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Osteoporosis Prevalence in East Jerusalem and the Environmental Factors Effect

By

Saib Shareef Dkeidek

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Saib Shareef Dkeidek

B.Sc. Medical Imaging /Al-Quds University

College of Health Professions – Palestine

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Thesis Approval

Osteoporosis Prevalence in East Jerusalem and the Environmental Factors Effect

Prepared By: Saib S. Dkeidek

Registration No. 20211676

Supervisor: Dr. Ziad Abdeen

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The names and signatures of the examining committee members are as follows:

1. Head of Committee Dr. Ziad Abdeen Signature_____
2. Internal Examiner Dr. Mutaz Qutob Signature_____
3. External Examiner Dr, Rustom Namary Signature_____

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Dedication

To my family who have supported me in all phases of this thesis particularly to my wife and mother. And to my beloved daughters.

Declaration

I certify that this thesis submitted for the degree of master is the result of my own research, except where otherwise acknowledged, and that this thesis (or any part of the same) has not bee submitted for a higher degree to any other university institution.

Signed_____

Saib Shareef Dkeidek

Date: / / 2009

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Special acknowledgement to my beloved family, my wife, mother and all person in my family for their endless support during my study.

Definitions

Acute pain: Pain which start suddenly, may described as sever or sharp.

Body mass index: A measure of weight that takes your height.

Bone densitometry: A method of measuring bone density and strength; a bone density test is used to diagnose osteoporosis.

Bone mineral density (BMD): An indication of bone strength. BMD is measured in grams per square centimeter, using DXA.

Bone remodeling: Replacing old bone with new bone tissue.

Bone turnover: Replacing old bone with healthy new bone.

Calcaneus: The largest tarsal bone; forms the human heel.

Calcium absorption: The amount of calcium which the absorbs and uses.

Collagen: The fibrous protein constituent of bone, cartilage, tendon, and other connective tissue. It is converted into gelatin by boiling.

Colles fracture: A fracture of the distal radius or the wrist.

Estrogen: Any of several steroid hormones produced chiefly by the ovaries and responsible for promoting estrus and the development and maintenance of female secondary sex characteristics.

Hormone Replacement Therapy (HRT): hormones (estrogen and progestin) are given to postmenopausal women; believed to protect them from heart disease and osteoporosis.

Kyphosis: a curving of the spine that causes a bowing of the back, which leads to a hunchback or slouching posture.

Osteoblasts : A cell that makes bone. It does so by producing a matrix that then becomes mineralized. Bone mass is maintained by a balance between the activity of osteoblasts that form bone and other cells called osteoclasts that break it down.

Osteoclasts: A cell that nibbles at and breaks down bone and is responsible for bone.

Osteopenia: A condition of bone in which there is a generalized reduction in bone mass that is less severe than that in osteoporosis.

Osteoporosis: Thinning of the bones with reduction in bone mass due to depletion of calcium and bone protein.

Postmenopausal: Is defined formally as the time after which a woman has experienced twelve (12) consecutive months of amenorrhea (lack of menstruation) without a period.

Quantitative Computed Tomography (QCT): A restricted test used to measure true mineral density**.**

Quantitative Ultra sound (QUS): A method of assessing bone strength that uses high frequency sound waves.

Reasorption: Chewing up of old done by the osteoclasts .

Secondary osteoporosis: Osteoporosis that is caused by a medication the person is taking or by medical condition that the person has.

Standard Deviation: A consistent unit of measure above or below that average of a comparison group**.**

T- score: A measuring system used to detect standard deviations for a specific group - on a DXA - compares a person to group of young adults of the same sex.

Weight bearing exercises: Exercises In which a person supports her own body weight .

World Health Organization: An international organization concerned with world health and welfare.

National osteoporosis Foundation: An organization based in the United states that is dedicated to helping people with osteoporosis.

Acronyms

AR	Average Requirement
BMC	Bone Mineral Content
BMD	Bone Mineral Density (g/cm^2)
BMI	Body Mass Index
BUA	Broadband Ultrasound Attenuation
CI	Confidence Intervals
Cm	Centimeter
DEXA, DXA	Dual Energy X-ray Absorptiometry
DXL	Dual X-ray and Laser absorptiometry
HRT	Hormone Replacement Therapy
IOF	International Osteoporosis Foundation.
Kg	Kilogram
LS	Lumber Spine
MC	Medical Center
MRI	Magnetic Resonance Imaging
NOF	National Osteoporosis Foundation.
OR	Odd Ratio
PBMD	Peak Bone Mineral Density
PEM	Protein Energy Malnutrition
PTH	Parathyroid Hormone
QA	Quality Assurance
QCT	Quantitative Computed Tomography.

QUS	Quantitative Ultrasound
RA	Radiographic Absorptiometry
SD	Standard Deviation
SOF	Study of Osteoporotic Fractures
SOS	Speed of Sound
SXA	Single X-ray Absorptiometry
T-score	Patient's BMD related to the mean BMD of a young normal healthy reference population
WHO	World Health Organisation
Z-score	Patient's BMD related to the mean BMD of an age-matched reference population

Abstract

Environment is the sum of the total of the elements, factors and conditions in the surroundings which may have an impact on the development, action or survival of an organism or group of organisms. Furthermore environment is all the physical, chemical and biological factors external to a person, and all the related behaviors.

The interaction of humans with their environment divided into six major macro environment forces: cultural, demographic, economic, natural, political, and technological. The demographic environment includes the study of human populations in terms of size, density, location, age, sex, race, occupation, and other statistical information. This interaction honestly affect the human health.

One of the major healthy problem affecting a large proportion of the population is the osteoporosis disease "low bone mineral density".

The international osteoporosis foundation (IOF) estimates that 200 million women suffer osteoporosis across the world. Osteoporosis is characterized by a decrease in bone mass, which leads to fragility and consequently an increase in the risk of fractures. Osteoporosis has a number of serious complications, such as skeletal pain, kyphosis and fractures.

Many of the researches performed, in the past few years, have shown an important role for environmental factors in the appearance of low bone mineral density (BMD).

The main goal of the present study is to evaluate the prevalence of osteoporosis, and the impact of the environmental and other factors on osteoporosis development.

The research is a cross-sectional study, where 127 (111 women and 16 men) Palestinian population in East Jerusalem from 45 years of age onwards, is participated in the study between January 2008, and January 2009. A convenience sample of participants from health clinics that serve Palestinians residing in urban, rural and refugee camps were selected, with no exclusion criteria. A questionnaire with the risk factors mentioned above was performed, as well as lumbar spine & both hip joints BMD measured with a DXA

Prodigy Dual Photo Absorptiometer (LUNAR Corp.), weight, and height where assessed. A T-score will be derived by comparing each participant's BMD with the optimal and peak BMD of a 30-year-old healthy adult, as the World Health Organization criteria. Baseline and post intervention data analyzed by using Chi-square analyses and T-score data to determine the statistical significance of changes in risk factors and other variables of interest; regression analyses will be used to identify possible predictors of changes in risk factors scores.

By using T-scores from two bone sites; the prevalence of osteoporosis (T-scores ≤-2.5) was 22 % and 3.4% in post -and pre -menopausal women, respectively. and The finding in our study clearly demonstrate that the BMD of all the female subjects (pre-and post-menopauses) in east Jerusalem reaches 17% lower than the peak BMD, and the prevalence of osteopenia reaches 48.6%, whereas only 34.2% have a normal results. These data suggested that apart from advancing age, lower BMI, cigarette smoking, low Exposure to the Sun, and low milk consumption, is a significant modifiable determinants of bone mineral density in the Palestinian women society. The results also demonstrate that osteoporosis is significantly associated with gender, menopause, marital status and the animal proteins intake, for all these determinants the P-value < (0.05).

The conclusion of our study: The prevalence of osteoporosis in Palestinian women society is comparable or more than other countries. The present study revealed that the environment have a considerable role to develop or prevent osteoporosis prevalence in Palestinian women, but no statistically significant differences were observed in mean values of BMD between Palestinians residing in urban, rural and refugee camps.

ملخص الدراسة

مدى انتشار مرض هشاشة العظام في القدس الشرقية
و تأثير العوامل البيئية

البيئة هي ناتج مجموع العوامل والتأثيرات والظروف المحيطة التي من الممكن أن تؤثر على تطور وحياة الكائنات الحية أو مجموعة منها. بالإضافة إلى أن البيئة تمثل جميع العوامل الفيزيائية والكيميائية والبيولوجية المحيطة بالإنسان، وتشمل العادات والتصرفات المكتسبة.
علاقة الإنسان بالبيئة تتفرع إلى ست أقسام رئيسية: ثقافية، ديموغرافية، اقتصادية، طبيعية، سياسية وتكنولوجية. البيئة الديموغرافية تتطلب دراسة المجتمع من عدة نواحي مثل الحجم، الكثافة، الموقع، العمر، الجنس، السلالة، بالإضافة إلى نواحي الحياة المختلفة. هذه العلاقة تؤثر على صحة الإنسان.
ومن أهم المشاكل الصحية التي تؤثر على قطاع كبير من الشعوب هو مرض هشاشة العظام.

