was collected by anonymous self administered questionnaire. This project was considered exempt from needing a consent form, and completion of the written questionnaire constituted consent to participate. Participants were assured of complete anonymity, and no names or identifying information was requested or recorded.

A pilot run of the questionnaire was done to test it for comprehensibility, acceptability and completion timing amongst a random sample of female university students (N = 15) to ensure a "user friendly" format. Based on this pilot, the questionnaire was refined where needed and a final questionnaire that could be completed within the 15 minute time slot was presented. The pilot results/subjects were not included in the main study itself.

For the main study, the questionnaires were serially numbered for response rate tracking, then distributed to female seating area of the compulsory UJ course in all of the sections; 1000 serially numbered questionnaires were distributed in total to cover the total number of female students registered in the course in the second semester 2004/2005. Filtration of subjects for conformity to inclusion and exclusion criteria of

this study could only be done after return of questionnaires as the course admisntration only provided number of enrolled females and not their individual characteristics pertaining to age, study level, and nationality. The investigator was allowed 5 minutes at the beginning of each lecture to define study objectives and give instructions to participants on filling in the questionnaire. Participants were given 15 minutes for questionnaire completion and then all questionnaires were collected by investigator.

Data Collection Instrument

A self administered questionnaire in Arabic language– consisting of 2 parts and 3 themes with a total of 57 questions with mutually exclusive and exhaustive choices (where applicable) and carefully based on the literature and theoretical concepts (Appendix1).

Theme 1:

Theme one was developed to identify socioeconomic characteristics of subjects and their demographics. In addition to characteristics including self reported family history of osteoporosis, preferred sources for health information, assessment of osteoporosis awareness and sources.

Theme 2:

Theme two was developed to assess subject knowledge on osteoporosis and its risk factors. This was done by incorporating a published osteoporosis knowledge assessment instrument; The Facts on Osteoporosis Quiz (Ailinger et al., 1998) which was translated into Arabic herein for the purposes of this study, and a supplementary knowledge assessment instrument that was developed based on the literature. The two knowledge assessment parts allowed a comprehensive assessment of the subjects knowledge of osteoporosis and its risk factors. Evaluation of the level of knowledge of subjects on osteoporosis risk factors was defined based on the score achieved on the FOOQ as were

correlates of osteoporosis knowledge. Supplementary osteoporosis knowledge items were analyzed separately.

The Facts on Osteoporosis Quiz

The Facts on Osteoporosis Quiz (FOOQ)) was used to assess the women's knowledge of osteoporosis. Permission from the author was obtained. The original Facts on Osteoporosis Quiz (FOOQ), is theoretically informed based on the Self-Care Theory, was first published in 1998 by Ailinger et al. Self-Care Theory describes self-care as requisites performed by individuals to control human and environmental factors that influence human functioning.

There are three types of requisites: (a) universal—common to all human beings, (b) developmental—associated with human development processes, and (c) health–deviation—associated with structural and functional deviations. Successfully meeting universal and developmental self-care requisites is an important component of primary prevention of disease and ill health. For example, physical activity is a universal requisite in osteoporosis prevention. The fact that bone loss speeds up after menopause is a developmental requisite. Family history of osteoporosis is a risk factor for osteoporosis and a health deviation requisite. Thus, a person's knowledge of potential health problem is a prerequisite for promoting healthy self-care behaviors to prevent disease.

As a measure of knowledge, The Facts on Osteoporosis Quiz (FOOQ) was considered easy to complete and had reported validation with younger females as per the original publication, content validity of 0.92 and reliability of 0.83 and thus was selected for this study.

Originally FOOQ consists of 25 true and false + don't know response questions related to self-care risk factors and preventive behavior associated with osteoporosis. A

total possible score on the FOOQ is 25. In this study a modified FOOQ version relevant to local demographics omitting questions related to African Americans thus 23 questions were included. Each correct response was given 1 and 0 for false or don't know responses thereby the highest score would be 23 and the lowest 0.

In order to ensure that the tool maintains its consistency in the language it was used in (Arabic), the original FOOQ was subjected to translation to Arabic by a bilingual professional in the medical field and this was then followed by back translation to English by another bilingual professional in the medical field. The new back translated version was compared with the original tool to ascertain equivalence. Minor modifications were made on wordings to suit local culture and language.

Additionally, multiple choice questions were added to identify supplementary osteoporosis knowledge elements that were not originally included in the original FOOQ. These supplementary items were considered elementary by the author in the development of the original FOOQ. In our population it was opted to include such items to get a comprehensive assessment of level of knowledge in our population. The supplementary items comprised 7 questions and focused on the following: 1) Prime time for osteoporosis risk onset in females [multiple choice] 2) Gender at highest risk for osteoporosis - highest incidence [multiple choice] 3) ageing as an osteoporosis risk factor [multiple choice] 4) timing of peak bone mass [multiple choice] 5) knowledge of osteoporosis complications with 2 parts one being a closed ended question on self knowledge of osteoporosis complications and another open ended question to state the most serious osteoporosis complication according to the subject. Knowledge of these supplementary osteoporosis items were not included in the analysis of the FOOQ, but were analyzed separately.

Theme 3:

Subjects perceptions on osteoporosis by assessment of :

- Perceived susceptibility to osteoporosis (one question)
- Perceived seriousness of osteoporosis (five questions)
- Knowledge and practice of osteoporosis preventive strategies (two questions)
- Interest to obtain information on osteoporosis

Perceived susceptibility and seriousness items were developed from the literature. Perceived susceptibility was assessed by a 5 scale Likert question format (1 corresponding to totally disagree and 5 corresponding to totally agree).

Perceived seriousness was assessed in two formats; one using 4 Likert scale questions from the literature on perceived seriousness, and another question requiring subjects to rank osteoporosis among 4 other middle age diseases on a scale of 1 to 5; 1 being the most important and 5 being the least important.

Knowledge and practice of osteoporosis preventive strategies were assessed by 2 parts, the first a closed ended question for self evaluation of practice of osteoporosis preventive strategies and the second an open ended question to state those preventive strategies currently incorporated in the subjects lifestyle.

The subjects interest to receive information on osteoporosis was assessed using a 5 scale Likert question format; (1 corresponding to totally disagree and 5 corresponding to totally agree).

Data Management and Analysis

Data was coded and computerized for analysis. Descriptive analysis was conducted using the Statistical Package for the Social Sciences (SPSS) for Windows – version 11. Means, medians, percentages and standard deviations were derived to provide information on participant characteristics, demographics lifestyle behaviors, Osteoporosis risk factors, and Osteoporosis knowledge and perceptions of seriousness and severity. Multivariate analysis with pairwise comparisons for assessment of the association between independent variables and FOOQ score; a p value of 0.05 or less was considered statistically significant.

Results

Response rate

Response rate was determined by calculating the number of fully completed returned questionnaires after elimination of questionnaires not fitting inclusion criteria. The number of eliminated questionnaires accordingly was 950, out of these questionnaires fulfilling study criteria, 852 fully completed questionnaires were returned yielding a response rate of 89.7%. No record was made for incomplete questionnaires.

Characteristics of sample

Age Characteristics:

The majority of respondents were 20 years of age (41%), 26% were 19 years of age, 16% were 21 years of age, and 10% were 22 years and above (table 6). Mean age of subjects was 20 years old (± 1.1)

Faculty Category and levels:

More than half were enrolled in humanities faculties (65%), while 24% in scientific and 11% in medical faculties (table7). The University study level was coherent with age distribution where 52% were sophomores, 19% juniors, 15% freshmen and 14% seniors (table 8).

High School proprietorship:

Close to three quarters had graduated from public high schools (71%), 27% from private high schools and a minute percentage (1%) through home study or military schools (table 9).

Parental education level:

The highest educational level attained by majority of fathers (43%) was university education, whether Bachelors Degree or Post graduate degree (33% and 10%

respectively). Having not completed high school or attaining high school certificate was equal with 17% for both, while 18% had attained a diploma post high school. A small proportion (5%) was not formally educated. On the other hand the majority of mothers the highest education level attained by almost half was high school education whether completed or not (30% and 24% respectively). Those with a university degree being either a Bachelors degree or Postgraduate studies was 18% and 2% respectively. And the percentage of those whom have not had formal education was close to that found with fathers at 4% and so was that for education at the diploma level with 17% of mothers having attained such an education (tables 10 and 11).