تقدر مؤسسة هشاشة العظام الدولية أن 200 مليون امرأة حول العالم مصابة بمرض هشاشة العظام. يتصف هذا المرض بانخفاض في كثافة العظم ، مما يؤدي إلى زيادة الليونة في العظام وهذا يزيد احتمال وقوع كسور فيها. لهشاشة العظام عواقب عديدة مثل أوجاع في الهيكل العظمي انحناء العمود الفقري والكسور. في السنوات الأخيرة أظهرت بعد الدراسات أن للعوامل البيئية أهمية كبيرة في ظهور انخفاض كثافة العظام.

الهدف الرئيسي من هذه الدراسة هو تقييم مدى انتشار هشاشة العظام ومدى تأثير العوامل البيئية وعوامل اخرى عليه.

هذه الدراسة هي دراسة مقطعية حيث أن 127 شخص (111 امرأة و 16 رجل) من الفلسطينيين القاطنين في القدس الشرقية وأعمارهم 45 سنة فما فوق اشتركوا بالدراسة في الفترة ما بين كانون ثاني 2008 وكانون ثاني 2009 . عينة الدراسة تم إشراكها بالبحث بمساعدة المراكز الطبية التي تقدم خدمات للفلسطينيين في كل من الأرياف والمدن ومخيمات اللاجئين.تم تعبئة استبيان حول

عوامل الخطر بالإضافة إلى عمل فحص هشاشة العظام باستخدام جهاز(DXA) لفقرات الظهر السفلية ولمفصل الورك الأيمن والأيسر "عنق عظمة الفخذ" لكل مشترك بالإضافة إلى قياس الطول والوزن.

نتائج الفحوصات الطبية تم حسابها باستخدام قيمة(T-score) بمقارنة كثافة عظام كل مشترك بذروة كثافة العظم عند الشخص السليم بعمر 30 عام، حسب توصيات وزارة الصحة العالمية. معطيات قيمة (T-score) كنتيجة للفحص الطبي بالإضافة إلى معطيات الاستبيان تم تحليلها إحصائيا باستخدام برنامج الإحصاء المحسوب (SPSS)لإظهار النتائج النهائية.

وبحسب هذه المعطيات فإن النتائج النهائية للدراسة أكدت أن (22%) من النساء (في سن اليأس) و (3.4 %) من النساء (اللاتي في سن الإنجاب) تعاني من مرض هشاشة العظام. ونتيجة لهذه الدراسة كان واضحا أن نسبة انتشار مرض هشاشة العظام لدى النساء عامة في شرقي القدس بلغت(17%) وبلغت نسبة النساء المصابات بلين العظام (48.6 %) وفقط (34.2 %) من جميع النساء المشاركات كانت نتائجهم سليمة. كما أن تحليل المعطيات لهذه الدراسة أكد أن زيادة العمر ،انخفاض كتلة الجسم، التدخين،قلة التعرض لأشعة الشمس وقلة استهلاك الحليب ،هي أسباب رئيسية لظهور مرض هشاشة العظام عند المجتمع النسوي الفلسطيني، بالإضافة إلى ذلك فإن هذا البحث أظهر أن هناك علاقة وثيقة بين كل من الجنس،انقطاع الطمث عند النساء ، الحالة الاجتماعية استهلاك البروتينات الحيوانية وبين نقص كثافة العظم في منطقة القدس الشرقية ، لجميع العوامل سابقة الذكر كانت قيمة (*P*-Value) أقل من (0.05).

الاستنتاج النهائي للدراسة هو أن مدى انتشار مرض هشاشة العظام عند النساء الفلسطينيات مشابه أو يزيد عن مدى انتشاره في الدول الأخرى.

كما أن هذه الدراسة تؤكد أن للبيئة دور هام لزيادة أو الحد من خطر الإصابة بنقص كثافة العظم عند النساء الفلسطينيات ، لكن لم تظهر أي فروقات في كثافة العظم بين الفلسطينيين المقيمين في المناطق الريفية أو المدنية أو مخيمات اللاجئين.

List of Tables

List of Figures

Table of Contents

Chapter Four: Results

Chapter Five: Discussion

Chapter six: Conclusion and Recommendations

Chapter 1
Introduction

1.1 : Background:

Osteoporosis is a major public health problem, affecting a large proportion of the population and can be defined as a loss of bone mass, larger than expected, due to the aging process. Due to the loss of bone, there are microarchitectural changes of the bone tissue. Peak bone mass of the skeleton is achieved between the ages 20-30, and bone loss starts after the age of 35 and is related to aging. Other factors also affect this process, as well as environmental causes.

The loss of bone mass is about 1% per year, in women during menopausal period, after menopause it can achieve 2% per year, due to the hormonal changes, especially the reduction of estrogen secretion.

Osteoporosis is 6 times more prevalent in women than in men, in men, osteoporosis appears at a later age than women, due to the greater bone mass found in men. This is the result of genetic factors. The appearance of osteoporosis is related to peak bone mass, a higher one prevents or delays the appearance of osteoporosis. Environmental factors play an important role in the development of the skeleton, especially on bone mass. Physical exercise, a balanced diet which contains the needed amounts of calcium and vitamin D as well as an adequate amount of proteins, determines the peak bone mass. Large amounts of protein and salt in the diet increase calcium secretion in the urine.

The international osteoporosis foundation (IOF) estimates that 200 million women suffer osteoporoses across the world.

Osteoporosis has a number of serious complications, such as skeletal pain, kyphosis and fractures. The typical fractures of osteoporosis are of the wrist, spine, ribs, and neck of

femur. The fracture of the hip is a serious complication and needs surgical intervention with a long period of rehabilitation. Patients with a fracture of the hip, especially in the higher age group, do not recover completely and do not return to their previous functional state. (Kado, 1999), (Johnell, 2003). There is also higher mortality due to this type of fracture.

Osteoporosis is a major risk factor for fracture and one of the major health problems in the world, considering the costs for the fragility fractures and the individual suffering. Both hip and vertebral fractures are associated with excess mortality (Kado, 1999), (Johnell, 2003).

Approximately 18,000 hip fractures and about 25,000 wrist fractures occur in Sweden. Vertebral fractures often remain undiagnosed although they are very common (Grados, 2004), (Kanis, 2004). Women are seldom evaluated despite a history of a previous fracture. Many of these women visit their family doctors at the primary health care centers for their other medical conditions but their osteoporosis is seldom diagnosed and treated. Osteoporosis is a common condition among women, the prevalence in Palestine is not known but according to physicians in the West Bank and Gaza, it is on the rise. In white populations, every second woman over 50 suffers a fragility fracture in her remaining lifetime (Kanis, 2000). In fact, women have a greater risk of hip fracture (one in six) compared with a one in nine risk of breast cancer (van Staa, 2002). The study presented in this thesis is part of a bigger project that intends to elucidate the epidemiology and risk factors for osteoporosis and the environmental factors effect on osteoporosis, in Palestine.

1.2 Problem statement:

The magnitude of morbidity and mortality associated with untreated osteoporosis is high; therefore it is important to determine the environmental risk factors in the East Jerusalem population. The determination of these factors and the correlations with the measurements of BMD will make it possible to identify people with a high risk of osteoporosis and to recommend preventive and therapeutic measurements.

1.3 Study justification:

Some researches proofed the importance of the environmental factors effect on the appearance of osteoporosis; on the other hand, other researches showed that these factors are not significant; therefore the importance of the environmental factors in developing of this disease has been investigated in this study.

There are many environmental differences in Palestine based on living location; therefore these environmental differences should be investigated to show its effect on the osteoporosis.

Because there are few studies about the osteoporosis prevalent in Palestinian population, it is very important to do a survey in east Jerusalem as first step for a survey project for all Palestinian population in the future.

1.4 Aims.

1.4.1 General Aim:

The general aim of this research was to evaluate the prevalence of osteoporosis and the risk factors for osteoporosis among Palestinian elderly population in East Jerusalem. The research is a cross-sectional study where the epidemiology, environmental and risk factors for osteoporosis are studied.

1.4.2. Specific Aims:

- To investigate the relationship between the environment and the prevalence of bone mineral density in an elderly population and to study the influence of different reference populations on the results of osteoporosis diagnosis.
- Determine prevalence of osteoporosis by using densitometry scan (DXA) method stratified by age and residency in Palestinians aged 45 years old or more living in East Jerusalem.

- Determination of the values of bone mineral density BMD (L2-L4 and the femoral neck) and evaluation of occurrence of osteoporosis among normal women living in rural and urban environments.
- Study some environmental factors (life style locality, personal behaviors, smoking, physical activity and exposure to the sun light) which affect the incidence of bone mineral density (BMD) in the targeted population using a special questionnaire
- To compare BMD between people living in the city, villages and in Palestinian camps.

1.5 Research Questions:

1) Is osteoporosis common in east Jerusalem?
2) Is there any relationship between living place and osteoporosis? And what is the effect of the environment on osteoporosis?
3) Can dietary consumption behavior be modified by an intervention program? Does exposure to food intake and osteoporosis information increase appropriate nutrient consumption?

1.6 Assumptions:

I assumed that: Palestinian people will respond to research questionnaire truthfully and thoughtfully. Medical centers and family doctors will help in facilitating the research process. Medical diagnosis report for bone density will be prepared by a bone diseases specialist doctor for each participant.

1.7 Limitations:

The East Jerusalem population participating in the study is not necessarily representative of Palestine.

Cost implications; This study needs to scan the participants by special machine, called DEXA machine for bone marrow density.

The location of the DEXA machine, which used to perform the participants medical test, is located in west Jerusalem, therefore it was difficult to move the participant from one location to the other.