Family Income level:

Seventy three percent responded to this question with potential knowledge on their families monthly income level, where 10% specified it to be less 200JDs, 27% between 200 – 400JDs, 17% specifying 401 – 600 JDs, 7% indicated an income level of 601-800 JDS and 15% above 800 JDs per month (table 12).

Preferred Medical Information Sources

The preferred source for medical information was almost equally divided between physician and media (34% and 33% respectively), whereas the Internet was shown to be an emerging source of medical information with 10% rating it as their preferred source for medical information. Social magazines were specified by 7%, medical books by 5% and a family member was indicated to be the preferred source by 1% (table 13).

Family history of osteoporosis (self reported):

The majority of respondents (82%) indicated that they did not have a first degree relative having osteoporosis (table 14).

Table 6 : Frequency Distribution of Subjects Age characteristics (Number and percentages)

AGE	Number (n)	Percent (%)
18 years	54	**6**
19 years	227	**27**
20 years	351	**41**
21 years	137	**16**
22 - 24 years	83	**11**
Total	852	**100**

Table 7 : Frequency Distribution of Subjects' by Study Faculty Category (Number & Percentage)

Faculty Category	Number (n)	Percent (%)
Humanities	559	**66**
Scientific	200	**24**
Medical	93	**11**
Total	852	**100**

Table 8 : Frequency Distribution Subjects' by university study level (Number & Percentage)

University Study Level	Number (n)	Percent (%)
Freshman	130	**15**
Sophomore	440	**52**
Junior	163	**19**
Senior	119	**14**
Total	852	**100.0**

Table 9: Frequency Distribution Subjects' High School Proprietorship (Number & Percentage)

High School Type	Number (n)	Percent (%)
Public	612	**72**
Private	233	**27**
Others*	7	**1**
Total	852	**100.0**

* Home study & Military

Table 10: Frequency Distribution of Subjects' Father educational level (Number & Percentage)

Highest educational level attained	Number (n)	Percent (%)
Not formally educated	40	**5**
Less than high school	148	**17**
High School	151	**18**
Diploma	151	**18**
Bachelors Degree	278	**33**
Post Graduate Studies	84	**10**
Total	852	**100**

Table 11: Frequency Distribution of Subjects' Maternal educational level (Number & Percentage)

Highest educational level attained	Number (n)	Percent (%)
Not formally educated	76	**9**
Less than high school	210	**25**
High School	253	**30**
Diploma	145	**17**
Bachelors Degree	152	**18**
Post Graduate Studies	16	**2**
Total	852	**100**

Table 12: Frequency Distribution of Subjects' Family Monthly Income level (Number & Percentage)

Level	Number (n)	Percent (%)
Less than 200 JDs	89	**10**
200-400 JDs	229	**27**
401-600 JDs	115	**14**
601-800 JDs	64	**8**
More than 800 JDs	125	**15**
Do not know	230	**27**
Total	852	**100**

Table 13: Frequency Distribution of Subjects' Preferred medical information source (Number & Percentage)

Source	Number (n)	Percent (%)
Family Member	10	**1**
Medical books	40	**5**
Social Magazines	62	**7**
Medical Magazines	78	**9**
Internet	87	**10**
Media	284	**33**
Physician	291	**34**
Total	852	**100**

Table 14 : Frequency Distribution of Self Reported family history of osteoporosis in first degree relatives of subjects (Number & Percentage)

	Number (n)	Percent (%)
Yes	153	**18**
No	699	**82**
Total	852	**100**

Lifestyle characteristics

Only a third of the respondents exercised on a daily basis (33%) and almost all of those who exercise practice one or more WBE (tables 15 and 16); the most common WBE practice was fast walking (67%) followed by dancing (42%) whereas 13% practiced WBE in the form of running, 9% used the steps machine for WBE and 3% practiced tennis (table 17).

Assessment of nutritional habits showed that those who do not drink milk on daily basis are more than those who do (55% and 45% respectively) Of those who do drink milk daily the majority drink only one glass per day (83%). On the other hand almost all respondents (90%) consumed at least one type of dairy product derivative aside from milk on daily basis (tables 18&19).

Regarding caffeine intake in the form of caffeinated beverages 83% consumed such on daily basis with 45% once a day and 31% 2-4 times/day and 7% more 5 times/day (table 20). Alcohol consumption and smoking was not common among respondents with 97% and 95% not consuming respectively (tables 21 & 22).

Table 15 : Frequency Distribution of Practice of Daily Exercise by Subjects (Number & Percentage)

	Number (n)	Percent (%)
No	574	**67.4**
Yes	278	**32.6**
Total	852	**100**

Table 16: Frequency Distribution of Practice of Weight Bearing Exercises at least 3 times /week by Subjects (n=271*) (Number & Percentage)

	Number (n)	Percent (%)
1 WBE	202	**74.5**
2 WBE	56	**20.7**
3 WBE	7	**2.6**
4 WBE OR MORE	6	**2.2**
TOTAL	271	**100**

* As a percentage of respondents who exercise regularly

Table 17 : Frequency Distribution of Types of Weight Bearing Exercises practiced by subjects who exercise (n= 271) * (Number & Percentage)

Type of WBE	Number (n)	Percent (%)
Fast walking	182	**67.2**
Dancing	114	**42.1**
Tennis	9	**3.3**
Running	34	**12.5**
Steps machine	23	**8.5**

* percentages do not add up to 100 as more than 1 WBE could be practiced by subject

Table 18 : Frequency Distribution of Subjects' Milk Consumption Habits (Number & Percentage)

	Number (n)	Percent (%)
No	468	**54.9**
Yes	384	**45.1**
Total	852	**100**
MILK GLASSES/DAY		
0 glasses	468	**54.9**
1 glass	322	**37.8**
2-3 glasses	54	**6.3**
3 glasses or more	8	**0.9**
Total	852	**100**

Table 19 : Frequency Distribution of Consumption of dairy products by subjects * (Number & Percentage)

	Number (n)	Percent (%)
No	90	**10.6**
Yes	762	**89.4**
Total	852	**100**

* Consumption of at least one or more serving of a dairy product derivative other than milk at least one a day

Table 20 : Frequency Distribution of Caffeine consumption habits of subjects (Number & Percentage)

	Number (n)	Percent (%)
No	146	**17.1**
Yes	706	**82.9**
Total	852	**100**
Frequency of Caffeinated beverage intake /day by subjects		
0 times	146	**17.1**
Once	383	**45.0**
2-4 times	263	**30.9**
5 times or more	60	**7.0**
Total	852	**100**

Table 21: Frequency Distribution of Alcohol consumption by Subjects (Number and Percentage)

	Number (n)	Percent (%)
No	828	**97.2**
Yes	24	**2.8**
Total	852	**100**

Table 22: Frequency Distribution of Cigarette Consumption by subjects (Number and Percentage)

	Number (n)	Percent (%)
No	808	**94.8**
Yes	44	**5.2**
Total	852	**100**

Sources and level of knowledge of osteoporosis

Self reported osteoporosis awareness and sources

Almost all of the respondents indicated that they had heard of osteoporosis (96%). Forty percent had heard of osteoporosis from the media; magazines and university curriculum was the source for 11%. Awareness through osteoporosis awareness campaigns or from a family member was equally reported as an awareness source by 9%. The physician was a source for 6% while knowing an osteoporosis patient was the source of awareness for 4%. The Internet was the source for 5% while exposure through school curriculum or medical books was reported by 3% and 4% respectively. A small proportion indicated that a friend was their source of awareness on osteoporosis (Table 23& 24).

Knowledge of osteoporosis risk factors as per the Facts on Osteoporosis Quiz

The median score achieved by our sample on a scale of 23 knowledge FOOQ items was 12, with the lowest score attained zero and the highest being 20. The mean score achieved by respondents was 11.5 ± 4.1. The percentages of correct responses per individual FOOQ item are shown in table 25.

Supplementary osteoporosis knowledge

No scale was given to the supplementary osteoporosis knowledge items, rather the percentages of those answering correct to each knowledge item was calculated (table 26). Regarding knowledge of osteoporosis complications, self assessment yielded 34% of sample with the perception of knowledge of osteoporosis complications and only 21% were able to indicate fracture as the most serious osteoporosis complication and of those correctly stating this 1% specifically stated hip fracture as the most serious osteoporosis complication (table 27).