1.8 Targeted population:

Palestinians residing in East Jerusalem from 45 years of age onwards

1.9 Summary:

Some studies approved an important role of environmental factors in the appearance of osteoporosis, and other researches show this factors are not significant. many studies approved an important role of nutrition in the appearance of osteoporosis.

Some studies in Palestine focused on the prevalence of osteoporosis by using quantitative heel ultra sound or DEXA machine, but this is the first study on east Jerusalem using DEXA machine to study the relation ship between the osteoporosis and the environmental factors, nutritional factors, demographic factors.

Chapter Two
Osteoporosis Definitions

2.1 Introduction:

Roughly every ten years, the entire adult skeleton is replaced by remodeling. Osteoporosis is the result of an imbalance between bone resorption and bone formation. Osteoporosis occurs when there is an uncoupling between the bone formation of osteoblasts and bone resorption of osteoclasts, and bone resorption exceeds bone formation. This imbalance leads to increased fragility of bone. Osteoporotic fractures usually result from a combination of increased fragility of bone and increased rate of falls.

The first internationally accepted definition of osteoporosis came in 1993:
"A systemic skeletal disease characterized by low bone mass and micro architectural deterioration of bone tissue, with a consequent increase in bone fragility and susceptibility to fracture risk."

This definition is of little help when we want to diagnose osteoporosis. Osteoporosis is a part of the human ageing process and we can divide osteoporosis into primary osteoporosis caused by natural ageing and other risk factors, and secondary osteoporosis caused by other medical conditions and their treatment.

The Dual X-ray Absorptiometry (DXA) gives us a possibility to measure bone mineral density (BMD) very accurately. Thus, it can be used as a diagnostic test for osteoporosis. The WHO definition of osteoporosis 1994 is based on bone mineral density. A cut-off value of 2.5 SD below the BMD of young adult mean value was chosen to define osteoporosis. The WHO definition was originally created mainly for epidemiological purposes but is commonly used today for clinical purposes. When the WHO definition was created the sites of measurement of bone mineral density included in the definition were the femoral neck, lumbar spine and forearm. The cut-off points below identify approximately 30% of postmenopausal women as osteoporotic. The definition only applies to postmenopausal women and not to younger women and not to men.

WHO definition in 1994 (WHO 1994):

1) Normal bone density, BMD not more than 1 SD below the young adult mean BMD.

2) Osteopenia, BMD equal or more than 1 SD below the young adult mean BMD but less than or equal 2.5 SD below the young adult mean BMD.

3) Osteoporosis, BMD 2.5 SD or more below the young adult mean BMD.

4) Established (or severe) osteoporosis, is defined as an osteoporotic BMD value in a patient with an osteoporotic fracture.

The diagnosis of osteoporosis is based on an osteoporotic BMD value. It is important to remember that the decision about treatment is a weighted judgment where BMD is one of the risk factors taken into account.

Measuring bone mineral density is the best available non-invasive method to assess bone strength in clinical practice, but we must remember that there are other skeletal factors, often called bone quality, contributing to bone strength such as bone shape, bone micro architecture and bone turnover (Heaney, 2003).

2.2 Prevalence of Osteoporosis:

Osteoporosis is a worldwide problem because of the fractures that occur. The burden of fractures is increasing in direct correlation with life expectancy. This increase is greater in underdeveloped countries (Figure 2.1).

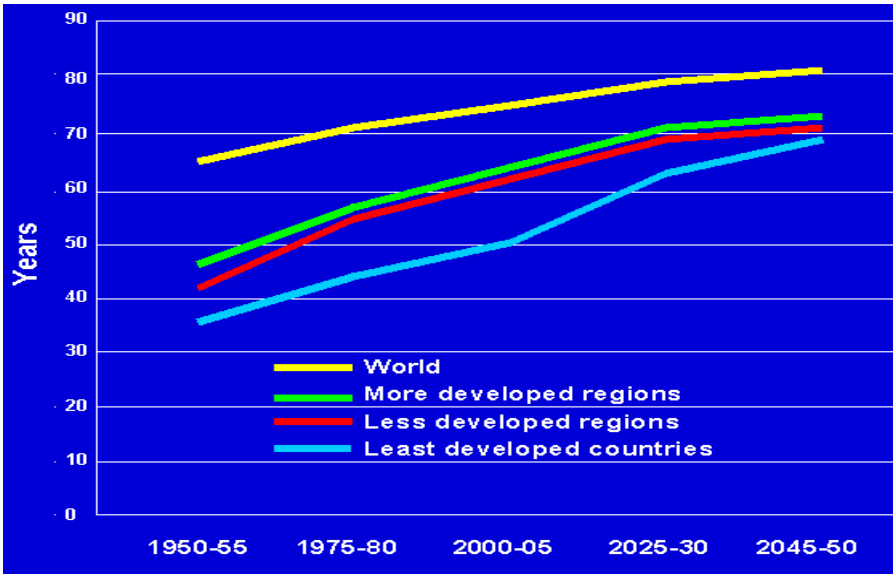


Figure (2.1): Life expectancy at birth
Source: (Maalouf, 2007).

According to the National Osteoporosis Foundation (NOF), the number of postmenopausal women in the United States will double over the next 20 years, leading to a tripling of the number of osteoporotic fractures in 2040. (NOF 2004).

The International Osteoporosis Foundation (IOF) estimates that 200 million women suffer from osteoporosis across the world.(IOF 2005).

Moreover, osteoporosis has been misconceived as a women's disease because it also affects men significantly .

Indeed, at least one in five men compared to one in three women over the age of 50 will have an osteoporosis (NOF, 2004)

Osteoporosis is a major health risk for 28 million Americans. In the United States today, 10 million individuals already have osteoporosis, and 34 million at risk.

55% of people over 50 in the USA have osteoporosis risk, 80% of cases are women and 20% are men. (NOF, 2004)

50% of women over 50 in the USA will have an osteoporosis related fracture during their lifetime (NOF, 2004). Overall, "approximately eight million American women and 2 million men have osteoporosis" (excerpt from Osteoporosis: NWHIC, 2001).

By 2030, the increase in the aged population will affect developing countries more than developed ones (Figure 2.2), and this will increase occur in both sexes.

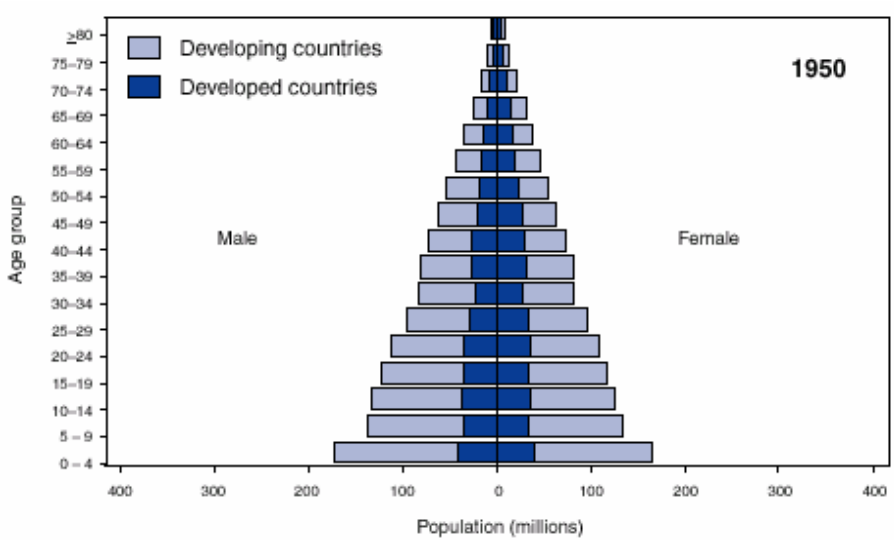


Figure (2.2.A) Age population distribution in 1950
Source: (Maalouf , 2007).

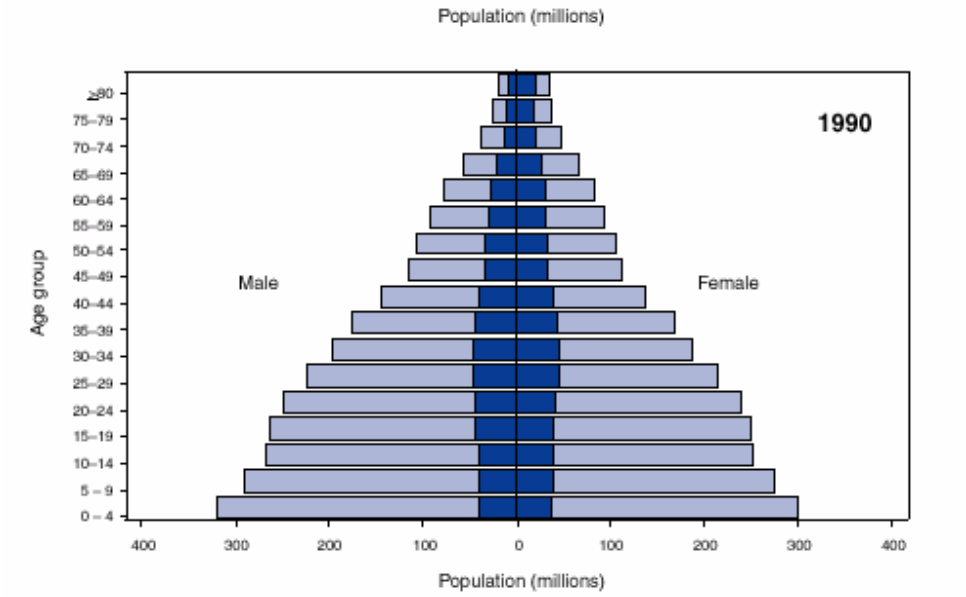


Figure: (2.2.B) Age population distribution in 1990
Source: (Maalouf , 2007).

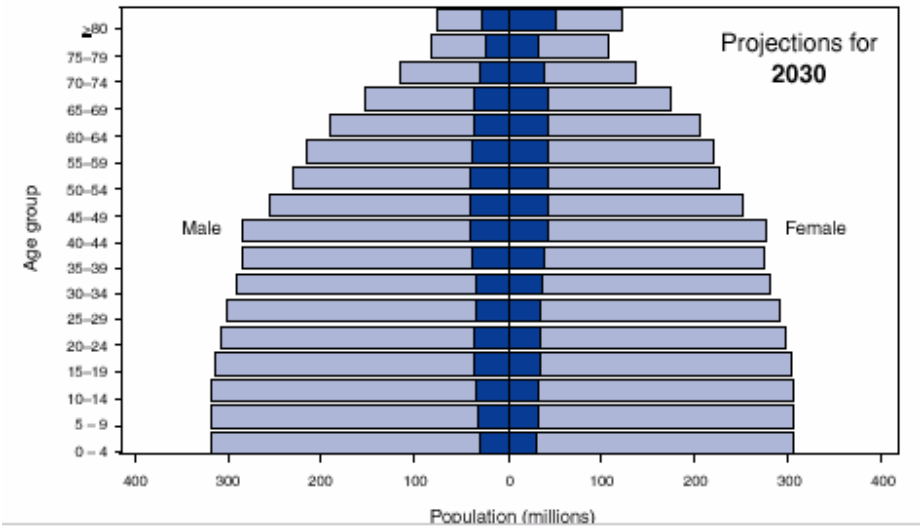


Figure: (2.2.C) Age population distribution in 2030
Source: (Maalouf , 2007).

The following chart illustrates the estimated prevalence of osteoporosis and low bone mass in the U.S. population through the year 2020.

Table(2.1): Prevalence of Osteoporosis and Low Bone Mass in People Aged 50 and Over.

	2002	**2010**	**2020**
Osteoporosis and Low Bone Mass in Women and Men	43,600,000	52,400,000	61,400,000
Osteoporosis in Women and Men	10,100,000	12,000,000	13,900,000
Low Bone Mass in Women and Men	33,600,000	40,400,000	47,500,000
Women With Osteoporosis or Low Bone Mass	29,600,000	35,100,000	40,900,000
Women With Osteoporosis	7,800,000	9,100,000	10,500,000
Women With Low Bone Mass	21,800,000	26,000,000	30,400,000
Men With Osteoporosis and Low Bone Mass	14,100,000	17,300,000	20,500,000
Men With Osteoporosis	2,300,000	2,800,000	3,300,000
Men With Low Bone Mass	11,800,000	14,400,000	17,100,000

An Ontario baseline data from the Canadian Multi center Osteoporosis study. The study population comprised 1376 women, testing with dual-energy X-ray absorpiometry (DXA) at both the femoral neck and the lumber spine (L1-L4). The results of the study shows that 38.7% reduction in DXA testing . the main outcome measure was low bone mineral density (T-score of 2 or more standard deviation below the mean for young Canadian women). (Canadian Medical Association, 2000).

A descriptive study in Thailand of 1,935 Thai women ranging in age from 40 to 80 years, with randomly selected strata using multistage sampling and stratifying from six representative provinces of the country. After recruiting, all the women were interviewed by a well-trained interviewer using structured questionnaires. Bone mineral density (BMD) of lumbar spine 1-4 and non dominant hip was measured by a dual energy photon absorptiometer. By Using the Thai BMD reference, the age-specific prevalence of osteoporosis among Thai women rose progressively with increasing age to more than 50% after the age of 70. The age-adjusted prevalence of osteoporosis also rose progressively. It was 19.8%, 13.6%, and 10% for lumbar spine, femoral neck, and intertrochanteric. The age-adjusted prevalence of osteoporosis indicates the overall magnitude of that condition in

the population or country. using a Western BMD reference resulted in a misleadingly high prevalence of osteoporosis in the population of Asian countries.(Khunying, 2001)

The reference values in Chinese criteria for the diagnosis of primary osteoporosis, higher than the young adult mean using WHO criteria for all skeletal regions except for the total hip, at a range of 0.9%–3.8% higher. The BMD cutoff values using Chinese criteria for the diagnosis of osteoporosis were 3.7%–10.9% higher than those using WHO criteria for various skeletal regions (Xian-Ping, 2002)

A chine's Cross-sectional study was done to determine age-specific bone mineral density (BMD) at various skeletal regions in a native Chinese reference population, and to explore the differences in the diagnosis of primary osteoporosis and estimated prevalence of osteoporosis based on both Chinese criteria (BMD of subjects, 25% lower than the peak BMD) and WHO criteria (BMD of subjects, 2.5 SD "T-score –2.5" lower than the young adult mean). There were 3406 subjects in the female reference population, ranging in age from 10 to 90 years. A dual-energy X-ray absorptiometry (DXA) fan-beam bone densitometer was used. hip (including femoral neck and total hip), and radius + ulna of the forearm. data analysis in stratified 5-year age intervals revealed that the peak BMD (PBMD) at various skeletal regions occurred within the age range of 30–44 years, with PBMD at the lateral spine and femoral neck occurring at 30–34 years, posteroanterior spine and total hip at 35–39 years, and distal forearm at 35–44 years.. The prevalence rate of primary osteoporosis according to Chinese criteria in subjects ranging from 50 to 90 years was 41.5% at the PA spine, 53.9% at the lateral spine, 34.2% at the femoral neck, 30.7% for total hip, and 51.4% at distal forearm; while according to WHO criteria, this rate was 32.1% at the PA spine, 34.9% at the lateral spine, 16.3% at the femoral neck, 18.9% for total hip, and 45.2% at distal forearm. The prevalence of primary osteoporosis according to both criteria varied with the age and skeletal region of the subjects. The prevalence of primary osteoporosis using Chinese criteria, compared with WHO criteria was 31% higher at the lumbar spine, 109% higher at the femoral neck, and 14% higher at the distal forearm. In conclusion, PBMD occurs in the age range of 30–44 years in native Chinese females. The BMD reference values, BMD cutoff values, and prevalence of primary osteoporosis determined by Chinese criteria are all higher than those determined by the WHO criteria;

thus, the application of Chinese criteria may overestimate the number of patients with primary osteoporosis. (Xian-Ping, 2002)

2.3 Osteoporosis in the Middle East:

in Saudi Arabia, the prevalence of osteoporosis was studied in a randomly selected group of 1980 Saudi males and females aged 20 to 79 years. The prevalence of the disease in Saudi women was 44.5% using the manufacturer's reference values compared to only 28.2% when the Saudi reference values were used. On the other hand, less Saudi men are diagnosed with osteoporosis when the manufacturer's reference values are used compared to the prevalence when the Saudi Arab reference value is used. Thus, the prevalence of osteoporosis in the Saudi Arab population is overestimated in women and underestimated in men when using the US/European data reference rather than the Saudi Arabian reference value (El-Dessouki, 2003).

A cross-sectional study of Jordanian women who visited outpatient clinics between August 2000 and August 2002 at two community hospitals in Amman City. BMD measurement was performed for all subjects, while comprehensive appraisal of clinical issues related to reproductive status and past medical history was carried out using a structured questionnaire administered to 50% of the subjects. According to WHO criteria, 119 (29.6%) were identified as having osteoporosis, 176 (43.8%) were osteopenic, and 107 (26.6%) had normal BMD. The multiple population. It was concluded that the prevalence of this worldwide public health problem among the Jordanian female population is extremely high, and is even found in younger age categories compared to previous international surveys (Sireen Shilbayeh, 2003).

A Lebanese study, using (QUS), looked at the prevalence of osteoporosis and osteopenia on a randomly selected sample of 4,320 women, ages ranging from 20 to 79. Broadband ultrasound attenuation (BUA), speed of sound (SOS) and stiffness index (SI) of the calcaneus were measured. The study showed an overall decline of 19.2% for BUA, 3.1% for SOS and 30.3% for SI between late adolescence and old age. The SI value for the female Lebanese young adult reference was 8% lower than that of the North American and European women (92 SI units compared to 100). At the age of 42, the SI value in Lebanese

women was 10.4% lower than North American women and 7.5% lower than European women (86 SI units compared to 96 and 93, respectively). The decline in SI for the Lebanese women between age 20 and 75 is about 30.3% compared to 32% for the North American or European reference curves. (Maalouf, 2000).

In the Palestinian society, very limited data is available on the epidemiology of osteoporosis in the west bank and Jerusalem district (Jabari, 2006).
Study about osteoporosis prevalence was conducted by Ms Al-shawish from Al-quds University, shows that the prevalence rate of the 100 postmenopausal woman screened by (QUS), 50% had Osteoporosis, 44% had osteopenia and only 4% were normal.(Al-Shawesh, 2008).