Table 23: Frequency Distribution of Subjects' Self reported osteoporosis awareness (Number & Percentage)

	Number (n)	Percent (%)
Had Heard of Osteoporosis	817	**96**
Did not hear of Osteoporosis	35	**4**
Total	852	**100**

Table 24: Frequency Distribution of Main Sources of osteoporosis awareness reported by subjects (Number & Percentage)

Source	Number (n)	Percent (%)
Media	323	**40**
Magazines	93	**11**
Physician	46	**6**
School	23	**3**
University Curricula	91	**11**
Family Member	71	**9**
Awareness Campaigns	75	**9**
Friends	10	**1**
Internet	40	**5**
Medical Books	13	**2**
Patients	32	**4**
Total	817	**100.0**

Table 25 : Frequency Distribution of Subjects' Correct Responses to Facts on Osteoporosis Quiz (Number and percentages)

FOOQ Item	Correct Response	
	N	%
One in four women over the age of 60 will develop osteoporosis.*	349	**41**
Heredity does not play a role in osteoporosis.	296	**35**
Early menopause, such as after a hysterectomy, is not a risk factor for osteoporosis	308	**36**
High caffeine intake (more than 2 cups per day) increases the risk of osteoporosis*	617	**72**
A lifetime low intake of calcium will increase the risk of osteoporosis.*	608	**71**
Young women (age 19 -50) need the equivalent in calcium of a glass of milk a day to prevent osteoporosis	64	**8**
Inactivity increases the risk of osteoporosis.*	655	**77**
Smoking is not a risk factor for osteoporosis.	550	**65**
Thin women are more often affected by osteoporosis than heavy women *	112	**13**
All types of exercise is recommended for the prevention of osteoporosis	96	**11**
After age 40, it is too late for people to prevent osteoporosis	372	**44**
All individuals lose bone mass after 40 years of age.*	401	**47**
A diet high in calcium throughout life can help prevent osteoporosis.*	688	**81**
People of the black race are more susceptible to osteoporosis than caucasians	315	**37**
Normally, bone loss slows down after menopause.	256	**30**
Women over 40 need about 1500 mg of calcium (eqv to 5 cups of milk/day either through diet or supplements [a]). *	315	**37**
It is normal for bone loss to continue throughout life.*	601	**71**
There is no way to prevent osteoporosis.	684	**80**
Milk and Dairy products are a major source of calcium.*	777	**91**
Active women are at higher risk for osteoporosis than inactive women.	588	**69**
A risk factor for osteoporosis is having a mother with it.*	118	**14**
After age 40, it is too late for people to increase their calcium intake to prevent osteoporosis	388	**46**
Alcohol abuse is not a risk factor for osteoporosis.	634	**74**

Note: True answers are indicated by an asterisk

[a] This item is based on the National Institutes of Health Consensus Conference recommendations (1994)

Table 26 : Frequency Distribution of Subjects with Correct Responses on Supplementary Osteoporosis Knowledge Items (Number & percentages)

Supplementary Osteoporosis Knowledge Item	Correct Response	
	N	%
The prime time a female is at most risk of developing osteoporosis	453	**53**
Aging as a risk factor for osteoporosis	685	**80**
The gender with the highest incidence of osteoporosis	628	**74**
Timing of accruing peak bone mass	486	**57**

Table 27: Frequency Distribution of Self Reported knowledge of osteoporosis complications by subjects (Number & Percentage)

	Number (n)	Percent (%)
NO	561	**65.8**
YES	291	**34.2**
TOTAL	852	**100.0**
Reporting fracture as most serious osteoporosis complication		
NO	179	**21.0***
YES	112	**13.1**
Reporting hip fracture as most serious osteoporosis complication		
NO	290	**99****
YES	1	**1**

* As a percentage of the total study population (n=852)
** As a percentage of those correctly stating fracture as most serious osteoporosis complication (n=291)

Variables associated with osteoporosis knowledge

Using multivariate analysis, five variables were shown to have a significant association with level of FOOQ score attained (table 28). The variables with a significant correlation at the ($p \leq 0.05$) level were faculty category, university level, father education level, milk consumption habits, exercise habits. For the former 3 categorical variables pair wise comparisons were done to identify the level of significance of the correlation for each sub item and the following correlations were found:

I. Those attending a medical faculty achieved a mean FOOQ score of 13.4, which was significantly higher than all other faculty types ($p = 0.000$ vs. Humanities and $p = 0.031$ vs Scientific faculties).

II. No frank ascending trend in mean FOOQ scores was evident with increasing university level and only students in the sophomore and senior levels has a significantly higher FOOQ mean score versus freshmen (11.6 & 12.1 vs. 10.6 respectively). P values for pairwise comparisons are shown in table 28.

III. Regarding Father education level and its correlation with FOOQ score, a significant correlation was found only between the diploma level vs. some subcategories of father educational level and the same for those with fathers attaining post graduate degree. The highest FOOQ mean score was attained by students with fathers achieving a post graduate education (12.7) and this mean score was significantly higher than mean score vs. not educated, or less than high school or those completing high

school only. This mean score was not significantly higher than those of fathers with diploma or bachelors degree. As well the mean FOOQ score of the students with fathers attaining a diploma was higher than those with fathers with no education or those completing less than high school certificate level.

For the two dichotomus variables that were found to have a significant correlation with mean FOOQ score of samples those who exercised on a daily basis achieved a significantly higher score (12) than those who did not (11.1) p = 0.015. But in contrast milk consumption habits correlation showed that those who did not consume milk daily or at all had a significantly higher FOOQ score (12) vs. those who did not (p = 0.005).

Osteoporosis perceptions

Mean scores of samples perceptions towards their personal susceptibility and the seriousness of osteoporosis are shown in table 29; the mean score for perceived susceptibility to osteoporosis was 2.7 on scales of 5.0. Regarding perceived seriousness, the mean score for equal for the possibility for prevention and the need to have osteoporosis as a society concern (4.2) but the mean score for osteoporosis being a personal concern was lower at (3.8). The percentages per Likert scale level for these perceptions are shown in table 30. Ranking osteoporosis vs. 4 other middle age disease with regards to personal importance on a scale of 1 to 5 with 1 being least important and 5 most important; 79% ranked osteoporosis as either the least important disease or the next least and only 3% ranked it as the most important disease (table 31).

The perspectives of the sample towards interest for more knowledge on osteoporosis was assessed on a scale of 1 to 5, with 1 being no interest at all and 5 being very interested. The interest of the students to learn more on osteoporosis was high ,

where the majority (80%) were either very interested or interested to learn more about osteoporosis; a small proportion (13%) were not interested or not interested at all to learn more and 7% were neutral on the subject.

Table 28: Variables with significant association with osteoporosis knowledge level based on Facts on Osteoporosis mean score as achieved by subjects

Variable	Mean Score ± SD	p value*	Pair wise Comparisons
Faculty Category		**0.000**	
Humanities	10.9 ± 4.1		vs. Scientific p = 0.001 vs. Medical p = 0.000
Scientific	12.1 ± 4.0		vs. Medical p = 0.031
Medical	13.4 ± 3.5		vs. Humanities p = 0.000 vs. Scientific p = 0.031
University level		**0.004**	
Freshman	10.6 ± 4.1		vs. Sophomore p = 0.027
Sophomore	11.6 ± 4.2		vs. Freshman p = 0.027
Junior	11.4 ± 4.4		Non significant vs. other levels
Senior	12.1 ± 3.4		vs. Freshman p = 0.012
Father Educational level		**0.002**	
Not formally educated	9.3 ± 5.2		vs. Diploma p = 0.036 vs. Post graduate studies p = 0.003
Less than High School	11.6 ± 4.3		vs. Diploma p = 0.041 vs. Post graduate studies p = 0.002
High School Certificate	11.3 ± 4.0		vs. Post graduate studies p = 0.05
Diploma	11.3 ± 4.0		vs. Not educated p = 0.036 vs. Less than high school p = 0.041
Bachelors Degree	11.7 ± 4.6		Non significant vs. other levels
Post Graduate Studies	12.7 ± 3.2		vs. Not educated p = 0.003 vs. Less than high school p = 0.002 vs. High School p = 0.005
Consumption of Milk		**0.005**	
Yes	11.1 ± 4.1		
No	12.0 ± 4.2		
Regular Exercise		**0.015**	
Yes	12.0 ± 4.0		
No	11.2 ± 4.2		