Another study was conducted by Miss Smoom from Al-quds University, shows that in association with BMD in 344 (165 osteoporotic, 93 osteopenic, and 86 normal) Palestinian woman in Bethlehem District (Smoom, 2005).

2.4 Osteoporosis complication:

Osteoporosis has a number of serious complications, such as: skeletal pain, kyphosis and fractures.

2.4.1 Kyphosis:

Kyphosis is a curving of the spine that causes a bowing of the back, which leads to a hunchback or slouching posture.

Kyphosis describes the progressive spine hump which is a result of physical changes in the spine and adjacent muscles, tendons, and ligaments occurring after vertebral fractures. The degree of kyphosis varies with the number of fractures and muscle strength.

2.4.2 Fractures:

Osteoporosis accounts for 70% of all fractures for people over 45 in the US (NIH, 2006). Osteoporosis also causes over 1.5 million fractures each year in the USA (NOF, 2004).
The typical fractures of osteoporosis are of the wrist, spine, ribs and neck of femur. The lifetime risk of fractures of the spine (symptomatic), hip, and distal radius is 40% for white women and 13% for white men from 50 years of age onwards. Following a hip fracture, there is a 10%–20% mortality over the subsequent 6 months, 50% of sufferers will be unable to walk without assistance, and 25% will require long-term domiciliary care. Contrary to prevailing opinion, the morbidity and suffering associated with wrist and spine fractures are also considerable.(Lawrence Riggs, 2008).

2.4.2.1 Hip Fracture:

The fracture of the hip is a serious complication and needs surgical intervention with a long period of rehabilitation. Patients with a fracture of the hip, especially in the higher age group, do not recover completely and do not return to their previous functional state. Osteoporosis causes over 300,000 hip fractures each year in the USA (NOF, 2004).
Hip fractures are usually painful, and nearly always necessitate hospitalization. In many countries, the mean hospital stay is 30 days. The number of hospital bed-days accounted

for by hip fracture among women is similar to that for cardiovascular disease, breast cancer and chronic obstructive pulmonary disease (Kanis, 1997).

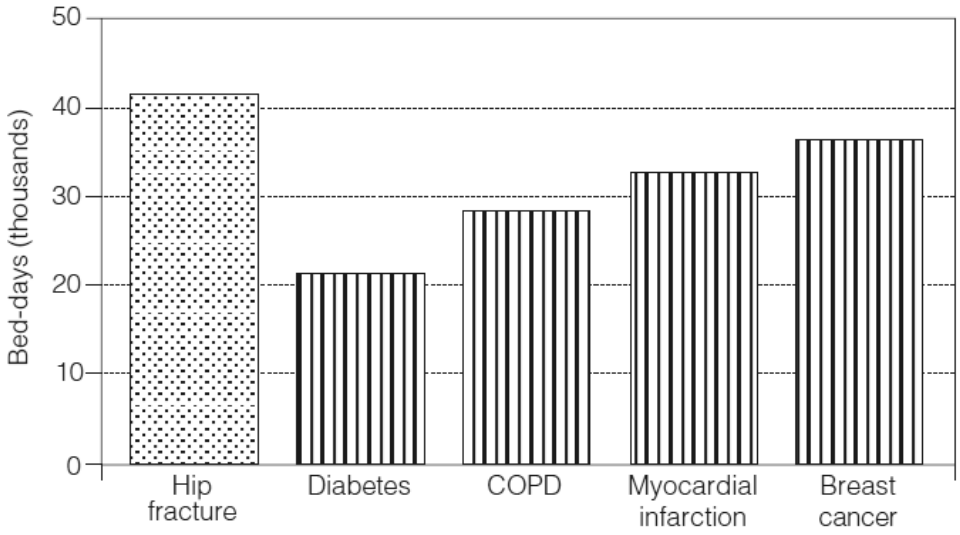


Figure (2.3): Hospital bed-days for hip fracture and other chronic diseases in women aged 45 years or more from the Trent Region of the United Kingdom.
Source: (Kanis, 1997)

As shown in (Figure 2.4), incidence rates for hip fractures increase exponentially with age in both sexes, reaching about 3% annually among Caucasian women aged 85 years and over; rates for Caucasian men of all ages are about half as much. Overall, 90% of hip fractures occur among people aged 50 years and over, and 80% occur in women. The average age at which osteoporotic hip fractures occur is about 80 years in developed countries but is less in countries with lower life expectancies. Age-adjusted and sex adjusted hip fracture rates are generally higher in Caucasian than in black or Asian populations, although urbanization has led to higher hip fracture rates in Asia and certain parts of Africa. Furthermore, the pronounced female preponderance observed in white populations is not seen among blacks or Asians, in whom male and female rates are similar (Gullberg, 1997).

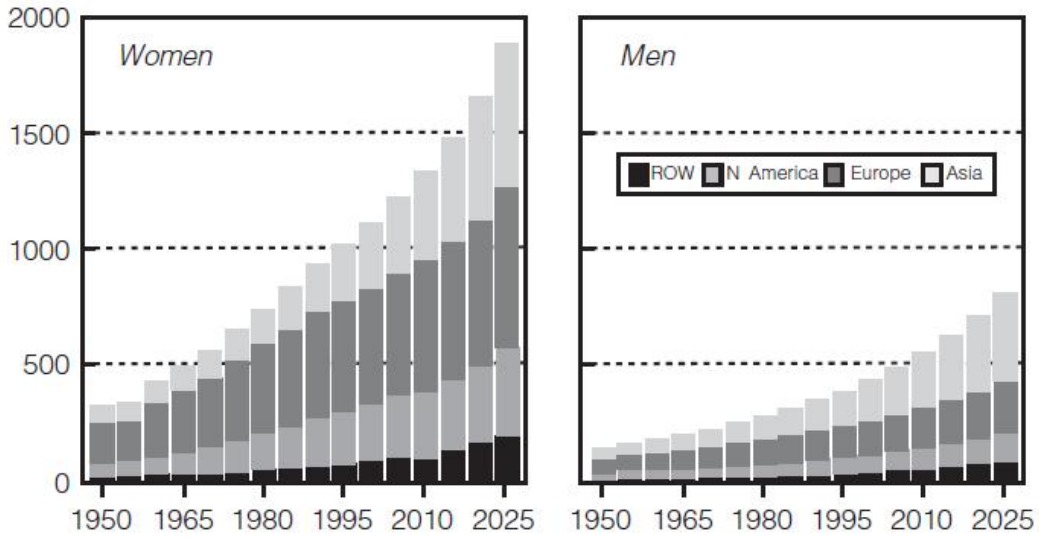


Figure (2.4): Estimates of the number of hip fractures between 1950 and 2025 by gender and Region HIP fractures (thousands).
Sours: (Gullberg, 1997).

2.4.2.2 Vertebral Fracture:

Osteoporosis causes over 700,000 vertebral fractures each year in the USA (NOF, 2004). Available data indicate that the incidence of vertebral fractures, like that of other osteoporotic fractures, is greater among women than among men and increases with age. Between the ages of 60 and 90 years, the incidence rises 20-fold in women but only 10-fold in men (Kanis, 1992). This age-related increase is less than that observed for hip fractures and there is also less variation in incidence rates among countries than for hip fractures (O'Neil, 1996). Vertebral fractures that come to clinical attention cause a significant decrease in the quality of life, although the impact is less than that of hip fractures. Approximately 4% of women with a vertebral fracture need assistance in conducting activities of daily living (Chrischilles, 1991). Quality of life becomes progressively impaired as the number and severity of vertebral fractures increases (Oleksik, 1998).

Vertebral fracture rarely leads to hospitalization; in the United Kingdom, as few as 2% of patients may be admitted, although this figure may be an underestimate depending on the accuracy of coding clinical cases (Kanis, 1992).

A fractured vertebra can take anywhere from six to eight weeks for the bone to set and up to 12 weeks to heal completely. But recovery from a vertebral fracture goes beyond healing

the bone. Recovery becomes an ongoing process to enable you to regain strength and mobility and to resume your daily activities.

2.4.2.3 wrist fractures:

Wrist fracture is the most common type of fracture before the age of 75. In women, the number of wrist fractures increases at menopause and plateaus after age 65. This increased incidence is most likely related to the rapid loss of bone in the years following menopause**.** Osteoporosis causes over 250,000 wrist fractures each year in the USA (NOF, 2004).

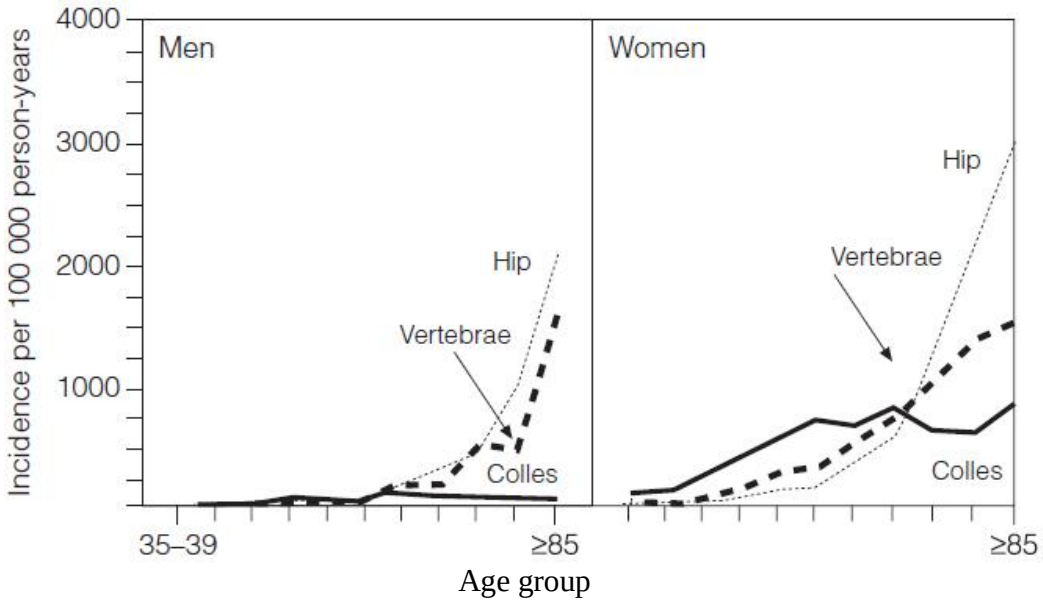


Figure (2.5) Age-specific incidence rates of hip, vertebral and Colles (forearm) fracture in Rochester, MN, USA

Source: (Cooper, 1992).

2.5 Economic Burden:

Over 1.3 million osteoporotic fractures occur each year in the United States.(Consensus Development conference, 1993). Osteoporotic fractures affect the quality of life and are associated with premature mortality(Browner, 1996). Spinal fractures commonly cause pain, deformity, loss of height and disability and are associated with an increased risk of fractures within the next year(Nevitt, 1998), (Rigs, 1995). while hip fractures are more painful and almost always require hospitalization (Lindsay, 2001). Many of those who suffer hip fractures never regain their normal mobility.

The overall mortality rate of hip fractures is 20 to 24 percent, the majority of deaths occurring in the first six months after the fracture(Leibson, 2002). In addition, survival after a hip fracture is less in men than in women(.Center, 1999).

In 2000 the number of osteoporotic fractures in Europe was estimated at 3.79 million. The total direct costs were estimated at €31.7 billion (£21 billion) which were expected to increase to €76.7 billion (£51 billion) in 2050 based on the expected changes in the demography of Europe. In the USA $47 million each day in direct expenditure on hip fractures. (NOF, 2004) and $14 billion annually (NIH, 2006).

A study predicts the burden of incident osteoporosis-related fractures and costs in the United States done, A state transition Markov decision model was used to estimate total incident fractures and costs by age, sex, race/ethnicity, and skeletal site for the U.S. population ≥50 years of age for 2005–2025.

The results of the study is. More than 2 million incident fractures at a cost of $17 billion are predicted for 2005. Total costs including prevalent fractures are more than $19 billion. Men account for 29% of fractures and 25% of costs. Total incident fractures by skeletal site were vertebral (27%), wrist (19%), hip (14%), pelvic (7%), and other (33%). Total costs by fracture type were vertebral (6%), hip (72%), wrist (3%), pelvic (5%), and other (14%). By 2025, annual fractures and costs are projected to rise by almost 50%. The most rapid growth is estimated for people 65–74 years of age, with an increase >87%. An increase of nearly 175% is projected for Hispanic and other subpopulations. (Russel**,** 2007).

The burden of disease may be even greater in developing countries, including the Middle East. In our countries, osteoporosis represent a heavy financial burden. In Lebanon, the direct cost of hip surgery is 9,000USD, taking into consideration that the minimum income level of the Lebanese population is 200 USD per month.In Iran According to the Ministry of Health, the yearly cost of hip fractures is between 8,000,000 and 16,000,000 USD(Larijani, 2004).

2.6 Measurements of Bone Mineral Density (BMD):

Bone densitometry is a noninvasive technology that is used to measure bone mass. Bone mass, simply put, is the weight of the skeleton, overall or in specific regions. Bone mineral density, or BMD, reveals a risk factor for fractures. BMD is usually expressed as the amount of mineralized tissue in the area scanned (g/cm2); with some technologies it is expressed as the amount per volume of bone (g/cm3).(Bone Densitometers, 2004).

2.6.1 Imaging Modalities:

Outside of research settings, it has been largely replaced by radiographic methodology. Unfortunately, different techniques produce different results, even at the same site. (Kanis, 2000). Because bone mass may be discordant at various skeletal sites in an individual patient (Njeh, 1998), and because different techniques give different results even at the same site, T-scores cannot be used interchangeably with different techniques or at different sites.(NIH, 2006), (Kanis, 2000).

Three major imaging modalities are commonly used in the clinical setting: dual-energy x-ray absorptiometry (DXA), quantitative computed tomography (QCT), and calcaneal ultrasonography (US).

Table (2.2): Comparison of Different Modalities for Assessing Bone Fracture Risk

Factor	**DXA**	**QCT**	**US**
Cost	Intermediate	High	Low
Radiation	Low	High	None
Portability	Limited	No	Yes
Parts measured	Spine, hip, wrist	Spine, hip	Calcaneus
Precision	Excellent	Good	Low
Monitoring of treatment response	Excellent	Good	Low

Sours: (Kanis, 2000)

2.6.1.1 Dual Energy X-Ray Absorptiometry (DXA)or (DEXA):

DXA is the most widely used technique for measuring BMD. (Miller, 1999). The WHO criteria were established largely with DXA in mind. (Kanis, 2000). Measurements can be obtained from any site in the body, but the standard sites are the lumbar spine, the proximal femur, and the distal forearm. The high level of precision of this technique allows not only for diagnosis, but also for monitoring response to therapy. DEXA is a diagnostic test used to assess bone density in using radiation exposure about one tenth of that of a standard chest x- ray (Miller, 1999).

X-rays with two different energies are passed through the bone, some of the energy is absorbed, and the rest is detected on the other side of the body. In every "picture element" two variables can be defined. Two energies allow an estimation of the content of soft tissue (which contains water and fat) separated from the bones. The greater the bone mineral content of the skeleton, the more energy is absorbed. This radiation energy is detected and converted into an aerial density measured in g/cm2. A problem with the DXA method is that we do not fully know how the soft tissue content outside the bone differs from the soft tissue inside the bone. The amount of fat inside the skeleton differs at different ages and increases in elderly.(Bolotin, 2001).

The DXA technology is most often used for measurements of the lumbar spine and the hip, but there are also DXA technologies for peripheral sites such as the radius and the calcaneus. Light portable devices have been developed for measuring BMD in the calcaneus. This equipment offers a possibility to perform measurements at the local primary health care centre. These devices do not occupy much space, are easy to handle and do not cost as much as the central DXA devices. Several previous studies have compared methods for measuring heel BMD with axial measurements (Greenspan, 1997), (Diessel, 2000), (Williams, 2003). The studies have shown that calcaneal measurements of bone density with DXA technique can discriminate quite well between groups of osteoporotic subjects and those without the condition. Some of the studies have also proposed other cut-off points than -2.5 SD for the heel devices and have not found the WHO cut-off point to be applicable to the heel (Fordham, 2000), (Williams and Daymond 2003).

2.6.1.2 Quantitative ultrasound (QUS):

Newer diagnostic techniques such as ultrasound appear to offer a more widely-available, and possibly cost- effective method of screening bone mass; however careful comparison of DEXA and ultrasound is required.

The question of ultrasound vs. DEXA requires deeper scrutiny for the practitioner seeking to prevent and treat osteoporosis. Although some have said that ultrasound measures the "quality" of the bone, more careful studies suggest that it mainly measures the bone mass, revealing structure more than actual density. Ultrasound measurements are used to assess bone density at the calcaneus or patella. It is not possible to measure sites of osteoporotic fracture such as the hip or spine using ultrasound densitometry. Ultrasound measurements correlate only modestly with other assessments of bone density in the same patient. Most experts would agree that adding an ultrasound measurement to DEXA does not improve the prediction of fractures.

Ultrasound reports calculate a T-score (the number of standard deviations above or below the mean for young normal adults) based on an impedance and ultrasound attenuation. Again, since most patients who have a low density have also lost bone structure, a low T-score with the ultrasound units is generally accurate. However, there are many patients with low bone densities who don't have fractures because they still have good structure; and there are other patients who still have fractures even if they have good density because they have lost the structure. At best, the ultrasound complements, but does not compete with, the DEXA.

Further research needs to be done to determine the percentage of false negatives produced with ultrasound systems which may tell patients they have a good T-score when in fact they have low bone mineral density. This is a work in progress and again is another screening tool being endorsed and being pushed mainly by the drug companies who are frustrated, especially in rural regions where space limitations and capital equipment costs are limiting the number of DEXA tables available. Most practitioners would agree that some type of testing for low bone mineral density is better than no testing whatsoever. There are still serious concerns about giving patients a false sense of security and telling them they are normal within normal ranges with the ultrasound studies, when in fact, a hip scan may show that they have osteopenia or osteoporosis. Again, the issue is accessibility.

2.6.1.3 Quantitative computed tomography (QCT):

Less common methods are QCT, RA and SXA. QCT, or Quantitative computed tomography of the spine, reflects three-dimensional bone mineral density. It is usually used to assess the lumbar spine, but has been adapted for other skeletal areas. QCT must be done following strict protocols in laboratories that do these tests frequently; in community settings the reproducibility is poor. The QCT measurements decrease more rapidly with aging, so the "T scores" in older individuals will be much lower than DEXA measurement. Its ability to enable prediction of spinal fracture, however, is equal to that of DXA scanning; the cost and level of radiation exposure are higher. (Miller, 1999).