Table 29: Mean Scores of subjects' perceived osteoporosis attitudes

Osteoporosis Perception Measure	***Mean Score****
I may someday be personally susceptible to development of osteoporosis	**2.7± 0.03**
Osteoporosis is a preventable disease	**4.16±0.02**
Osteoporosis is a disease of personal concern	**2.97±0.05**
Osteoporosis should be a public concern	**4.17±0.03**
Osteoporosis has life threatening consequences	**3.83±0.04**

*Likert 1 - 5 scale; (1) Totally Disagree / (5) Totally Agree

Table 30 : Frequency Distribution of Subjects' Perceived Susceptibility and Seriousness Towards Osteoporosis based on Likert scale* (Number and percentage)

Osteoporosis Perception Measure	Totally disagree		disagree		Neutral		Agree		Totally agree	
	N	%	N	%	N	%	N	%	N	%
May someday be personally susceptible to development of osteoporosis	104	**12**	304	**36**	225	**26**	170	**20**	49	**6**
Osteoporosis is a preventable disease	9	**1**	43	**5**	66	**8**	414	**49**	320	**38**
Osteoporosis is a disease of personal concern	145	**17**	221	**26**	123	**14**	233	**27**	130	**15**
Osteoporosis should be a public concern	9	**1**	56	**7**	51	**6**	393	**46**	343	**40**
Osteoporosis has life threatening consequences	20	**2**	105	**12**	111	**13**	377	**44**	239	**28**

*Likert scale of 1 - 5; (1) Totally Disagree / (5) Totally Agree

**Table 31: Frequency Distribution of Subjects Perceived Seriousness of osteoporosis versus selected diseases based on ranking of importance*
(Number and percentage)**

Disease Rank	Osteoporosis		Diabetes		CVD		Breast Cancer		Stroke	
	N	%	N	%	N	%	N	%	N	%
1(Most Important)	22	**3**	50	**6**	98	**12**	51	**6**	62	**7**
2	50	**6**	62	**7**	267	**31**	65	**8**	95	**11**
3	104	**12**	130	**15**	341	**40**	175	**21**	109	**13**
4	317	**37**	268	**31**	110	**13**	216	**25**	252	**30**
5(Least Important)	359	**42**	342	**40**	35	**4**	348	**41**	334	**39**

*Based on ranking according to personal importance on a scale of 1-5: 1 the most important and 5 the least important

Self reported osteoporosis preventive strategies

When students were asked to self assess if they incorporated osteoporosis preventive strategies in their lifestyle, the majority (77%) either did not or do not know if they currently practice osteoporosis preventive strategies in their lifestyle (table 32). For those giving a positive answer, the most frequently mentioned osteoporosis preventive strategies used by them were regular consumption of milk 51%, exercise 46% and consumption of milk product derivatives 19%.

Table 32 : Frequency Distribution of Self Reported Osteoporosis Preventive Strategies practiced by subjects in their lifestyle (Number and Percentage)

Practice of Osteoporosis Preventive Strategies by subjects	Number	Percent (%)
No	287	**34**
Do not know	366	**43**
Yes	199	**23**
Total	852	**100**
Osteoporosis preventive strategies reported to be practiced by subjects* (N = 199)		
Regular consumption of milk	101	**51**
Exercise	92	**46**
Calcium consumption through diet	15	**8**
Consumption of dairy products	38	**19**
Avoidance of caffeine	11	**6**
Avoidance of carbonated beverages	19	**10**
Consumption of green leafy products in diet	7	**4**
Avoidance of smoking	4	**2**
Avoidance of osteoporosis inducing drugs (corticosteroids)	1	**1**
Exposure to sunlight	2	**1**
Calcium supplements	1	**1**
Weight Bearing Exercises	2	**1**

* percentages do not add up to 100 as more than one strategy could be applied per respondent

Discussion, conclusion and recommendations

Discussion

This is the first study to quantify osteoporosis knowledge solely in female university students, a population that still has the chance or possibly last window of opportunity to curtail their risk profile. Our findings suggest that female university students are not fully knowledgeable about osteoporosis. Only seven questions (out of 23) were answered to correctly by 70% or more subjects. The questions with the highest proportion of correct responses pertained to relationship of high-calcium diets to prevent osteoporosis, high amounts of calcium in dairy products, and the ability to prevent osteoporosis.

The majority of respondents did not believe they were personally at risk for osteoporosis, nor is it a personal concern for them and this disease was not ranked within the top 3 important diseases according to majority of sample (79%), although they believed that it should be society concern and that the condition could be prevented. However, based on their responses to other questions, they did not practice preventive health behaviors; had gaps in their knowledge about risk factors, preventive behaviors. Reasons for not practicing preventive health behaviors may include inadequate knowledge, contact with health care professionals who did not discuss risk for osteoporosis or prevention options; indifference to disease possibly by a sense of osteoporosis being a distant threat, and lack of parental advice even if affected by disease.

Osteoporosis is a relatively "recent" disease in Jordan. Previous studies assessing knowledge in Healthcare providers or general population have found low levels of knowledge (Sabha, 2000, IOF 2000) where physician scored 5.8 out of 9 on the risk factor scale in the study by Sabha and nurses scored 2 out of 6 on the risk factor scale

by the same author. In the IOF study (2000) postmenopausal women were virtually unaware of risk factors and eight out of ten did not believe that they were personally at risk of developing the disease, despite the presence of risk factors.

Our study, although coming later than these studies shows still that there are considerable knowledge deficits. When comparing our findings with a more recent study, that of Abu Teen (2005), which had different design and comprised both male and female UJ students, some overlap and others contrast. Although the study conducted by Abu Teen did not depict an overall knowledge score, subjects, in particular females, responded in a percentage higher than 50% correct responses to areas pertaining to modifiable risk factors, which is similar to our study. Also subjects in Abu Teen study with correct responses to some non modifiable risk factors were higher than those for subjects in this study, where heredity was identified as a risk by 70% in the former study vs. 35% in our study. Body frame correctly identified as a risk factor by 26% in Abu Teen study vs. 13% on our study. Although both the Abu Teen study and our study showed a low awareness and practice of osteoporosis preventive practices, all the subjects (100%) in Abu Teen study practiced regular exercise, as opposed to only 33% in our study. As stated previously methodology differed greatly in the 2 studies, hence it is difficult to draw analogy from comparative results of both studies despite similar setting and age group.

Osteoporosis societies in Jordan have made great strides in increasing osteoporosis awareness but since many of these programs are generic, they do not account for individual knowledge requirements. The message about this debilitating disease is not getting to women, young women in particular. With the establishment of osteoporosis societies and increasing focus on osteoporosis through media has raised "awareness", yet the level of knowledge remains low and superficial.

This is substantiated in these study findings where 96% have heard of osteoporosis indicating that they have been exposed to the term but the fact that only 50% of the females in our study could answer correctly 12 out of 23 questions on osteoporosis risk factors indicates that hearing about osteoporosis does not necessarily indicate knowledge. And despite the fact that 11% of subjects were from medical faculties, none of the subjects in the entire study were able to respond correctly to all FOOQ items.

What is more alarming are the scores on individual knowledge assessment items which are considered core risk factors in the literature where they extend beyond the misconception that osteoporosis is a disease of low calcium. Some of the core risk factors identified in the literature are (race, body frame (BMI), maternal history, heredity, early menopause); on all of these items the respondents who were able to answer correctly were well less than 50% of the sample; these are also categorized as non modifiabale risk factors.

Respondents also scored low on items relating to relationship of osteoporosis and exercise (distinction of specific preventive exercises), possibility for prevention after 40, bone mass trend and age, and bone mass and menopause. Even in areas relating to calcium which is considered general knowledge, the majority of respondents could not identify correctly the daily milk requirement for women in their own age group, or calcium requirement after 40. The lack of knowledge of daily milk requirement could be attributed to the low level of milk intake in our culture and society which is also confirmed by our study. Although the majority indicated that they consume dairy products on a daily basis it cannot be known nor was it an objective from this study whether this intake is sufficient enough to provide these young with the necessary calcium equivalent.

The FOOQ did not include some osteoporosis knowledge items that were considered elementary in the United States but were included in this study as supplementary knowledge questions. When applied in our sample there were key items also showing knowledge deficits in areas which were considered to be a well known fact by the original instrument author. To our surprise considering the local media attention osteoporosis is getting, only 53% identified menopause to be the prime risk onset time for osteoporosis in females. Although higher, only 74% could identify the female gender to have a higher incidence of osteoporosis. As well, only 57% could correctly identify the age of accruing peak bone mass. Knowledge regarding timing peak bone mass is critical for young women as they need to be aware of the latest window of opportunity available to them to alter their risk profile and prevent what may be in the future inevitable.

The low level of knowledge on osteoporosis is not only in the area of risk factors but also in the area of consequences. Not only is self perceived knowledge of consequences low (only 34% self reporting personal knowledge on osteoporosis complications) but actual knowledge is even lower; only 13% stated fractures to be the most serious osteoporosis consequence and only one respondent frankly indicated hip fracture per se.

The results highlight several areas of concern. First, it is worrisome that although the majority of the women claimed to have heard or read something about osteoporosis, half of them were not able to correctly answers more than 12 out of 23 risk factor questions in the FOOQ and 2 out of 4 supplementary osteoporosis knowledge questions. When asked to describe themselves osteoporosis preventive strategies , only a very few responded, and those that did, offered only vague, general personal practices. Of greater concern are the results indicating that women's knowledge about osteoporosis is

deficient even among this group of well educated women whom are future mothers and caregivers to a new generation that maybe even more subjected to osteoporosis inducing habits. One of the major knowledge gaps was in the identification of core risk factors. Without this knowledge women will not be able to determine their own risk of developing the disease, request diagnostic tests, and initiate appropriate preventive action before onset of disease

It is significant also that many of the women did not realize that the onset of bone demineralization starts well before menopause, which may lead them to think that no preventive action is necessary until after menopause.

Findings regarding inadequate preventive practices are a further cause for concern (23%). The low percent (6%) of women taking two or glasses of milk per day or, conversely, the large percent (38%) consuming more than three cups of caffeinated drinks per day strongly suggest the need to promote better nutritional practices among women of all ages. The need to encourage more women to exercise also is suggested by the results of this study. A considerable portion of the respondents did not exercise at all (67%). The fact that only half of the subjects (57%) were able to correctly identify the timing of accruement of peak bone mass, is an additional obstacle in the ability of respondents to be proactive with osteoprotective strategies and they would be unaware of the opportunity of primary prevention within their age group.

A small proportion practiced weight-bearing exercises (31%); it could not be identified if this was based on the knowledge of the impact of WBE on bone health but it is very likely that participants did not previously know the forms of WBE prior to being shown different forms of WBE to choose from. Results from the self reported preventive strategies questions confirm this as it shows a huge gap in distinction of WBE as a specific preventive strategy where only 1% could identify WBE per se as a

preventive strategy. For the small number of respondents who lead a self-reported healthy lifestyle, it was not clear whether these behaviors were undertaken as preventative strategies to avoid development of OP or for other reasons (e.g., pleasure). In fact, there appeared to be a lack of intentional behaviors designed to improve or maintain women's health. This is evident from the inability of the majority to identify a distinction for weight bearing exercises as preventive for osteoporosis and the lack of knowledge on the daily-required milk allowance for women of their age as shown by the FOOQ scores.

Out of the 8 independent variables depicted in this study, 5 were found to have correlation with level of knowledge. As expected faculty type was significantly correlated with level of osteoporosis knowledge where students in medical faculties had significantly higher FOOQ core than other faculty types.

The distribution of sample by faculty type was coherent with sources of exposure to osteoporosis knowledge mentioned by respondents where 11% indicated university curriculum. This does not exclude that osteoporosis is included in some elective courses offered by UJ such as the course Physical Activity and Health.

University level was also significantly correlated where senior level students had significantly higher score vs. other levels. This could be due to specialization of students and their ability to be more discriminating in the information they are exposed to. Within the variable parental education level, only father educational level was significantly correlated with FOOQ score. There was an increase in mean FOOQ score with increasing father educational level but was only significantly higher than preceding levels up until the diploma level. Hence in our study completion of formal education had an impact on knowledge level of the female daughters up until the cut off point of diploma.

Two lifestyle habits were significantly correlated with osteoporosis knowledge levels. The relationship between consumption of milk and osteoporosis knowledge was unexpected as those who did not drink milk had a significantly higher level of knowledge than those who did. Meaning that young who consume milk on a daily basis may not be consuming it with a consciousness of its benefits on bone health. At the same time only 6% of those who did drink milk daily are consuming the required amount for young women and the majority are well below the daily requirement. Such findings make it of interest to identify in new studies reasons for consuming or not consuming milk in young women. But with regards to the correlation of practice of exercise and knowledge, those who did exercised regularly had a significantly higher level of knowledge than those who did not. Indicating that possibly those who exercise are not only motivated by a strive for better health but also are more knowledgeable about the diseases that are positively influenced by regular exercise.

Of interest is the lack of association between presence of osteoporosis in a family member and level of osteoporosis knowledge, indicating a lost opportunity by healthcare providers to educate the patient and first-degree relatives on risk profile and preventive strategies and initiate a snow ball awareness effect. This underlines as well that intervention by health care providers needs to be embedded in a larger, supportive system that addresses the predisposing, enabling, and reinforcing factors at the individual, organizational, and community level.

Studies assessing how often primary care physicians discuss osteoporosis prevention and knowledge, found that it was primarily with postmenopausal women (Kasper et al., 1994, Kasper et al., 2001). Hence younger women may have less opportunity to receive knowledge and information from this source.

Alternatively, the lower levels of knowledge associated with younger women may be due to lower perception of risk in this population and therefore a lower interest in seeking information regarding this disease

Due to software constraints, the locally adapted and Arabic translated version of the FOOQ could not be subjected to testing for psychometric properties to allow for statistical comparison of our results with those of the original results of FOOQ study (Ailinger 1998), but off hand comparisons showed interesting yields with some similarities.

Our sample obtained a lower FOOQ median score than those in the Ailinger study (12 versus 16 respectively); where 16 was considered a low knowledge level by the author. The deficits in knowledge overlapped in some areas and differed in others; there was low knowledge in the Ailinger study in areas of risk factors pertaining to required calcium need for young women, alcohol abuse, ethnic origin, and body frame.

Exposure to prior osteoporosis knowledge was correlated with a higher FOOQ score whereas in our study it was not. Similar to our study presence of family history of osteoporosis was not correlated with increased FOOQ score.

The reporting of low levels of OP risk factor knowledge in our study as well as that of the Ailinger study (1998) indicates that we are not getting the message on osteoporosis or is not reaching young women in a manner that would lead them to intentionally incorporate preventive strategies in their lifestyle and take care to their own individual risk factor profile. The fact that less than half of the subjects were aware of the size of the problem also indicates that the message on seriousness is not reaching those at future risk.

In comparison to other international studies conducted in similar populations, low knowledge is reaffirmed across the board but in differing knowledge segments. The

findings of Kasper et al., (2001) showed a higher correct response rate to role of heredity (89%), lack of exercise (83%); similarly high knowledge rate (80%) for role of calcium as per our study and unfortunately similarly low knowledge rates for race (20%), menopause (35%) and body frame (42%) in the Kasper study which is in line with our findings. An even lower rate of practice of preventive osteoporosis strategies was also reported in the Kasper study than that found here in this study where fewer than 7% of young women were getting sufficient exercise and the recommended dietary calcium intake to build healthy bone.

Our findings also mirror low knowledge of osteoporosis risk factors found in the study by Nguyen (2002) in Asian American college students where only 11% of students answered at least 75% of osteoporosis fact questions correctly in that study.

In this study, the most interesting and maybe most sensitive indication of our sample's level of knowledge of osteoporosis risk factors (in particular modifiable) were questions pertaining to subjects' reporting of self incorporated preventive strategies. The findings here further confirm the low level of knowledge where 77% indicated that they either do not know or do not practice osteoporosis preventive strategies in their daily life. For those who did, the most reported strategies were the generic ones revolving around incorporation of calcium in diet, although none actually reported calcium rich dietary sources other than dairy products.