(RA): Radiographic Absorptiometry, is a diagnostic test used to assess bone density at a peripheral site, usually the hand. Such techniques are referred to as aluminum equivalence, photo densitometry, and radiographic densitometry.

(SXA): Single X-ray Absorptiometry, is a diagnostic test used to assess bone density. Limited to peripheral sites, it cannot measure bone density in the hip or spine, nor can it discriminate between cortical and cancellous bone.

2.6.2 Which sites to test?

The WHO definition of osteoporosis applies only to DEXA assessments of the hip, spine and forearm. It does not apply to other sites or technologies. It also did not specify how many skeletal sites should be measured or which skeletal site should be used for diagnosis. It appears that the hip is the best site to be tested, namely because over the age of 60, spinal osteoarthritic changes artifactually increases BMD. The forearm BMD should be measured when hip and/or spine cannot be measured or interpreted.

Table (2.3) Methods of Measuring Bone Mineral Density

Modality	Characteristics
Ionizing	
Gamma radiation	
Single-energy photon absorptiometry	Peripheral skeleton
Dual-energy photon absorptiometry	Central skeleton
Neutron activation analysis	Research method
Compton scattering	Research method
Radiographs	
Single-energy x-ray absorptiometry	Peripheral skeleton
Dual-energy x-ray absorptiometry	Peripheral and central skeleton
Quantitative computed tomography	Peripheral and central skeleton
Radiogrammetry	Peripheral and central skeleton
Non ionizing	
Magnetic resonance imaging	Research method
Spectroscopy	
Quantitative magnetic resonance imaging	
Ultra sonography	Peripheral skeleton

Sours: (Kleerekoper, 1998)**.**

2.6.3 T-scores and Z-scores

Values of bone mineral density are measured in g/cm2 and then converted into T-scores and Z-scores. The origin of the T-score is described by Faulkner (Faulkner, 2004).

T-scores are related to the young mean peak bone mass (the young normal healthy mean BMD) of the reference population of the same gender and are calculated according to the following formula:

$$\textbf{T}\text{-score} = \frac{\text{patient's BMD - young adult mean BMD of the reference population}}{\text{standard deviation (SD) of the young mean peak BMD}}$$

Z-scores are related to the mean BMD in the reference population with the same age group as the patient and are calculated according to the following formula:

$$\textbf{Z}\text{-score} = \frac{\text{patient's BMD - mean BMD of age-matched reference population}}{\text{standard deviation (SD) of the young mean peak BMD}}$$

T-scores are used for the densitometric diagnosis of osteoporosis:

1. Normal: a T-score > -1
2. Osteopenia: T-score =< -1 and => -2.5
3. Osteoporosis: T-score < -2.5
4. Established or severe osteoporosis: T-score< -2.5 and the presence of one or more fragility fractures.

2.7 Risk Factors for Osteoporosis:

Risk factors for osteoporosis and fractures those are impossible to influence (non modifiable):

- Age
- Previous fractures
- Hormonal status “Menopause”
- Ethnic origin
- Gender
- Family history “genetic factors”

Risk factors for osteoporosis and fractures those are possible to influence (Modifiable):

- Demographic variables :
  - Low body weight/low BMI.
  - Marital status.
  - Educational level.
  - Pregnancies and Parity.
- Environmental factors:
  - Physical inactivity.
  - Poor exposure to sunlight.
  - Cigarette smoking.
  - Toxic metals and substances
  - Estrogen Exposure
  - Air Pollution
  - Water hardness
- Nutritional Factor:
  - Malnutrition in elderly.
  - Protein. PEM (Protein energy malnutrition).
  - Vitamin D deficiency.
  - Calcium deficiency.
- Low bone mineral density BMD.
- Medicinal Factors.

2.7.1 Non modifiable.

2.7.1.1 Age:

Advanced age is the strongest individual risk factor for fragility fracture, demonstrated in many studies (Bauer, 1993). The highest bone mass, peak bone mass, is reached in young adults in both sexes 20-30 years of age (Bonjour, 1991), (Recker, 1992). For men, the decrease in bone mass is slow and continuous throughout life.

2.7.1.2 Previous Fracture:

Epidemiological studies have shown that a previous fragility fracture is a major risk factor for subsequent fractures (Siris, 2001), (Van Staa, 2002). The most common sites of fragility fractures are the radius, humerus, vertebra and hip. The lifetime risk of a hip fracture for a Swedish middle-aged woman is 23% (Kanis, 2000). The combination of decreased bone mineral density and several risk factors leads to a greatly elevated risk of fracture, as shown in several major studies (Cummings, 1995), (Johnell, 1995), (Siris, 2001).

2.7.1.3 Menopause Factor:

for women, the estrogen deficiency initiated by menopause accelerates the bone losses between age 50 and 60. Thereafter, the decrease is slower, resembling that of men but even between 60 and 80, women had greater bone losses than men, 19% in women compared with 10% in men in the study by Nguyen and colleagues (Nguyen, Kelly, 1994). The rate of bone losses in the first ten postmenopausal years varies from 1-5% per year (Hansen, 1991). Peak bone mass of women is not as high as that of men (Looker, 1995) and when bone losses accelerate at menopause, the risk of fragility fracture increases rapidly. The most common first fragility fracture is the wrist fracture followed by vertebral compression fractures and hip fractures. The mean age for a woman to get her hip fracture is 81 years while that for men is 86 years, and therefore many men may already have died of other causes.

2.7.1.4 Ethnic origin:

Bone mineral density may by determined by genetics up to about 70% (Flicker, Hopper 1995). The risk of osteoporotic fracture is doubled if the patient's mother has suffered a hip fracture (Cummings, 1995). In a meta-analysis Kanis and colleagues showed that a family history of hip fracture in parents was associated with a significant risk increase of about 50% of all osteoporotic fracture (RR 1.54; 95CI=1.25-1.88) and of hip fracture (RR=2.27; 95% CI=1.47-3.49) (Kanis, Johansson, 2004).

The risk of fragility fractures varies considerably around the world. Sweden is one the countries where the 10-year risk of hip fracture is highest; only Norway and Iceland have higher risks (Kanis, Johnell, 2002).

2.7.1.5 Gender

Osteoporosis is 6 times more prevalent in women than in men, in men, osteoporosis appears at a later age than women which had greater bone losses than men, (Nguyen, Kelly. 1994).

2.7.2 Modifiable Factors.

2.7.2.1 Demographic variables :

Low body weight/low BMI factor:

BMI below 19-20 in elderly is often associated with osteoporosis while individuals with a weight over 70 kg are seldom affected (Michaelsson, 1996). Low body weight and low body mass index (BMI) have consistently been shown to be associated with an increased risk of osteoporosis (Brot, 1997), (Meyer, 1993), (Nguyen, 1998), (Dargent-Molina, 2000). In the age category of the subjects in our study, low body weight rather than low BMI has the strongest association with osteoporosis. This may due to the fact that many individuals lose height due to the deformities in spine, and perhaps also due to vertebral fractures, often undiagnosed (Cooper, 1992), (O'Neill, 1996). A reduction in height over 4—5 cm may be caused by vertebral fractures (Kantor, 2004). Also tall individuals have an increased risk of some osteoporotic fractures (Meyer, 1993). Weight variability and weight change are also risk factors for hip fractures (Melton, 1998).

2.7.2.2 Environmental Factors:

The absolute risk of fractures due to osteoporosis varies markedly from country to country (Melton, 1995), (Bacon, 1996), (Johnell, 1992).

The marked variation in fracture incidence within specific countries suggests that environmental factors are important. The higher incidence of hip fractures in urban as opposed to rural districts has been explained on the basis of the lower bone mass of urban residents (Gardsell, 1991). However, regional differences in the USA do not seem to be accounted for by differences in the levels of physical activity, obesity, cigarette smoking or alcohol consumption or by Scandinavian descent (Jacobsen, 1990). Other factors that may contribute to regional differences include water hardness, sunlight exposure, poverty levels, the proportion of agricultural land and more environmental factors where shown in this chapter.

Table (2.4): distributions of osteoporosis prevalence in the world.