Knowledge on osteoporosis risk factors and preventive strategies should not be viewed in isolation, rather this should be viewed in light of a total healthy lifestyle program as many of the risk factors and the preventive strategies for osteoporosis are similar and intertwined with other chronic and debilitating diseases. A comprehensive health lifestyle education and awareness approach targeting young adults has the potential to reduce not just the direct and indirect costs of osteoporosis on society but

that of many other diseases that are affecting our community as life expectancy increases.

When interpreting the results regarding osteoporosis perceptions it can be said that young women are aware but not personally concerned. This may be due to a belief that osteoporosis is a distant threat and as well its consequences have not been visually implanted in the minds of women of all age groups especially versus other middle age disease.

A superficial knowledge of the disease may be giving women a false sense of security about the disease its severity, their personal susceptibility and its potential impact on their lives. The majority of women perceived that osteoporosis is less serious than breast cancer and cardiovascular diseases and stroke . As nationwide heart disease and cancer education campaigns have been well established in Jordan, there may be a greater awareness of the morbidity and mortality of these conditions, compared with more recent educational initiatives for osteoporosis.

This study had some limitations that should be noted. Use of a convenience sample, where this method was chosen due to the non-feasibility of a simple random procedure on campus ground. Although convenience in type, the sample its self may be considered representative of all female students attending UJ in the second semester 2004/2005 as it is compulsory to take the said university course by all students and the frequency distribution of study faculties in our sample is coherent with the actual enrollment by faculty category as stated by the statistics of the Ministry of Higher Education on this subject (MHE 2005). The representation of the three faculty types of Humanities, Scientific and Medical was 66%, 24% and 11% respectively. This is coherent for that reported by the Ministry of Higher Education indicating that Bachelor Degree female students of UJ are distributed in the 3 aforementioned faculty categories

in the following respective manner of 60%, 26% and 13% for categories of Humanities, Scientific and Medical. Hence our sample may be further considered representative. Furthermore, and in order to verify if there was coherence with national statistical data versus our sample characteristics, the only comparison that could be made was regarding parental education level. Upon reverting to the Demographic and Health Survey (DOS, 2002) in Jordan for 2000, it is important to note that results in our survey regarding parental education level were close to that of the DHS; as per the DHS 94% of fathers have had some sort of schooling versus 95% in this study, and for mother, the DOS survey showed that 88% have had some sort of schooling versus 91% in our survey.

Second, the FOOQ used was the 1998 version which is the only published version, despite that an updated version was prepared by author that is more uniform with development in osteoporosis (Ailinger 2003) but the tool itself was not published. As well due to software constraints the local Arabic version of FOOQ questionnaire did undergo testing for psychometric properties in Arabic so no statistical comparisons between our results and those of Ailinger 1998 can be drawn.

Finally data was collected by self-reporting. Though data collection procedure was anonymous and the measures did not assess particularly sensitive issues, biases may have produced some degree of inaccurate reporting.

Despite these limitations, our finding have uncovered key knowledge gaps among young women regarding osteoporosis and has emphasized the need to move away from generic awareness campaigns to specifically tailored education programs incorporating a healthy life style approach overall that will allow this generation and future ones to minimize their risk of this serious debilitating disease

In summary, and consistent with previous studies, despite a high level of awareness of osteoporosis, young women who are at risk for this potentially disabling disease know little about osteoporosis and take even less action to prevent it. Over the next decade the socioeconomic impact of hip fractures will increase markedly throughout the world, particularly in Asia, and that there is an urgent need to develop preventive strategies, particularly in the developing countries (Gullberg et al., 1997). Our data suggest that young women are en route to adding to this burden. Coupled with a greater proportion of our population surviving to older age, osteoporosis is becoming an increasing public health concern.

Caveat

In providing health education that will have the most impact for young women, Public Health professionals must go beyond identifying knowledge gaps & providing information. Recognizing that knowledge although necessary, does not translate to behavior is important

Conclusions

The results of this study are consistent in the following 5 major areas and point to the need for osteoporosis prevention programs. First, a small percentage of young women were getting sufficient exercise or exercising at all, and lacked adequate knowledge on recommended dietary calcium intake to build healthy bone. Second, health care providers and educational institutions have missed opportunities or failed to disseminate impacting osteoporosis information to young women, or such information has not been received and retained by them. Third, a good proportion of young women were able to identify the risk factors of lack of physical exercise and low calcium intake, but few were able to identify the risk factors of early menopause, postmenopause status,

or heredity. Fourth, participants were somewhat concerned about developing osteoporosis, but they were much more concerned about and believed that they were much more likely to develop heart disease and breast cancer. Fifth, respondents' level of knowledge did not correlate with presence of osteoporosis in a first degree relative, calcium intake in a positive sense, or health information sources. Moreover, respondents did not actively ensue in osteoporosis preventive behaviors or did not know if they are.

Recommendations

Primary preventive behavior is fundamental to decreasing the incidence of osteoporosis. Because osteoporosis is preventable and results in decreased quality of health and increased health expenditures, information and interventions should be provided to individuals of all generations. The results of this study clearly suggest that there is an urgent need to intensify public education and other health promotion efforts designed to improve young women's knowledge and practices regarding osteoporosis, its consequences and seriousness.

Although there are many challenges in raising the level of knowledge on this serious disease, the presence of many bodies and channels within UJ that can assist in getting the right message out to young adults is an opportunity that should not be missed. It may be of interest to make use of the key health education sources that were identified in this survey such as the Internet and the physician.

Based on the findings of this study, the recommendations are as follows:

1) Interventions designed to promote osteoprotective behaviors in young adults will need to go beyond disseminating information about simple definitions of osteoporosis and its consequences in old age, but rather to emphasize recommended levels of calcium consumption and

involvement in exercise. Such interventions need to focus on promoting regular, ongoing participation in weight-bearing exercise and valuing one's personal health.

2) Although more research is needed, the results of this study also suggest that osteoporosis prevention may be best accomplished as part of a broader health promotion effort that perhaps emphasizes exercise, but also seeks to reduce other health-compromising behaviors.
3) Health promotion campaigns should, whenever possible, emphasize the immediate onset of a health threat and any visible features. Second, in order to convince people a health threat can be severe, the sudden rate of onset should be emphasized whenever possible.
4) The health care setting, where a large percentage of young women visit frequently, is an important site for the delivery of effective osteoporosis prevention programs. The JU clinics could be utilized as sites for healthy lifestyle counseling on a regular basis for all students seeking care at this clinic. This in turn demands that health professionals be well prepared to educate the public regarding these matters and to find innovative ways of encouraging preventive actions.
5) Use of the vast university Internet network to send locally tailored messages on osteoporosis preventive strategies through pop up screens upon log in for university students that are interactive.
6) Introduction and familiarization of young women with the term weight bearing exercises and to make a distinction between haphazard exercising and routine physical activity and weight bearing exercises.

7) Review of content of elective university course that incorporate osteoporosis in their curriculum to include pre and post self-efficacy assessments on preventive strategies.

8) Healthy college students do not always access the health system for wellness, so other educational forums, such as university newspaper articles and university or community education programs should be considered. Such intervention should begin early in individuals' lives so that they can make appropriate decisions and lifestyle modifications to help prevent osteoporosis.

9) Additional research is needed to explore factors that influence and change behavior among young women as the end point is not just decreasing osteoporosis knowledge gaps, but a strive towards a positive change in healthy lifestyle attitude

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Appendix 1
Study Questionnaire (Arabic)

إستبيان دراسة درجة المعرفة بعوامل خطر الاصابة بهشاشة العظام

لدى طالبات الجامعة الأردنية

استبيان الدراسة 2004/2005

Serial Number ☐ ☐ ☐ ☐

زميلتي الطالبة:

هذا الاستبيان يقع ضمن دراسة هدفها دراسة و تقييم المعرفة الصحية بمرض هشاشة العظام لدى طالبات الجامعة الاردنية. الاجابات ستكون سرية وتستعمل فقط لاغراض هذه الدراسة، ولن يكون هناك اية اشارة لشخصك أو هويتك.

نشكر اجابتك على كافة الاسئلة

يتكون هذا الاستبيان من جزئين "ا" و "ب"

الرجاء وضع اشارة ✓ داخل المربع الذي يمثل اجابتك على السؤال او اتباع التعليمات المبينة عند أسئلة معينة و التي تستدعي كتابة الجواب او الترقيم في المربعات المحددة او اختيار جواب واحد صحيح.

ألجزء أ:

1. **العمر** _____ سنة
2. **ألكلية**: _____
3. **ألمستوى الدراسي**:

☐ سنة اولى ☐ سنة ثانية ☐ سنة ثالثة ☐ سنة رابعة ☐ اكثر من سنة رابعة

4. **فرع شهادة الدراسة الثانوية**:

☐ ادبي ☐ علمي ☐ غير ذلك _____

5. **المدرسة خلال المرحلة الثانوية كانت تابعة للقطاع:**

☐ حكومي ☐ خاص ☐ غير ذلك _____

6. **الدخل الشهري للأسرة:**

☐ أقل من 200 دينار شهريا ☐ 200-400 دينار شهريا
☐ 401-600 دينار شهريا ☐ 601-800 دينار شهريا
☐ اكثر من 800 دينار شهريا ☐ لا أعرف

7. **ما هو المستوى التعليمي للوالد**

☐ غير متعلم ☐ اقل من ثانوية عامة ☐ توجيهي
☐ دبلوم ☐ جامعي بكالوريس
☐ جامعي دراسات عليا ما بعد البكالوريس

8. **ما هو المستوى التعليمي للوالدة**

☐ غير متعلمة ☐ اقل من ثانوية عامة ☐ توجيهي

☐ دبلوم ☐ جامعية بكالوريس

☐ جامعية دراسات عليا ما بعد البكالوريس

9. **المصدر الرئيسي الذي تعتمدينه عادة لمعرفة معلومات طبية هو (جواب واحد فقط)**

☐ المجلات الاجتماعية ☐ المجلات الطبية ☐ الراديو

☐ التلفزيون ☐ الطبيب ☐ الانترنت ☐ غير ذلك _____

10. **هل تمارسين الرياضة بانتظام (التزام روتين زمني معين لرياضة ما بشكل مستمر)**

☐ نعم ☐ لا (اذا كان لا انتقلي للسؤال رقم 12)

11. **هل تمارسين اية من الرياضات التالية 3 مرات اسبوعياً على الاقل (ممكن اكثر من جواب)**

☐ المشي السريع ☐ الرقص ☐ التنس ☐ الركض ☐ الة صعود الدرج الرياضية

12. **ما هي عدد الاكواب التي تتناولين فيها الحليب يوميا**

☐ لا اتناول الحليب ☐ كوب واحد ☐ كوبان – 3 اكواب ☐ 4 اكواب أو اكثر

13. **هل تتناولين أي من مشتقات الحليب التالية يومياً (مثل ألاجبان, اللبنة, البوظة, اللبن, الخ)**

☐ نعم ☐ لا

14. **هل تدخنين؟**

☐ نعم ☐ لا

15. **ما هو عدد المرات التي تتناولين فيها القهوة (او المشروبات التي تحتوي على الكافيين مثل الكابتشينو, النسكافيه, البيبسي) يومياً؟**

☐ لا أتناول الكافيين ☐ مرة واحدة ☐ 2-4 مرات ☐ 5 مرات أو أكثر

16. **هل تتناولين المشروبات الكحولية؟**

☐ نعم ☐ لا

17. **هل سمعت عن مرض هشاشة العظام؟**

☐ نعم ☐ لا (اذا كان لا انتقلي للسؤال رقم 20)

18. **من اين سمعت عن هشاشة العظام؟**

_____

_____

_____

19. **هل تم تشخيص احد في عائلتك (ألام, ألاب, ألاخت, الجدة) بمرض هشاشة العظام؟**

☐ نعم ☐ لا ☐ لا أعرف

20. **أي الفئات معرضة اكثر للإصابة بهشاشة العظام؟**

☐ الذكور ☐ الإناث ☐ لا فرق ☐ لا أعرف

21. **عظام الانسان تصل الى ذروة قوتها في سن (جواب واحد فقط)**

☐ اقل من 20 سنة ☐ ما بين 20 -30 سنة ☐ ما بين 40 -50 سنة

☐ بعد سن الخمسين ☐ لا أعرف

22. **هل تعتقدين بأنك يوماً ما قد تكونين معرضة للإصابة بهشاشة العظام؟**

☐ موافقة كلياً ☐ موافقة ☐ محايدة ☐غير موافقة ☐ غير موافقة أبداً

23. **هل يمكن الوقاية من مرض هشاشة العظام؟**

☐ موافقة كلياً ☐ موافقة ☐ محايدة ☐غير موافقة ☐ غير موافقة أبداً

24. **هشاشة العظام من الامراض التي تقلقني و تهمني**

☐ موافقة كلياً ☐ موافقة ☐ محايدة ☐غير موافقة ☐ غير موافقة أبداً

25. **هل يجب أن تكون هشاشة العظام من الامراض التي تولى اولوية و اهتمام في المجتمع؟**

☐ موافقة كلياً ☐ موافقة ☐ محايدة ☐غير موافقة ☐ غير موافقة أبداً

26. **هل تعتقدين أن هشاشة العظام مرض له مضاعفات خطيرة ممكن ان تهدد حياة المصاب به؟**

☐ موافقة كلياً ☐ موافقة ☐ محايدة ☐غير موافقة ☐ غير موافقة أبداً

27. **هل تعرفين المضاعفات الي تصاحب هشاشة العظام**

☐ نعم ☐ لا (اذا كان لا انتقلي للسؤال رقم 29)

28. **برأيك ما هي اخطر المضاعفات التى بمكن ان يتعرض لها المصاب بهشاشة العظام**

_____

29. **من اكثر المراحل العمرية التي تتعرض فيها ألاناث للاصابة بهشاشة العظام المزمن (جواب واحد فقط)**

☐ الطفولة (لغاية14 سنة) ☐ في سن الانجاب (15- 49 سنة)

☐ بعد الرضاعة ☐ بعد إنقطاع الدورة الشهرية ☐ لا أعرف

30. **التقدم في العمر يزيد من مخاطر الاصابة بهشاشة العظام**

☐ نعم ☐ لا ☐ لا أعرف

31. **صنف الأمراض التالية من (1-5)، حسب أهميتها إليك 1 هو الأهم و 5 هو الأقل أهمية.**

☐السكري ☐ امراض القلب ☐ سرطان الثدي ☐ هشاشة العظام ☐ الجلطة الدماغية

32. **هل تعتقدين أنك تقومين بالأمور اللازمة للوقاية من هشاشة العظام؟**

☐ نعم ☐ لا ☐ لا أعرف (اذا كان لا او لا اعرف انتقلي للسؤال رقم **32**)

33. **اذكري أمرين من الأمور التي تمارسينها للوقاية من هشاشة العظام؟**

_____

_____

34. **عندي اهتمام لمعرفة المزيد من المعلومات عن هشاشة العظام؟**

☐ موافقة كلياً ☐ موافقة ☐ محايدة ☐غير موافقة ☐ غير موافقة أبداً

الجزء ب:

الرجاء الإجابة على الأسئلة التالية بنعم أو لا بوضع اشارة ✓ في المربع:

1) واحدة من كل 4 نساء فوق سن الستين سوف تصاب بهشاشة العظام	☐ نعم ☐ لا ☐ لا أعرف
2) العوامل الوراثية لا تلعب دور في الإصابة بهشاشة العظام	☐ نعم ☐ لا ☐ لا أعرف
3) الانقطاع المبكر للدورة الشهرية (نتيجة للاستئصال الرحم مثلاً) ليس عامل من عوامل الإصابة بهشاشة العظام	☐ نعم ☐ لا ☐ لا أعرف
4) تناول كميات كبيرة من الكافيين (أكثر من فنجانين من القهوة يومياً) يزيد من خطر الإصابة بهشاشة العظام	☐ نعم ☐ لا ☐ لا أعرف
5) تناول كميات قليلة من الكالسيوم من خلال الغذاء على مدى الحياة يزيد من خطر الإصابة بهشاشة العظام	☐ نعم ☐ لا ☐ لا أعرف
6) تحتاج الإناث بعمر الشباب(19- 50 سنة) ما يعادل كأس من الحليب للوقاية من هشاشة العظام	☐ نعم ☐ لا ☐ لا أعرف
7) الإقلال من النشاط والحركة يزيد من خطر الإصابة بهشاشة العظام	☐ نعم ☐ لا ☐ لا أعرف
8) التدخين لا يزيد من احتمالية الإصابة بهشاشة العظام	☐ نعم ☐ لا ☐ لا أعرف
9) بشكل عام الإناث ذو البنية النحيلة اكثر عرضة للاصابة بهشاشة العظام من الإناث ذو البنية الممتلئة	☐ نعم ☐ لا ☐ لا أعرف
10) كل انواع الرياضة دون تحديد ممكن ان تساعد على الوقاية من هشاشة العظام	☐ نعم ☐ لا ☐ لا أعرف
11) بعد عمر الأربعين عاماً يكون قد فات الأوان لاتباع إجراءات وقائية ضد هشاشة العظام	☐ نعم ☐ لا ☐ لا أعرف
12) هناك نقصان لكثافة العظام عند جميع الاشخاص بعد عمر الاربعين	☐ نعم ☐ لا ☐ لا أعرف
13) تناول غذاء يحتوي على كميات عالية من الكالسيوم على مدى الحياة يمكن ان يساعد على الوقاية من هشاشة العظام	☐ نعم ☐ لا ☐ لا أعرف
14) الاشخاص ذو البشرة السوداء (العرق الزنجي) معرضين اكثرللاصابة بهشاشة العظام من اي الاجناس العرقية الاخرى (مثل ذو البشرة البيضاء)	☐ نعم ☐ لا ☐ لا أعرف
15) عملية خسارة كثافة العظام عادة تتباطأ بعد سن اليأس (اي عند انقطاع الدورة الشهرية)	☐ نعم ☐ لا ☐ لا أعرف
16)تحتاج النساء الى حوالي 1500 مليغرام من الكالسيوم (اي ما يعادل 5 اكواب من الحليب يوميا او ما يعادلها من خلال الدواء) بعد عمر الاربعين	☐ نعم ☐ لا ☐ لا أعرف
17) من الطبيعي ان يكون هناك نقصان لكثافة العظام خلال عمر الانسان	☐ نعم ☐ لا ☐ لا أعرف
18) لا يوجد وسيلة للوقاية من هشاشة العظام	☐ نعم ☐ لا ☐ لا أعرف
19) الحليب و مشتقاته هو مصدر اساسي للكالسيوم	☐ نعم ☐ لا ☐ لا أعرف
20)النساء اللواتي يمارسن حياة نشيطة اكثر عرضة للاصابة بهشاشة العظام من النساء اللواتي لا يمارسن حياة نشيطة	☐ نعم ☐ لا ☐ لا أعرف
21) اصابة والدة شخص ما بهشاشة العظام تزيد من احتمالية اصابة هذا الشخص بهشاشة العظام	☐ نعم ☐ لا ☐ لا أعرف
22) زيادة تناول كميات الكالسيوم بعد عمر الاربعين ليس له تأثير على الوقاية من هشاشة العظام	☐ نعم ☐ لا ☐ لا أعرف
23) الافراط في تناول الكحول ممكن ان يزيد من احتمالية الاصابة بهشاشة العظام	☐ نعم ☐ لا ☐ لا أعرف

Appendix 2

Sample size determination (S) for a given population number (N)

N	S	N	S	N	S
10	10	220	140	1200	291
15	14	230	144	1300	297
20	19	240	148	1400	302
25	24	250	152	1500	306
30	28	260	155	1600	310
35	32	270	159	1700	313
40	36	280	162	1800	317
45	40	290	165	1900	320
50	44	300	169	2000	322
55	48	320	175	2200	327
60	52	340	181	2400	331
65	56	360	186	2600	335
70	59	380	191	2800	338
75	63	400	196	3000	341
80	66	420	201	3500	346
85	70	440	205	4000	351
90	73	460	210	4500	354
95	76	480	214	5000	357
100	80	500	217	6000	361
110	86	550	226	7000	364
120	92	600	234	8000	367
130	97	650	242	9000	368
140	103	700	248	10000	370
150	108	750	254	15000	375
160	113	800	260	20000	377
170	118	850	265	30000	379
180	123	900	269	40000	380
190	127	950	274	50000	381
200	132	1000	278	75000	382
210	136	1100	285	100000	384

Reference: Sekaran, 2003

تقييم درجة المعرفة بعوامل خطر الاصابة بهشاشة العظام لدى طالبات الجامعة الاردنية

اعداد

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ملخص

تهدف هذه الدراسة اساساً الى تقييم درجة المعرفة بعوامل خطر الاصابة بمرض هشاشة العظام لدى طالبات الجامعة الاردنية. الاهداف الثانوية كانت تستهدف الى تقييم معتقدات و اتجاهات وممارسات الطالبات حول مرض هشاشة العظام.

تمثلت عينة الدراسة بجميع الطالبات المسجلات في الفصل الثاني 2005/2004 في متطلب جامعي اجباري لجميع الطلبة , حيث تم توزيع استبيان الدراسة علي جميع الطالبات في هذا المساق و البالغ عددهن 1000 طالبة.

درجة الاستجابة التي حددت بارجاع استبيان كامل الاجابات كانت 89.7%, و عند تحليل البينات وجد ان العينة تمثل الطالبات الملتحقات في الجامعة ألاردنية من حيث التركيب و التوزيع في الكليات الدراسية.

اظهرت الدراسة ان 96% من الطالبات قد سمعوا عن مرض هشاشة العظام ولكن درجة المعرفة لم تكن موازية. المعدل الوسيط لتقييم درجة المعرفة كان 12 نقطة من اصل 23 نقطة.

اقل درجات المعرفة كانت تلك المتعلقة بعلاقة العوامل التي لا يمكن التحكم بها كالوراثة, العرق, سن اليأس المبكر و بنية الجسم. و كان هناك ايضاً ضعف في المعرفة في بعض العوامل

التي يمكن التحكم بها مثل دور تمارين المقاومة وكمية الحليب و الكالسيوم المطلوبة للوقاية من مرض هشاشة العظام لهذه الفئة العمرية من الطالبات.

و كذلك اظهرت النتائج ان لدى الطالبات اعتقاد ضئيل بامكانية تعرضهن للاصابة بمرض هشاشة العظام في المستقبل قليل, حيث كان معدل نقاط الاعتقاد حول امكانية التعرض لمرض هشاشة العظام 2.7 نقطة من 5 نقاط.

كما ان مرض هشاشة العظام لم يكن من بين الامراض الثلاثة الاولى الاكثر باعثة للقلق و الاهتمام لدى طالبات الجامعة بالمقارنة مع امراض اخرى مثل امراض القلب و سرطان الثدي (2.97 نقطة من 5.0) .

بالرغم من و جود اعتقاد عالي بامكانية الوقاية من مرض هشاشة العظام (4.16 نقطة من 5.0) و ضرورة ايلاء هذا المرض اهتمام عام في المجتمع (4.17 نقطة من 5.0) الا ان الغالبية من الطالبات (77%) لا يمارسن او لايعرفن استراتيجيات الوقاية من مرض هشاشة العظام في حياتهن اليومية.

العوامل التي وجد لها في هذه العينة ارتباط و ثيق (بدرجة $p \leq 0.05$) بمعدل درجة المعرفة بعوامل خطر الاصابة بمرض هشاشة العظام كانت المستوى الدراسي الجامعي, نوع الكلية التي تنتمي اليها الطالبة, المستوى التعليمي للاب, تناول الحليب بانتظام, و ممارسة الرياضة بانتظام. و لكن لم يكن هناك علاقة ارتباط و ثيقة بين درجة المعرفة ووجود اصابة بمرض هشاشة العظام في احد افراد العائلة لدى الطالبات.

بشكل عام بالرغم من ان اغلبية الطالبات قد سمعوا من مرض هشاشة العظام , درجة المعرفة بعوامل خطر الاصابة بمرض هشاشة العظام لم تكن جيدة مما يبعث على القلق حيث ان فئة الشباب التي تنتمي لها هذه العينة ما زال لديها فرصة للوقاية من هذا المرض الصامت عن طريق اتباع استراتيجيات الحياة الصحية السليمة لكن ليتم هذا يجب رفع درجة الوعي عن مرض هشاشة العظام لدى فئة الطالبات عن طريق برامج توعية تهدف هذه الفئة تحديداً.