Race & Ethnicity aged 50+	**Osteoporosis (%)**	**Low bone mass (%)**
Caucasian women	20%	50%
Asian women	20%	50%
Hispanic women	10%	49%
Caucasian men	7%	35%
Asian men	7%	35%
Black women	5%	35%
Black men	4%	19%
Hispanic men	3%	23%

A study was done among rural and urban women in Poland. the aim of this study was determination of the values of bone mineral density (BMD L2-L4) and evaluation of occurrence of osteoporosis (according to densitometric criteria valid until 2000) among normal women living in rural and urban environments (especially postmenopausal) in comparison to other populations. Subjects of the study were 503 normal women aged 30-79 (mean 49.5 years), all residents of Lublin Region (eastern Poland). Analyzed population was divided into two subgroups: urban (n=282, 56%) and rural (n=221, 44%). 65 (12.9%) women working as farmers, 107 (21.3%) were retired; other occupations were performed

by 325 (64.6%) women. The lumbar spine (L2-L4) of all subjects was examined in anterior-posterior position using the dual X-ray absorptiometry--DEXA (LUNAR Corp.) at the Densitometric Laboratory of the Institute of Agricultural Medicine in Lublin from November 1999-June 2000. No statistically significant differences were observed in mean values of BMD between urban and rural populations, nor between farmers and other occupations. Mean values of BMD in every age range were similar to the populations of North America and Northern Europe. The prevalence rates of osteoporosis according to WHO criteria in the entire analysed population were calculated as 6.9%, and osteopenia as 25.4%. The prevalence of osteoporosis and osteopenia increased with advancing age (Filip RS, 2001)

2.7.2.2.1 Physical Inactivity:

Immobility is an important cause of bone loss, and its detrimental effect on bone mass is far greater than the beneficial effect of additional exercise in an already ambulatory subject (Marcus, 1996). In contrast, bone density increases in response to physical loading and mechanical stress. In many cross-sectional studies, a beneficial effect of weight-bearing exercise on peak bone mass has been reported (Bradney, 1998), (Bass, 1998). The observation that retired adult gymnasts have higher BMD than age-matched sedentary controls suggests the benefits of physical activity outlast the termination of such activity (Bass, 1998), and the results of randomized controlled trials suggest that certain forms of exercise may retard bone loss. These studies also show that the skeletal site which is maximally loaded demonstrates the greatest effect. The type of loading also influences skeletal response. High-impact exercise appears to result in greater increases in bone density than low-impact ones. A recent meta-analysis of 18 studies of postmenopausal women reported a significant protective effect against bone loss at the lumbar spine, but a less clear effect at the femoral neck (Berard, 1997)

2.7.2.2.2 Poor exposure to sunlight:

All vertebrates, including humans, obtain most of their daily vitamin D requirement from casual exposure to sunlight. During exposure to sunlight, the solar ultraviolet B photons

(290-315 nm) penetrate into the skin where they cause the photolysis of 7-dehydrocholesterol to precholecalciferol. Once formed, precholecalciferol undergoes a thermally induced rearrangement of its double bonds to form cholecalciferol. An increase in skin pigmentation, aging, and the topical application of a sunscreen diminishes the cutaneous production of cholecalciferol. Latitude, season, and time of day as well as ozone pollution in the atmosphere influence the number of solar ultraviolet B photons that reach the earth's surface, and thereby, alter the cutaneous production of cholecalciferol. In Boston, exposure to sunlight during the months of November through February will not produce any significant amounts of cholecalciferol in the skin. Because windowpane glass absorbs ultraviolet B radiation, exposure of sunlight through glass windows will not result in any production of cholecalciferol. It is now recognized that vitamin D insufficiency and vitamin D deficiency are common in elderly people, especially in those who are infirm and not exposed to sunlight or who live at latitudes that do not provide them with sunlight-mediated cholecalciferol during the winter months. Vitamin D insufficiency and deficiency exacerbate osteoporosis, cause osteomalacia, and increase the risk of skeletal fractures. Vitamin D insufficiency and deficiency can be prevented by encouraging responsible exposure to sunlight and/or consumption of a multivitamin tablet that contains 10 micrograms (400 IU) vitamin D.(Am J Clin Nutr. 1995).

2.7.2.2.3 Cigarette Smoking:

Smoking is a strong risk factor which doubles the risk of osteoporosis, as shown in the meta-analysis by Kanis and colleagues (Kanis, Johnell, 2005).

In contrast to the large number of studies documenting the adverse effects of cigarette smoking on peak bone mass, few studies of the relationship between cigarette smoking and bone loss have been carried out. A recent meta-analysis of the results of 48 published studies (Law MR, 1997) showed that, although no significant difference in bone density at age 50 years between smokers and non-smokers existed, bone density in women who smoked diminished by about 2% for each 10-year increase in age, with a 6% difference at age 80 years between smokers and nonsmokers. These data are borne out by longitudinal observational studies. Epidemiological studies have also shown an independent effect of cigarette smoking on the risk of hip fracture (Law MR, 1997).

2.7.2.2.4 Toxic metals and substances :

1. Lead:

Lead is a potential risk factor for osteoporosis because of the central role the skeleton plays in lead toxicokinetics, and as well as being a target tissue for lead toxicity.

Lead contribute to pathogenesis of osteoporosis Indirectly by altering the plasma levels of calciotropic hormones, like vitamin D3 and parathyroid hormone. Or Directly by altering bone cell function like the ability of bone cells to respond to hormonal stimuli, and interfere with hormone and cytokine signal transduction.

The potential link between lead exposure and osteoporosis is reasonable, based on our current understanding of osteoporosis and lead toxicity. Human and animal studies provide strong evidence for effects of lead on the endocrine regulation of bone mineral homeostasis, bone growth, and skeletal toxicity. These studies are in accord with current understanding of the cellular and molecular mechanisms of lead toxicity in bone and other cells.(Goyer. 1994).

lead accumulates in bone by the replacement of calcium, and the skeleton contains as much as 90% of the lead body burden (Berglund. 2000), (Nilsson. 1991).

2. Cadmium:

Environmental levels of cadmium exposure in areas of previous contamination from smelter activities may affect calcium metabolism in the kidney, resulting in small increases in urinary calcium excretion. Epidemiology studies from Japan demonstrate that once renal tubular dysfunction appears in response to cadmium exposure, hypercalciuria and osteopenia follow. This response may be mediated by decreases in circulating levels of 1,25 (OH)2-vitamin D, with concomitant increases in parathyroid hormone. Results of experimental studies support the conclusion that cadmium causes bone loss early after the start of dietary cadmium exposure “within 96 hr”, before the start of cadmium- induced renal damage typified by increased urinary excretion of NAG, I2 microglobulin, and amino acids. In addition, the bone demineralization response to cadmium is increased in females during pregnancy and lactation and in elderly females after menopausal hormone depletion, making females at greater risk of cadmium- induced bone loss than males.(Goyer. 1994).

The toxic effect of cadmium on bone became evident at the outbreak of Itai-itai disease in Japan, where severe renal and skeletal damage in women was associated with consumption of heavily cadmium-polluted rice (Kjellström. 1992). Cadmium is a widespread environmental pollutant, present in food (mainly cereals, vegetables, and shellfish) and tobacco. It poses a threat to human health because of its long retention (decades) in the kidneys (Järup. 1998). Recent studies indicate that relatively low exposure may also affect the skeleton (Alfvén. 2004), (Staessen. 1999), but the relationship is not well documented. Whether the effects are mediated directly on bone or are secondary to kidney damage is still unclear (Kjellström 1992).

3. Aluminum:

The relationship between aluminum and bone disease, particularly osteoporosis, is currently not clear. But association was found renal osteodystrophic diseases low-turnover osteomalacia (LTOM). The decrease in circulating parathyroid hormone concentrations that accompanies both low turnover osteomalacia and aplastic bone disease may be the result of an aluminum-mediated decrease in parathyroid hormone levels. However, the connection between aluminum exposure and bone disease should not be underestimated. There is seldom a patient with clear evidence of aluminum deposition in bone who does not also have bone disease.(Goyer. 1994).

Other sourses of Aluminum exposure: Cooking in aluminum jar, Pharmaceutical , Petrochemical aluminum, Cosmetic products, Special niacin supplements.

4. Fluride:

Fluoride at low doses like the levels found in drinking water (1 to 2 mg/d), not appear to be associated with increases in bone fractures, At intermediate doses (8 to 80 mg/d, which might be encountered in geographic regions with high fluoride levels in well water or in settings of industrial exposure to cryolite dust), skeletal fluorosis develops. Taking advantage of this osteoscle-rosing effect, which is toxic in a different setting, clinical investigators have used fluoride to increase bone mass in patients with osteoporosis for the past 30 or more years. (Robert. 1994). and at intake levels (50-80 mg/day), fluoride may decrease fractures when given in a slow release form.(Goyer. 1994).

5. **Dioxine:**

Known as Aryl hydrocarbon receptor "AhR" ligands, it is environmental contaminants found in cigarette smoke and other sources like breast feeding, animal fats, air pollution and through human activity from the environment. (Singh. 2000) There is an increasing body of knowledge linking cigarette smoking to osteoporosis and periodontal disease, but the direct effects of smoke-associated aryl hydrocarbons on bone are not well understood.

2.7.2.2.5 Estrogen Exposure:

Estrogen is believed to act directly on estrogen receptors in bone cells.(Goyer. 1994). Transient exposure to estrogen during early developmental periods may affects adult bone density by influencing osteoblasts response to steroid hormones. Exposure to diethylstilbestrol and other environmental estrogens and estrogen agonists can affect the bone density, resulting in changes in the skeleton during adulthood.

Environmental Sources of Estrogens it may be direct exposure like the plant diet "Phytoestrogen", Industrial chemicals, Ordinary house hold products, Pharmaceuticals "cosmetics", Pesticids, Product associated with plastics. or indirect exposure from the chemicals released into air and water.

2.7.2.2.6 Air Pollution:

living in air-polluted areas can be an important risk factor for osteoporosis. this is the conclusion of study in Tehran which indicate that Vitamin D deficiency prevalence in the men in polluted areas was higher than the men in non polluted areas. (Taghizadeh 2004). Air pollution could promote blocking of some of Ultraviolet rays of sun and can compromise Vitamin D status and promote VD deficiency.

2.7.2.2.7 Water Hardness:

Hard water is water high in mineral contents "mainly Calcium and Magnesium". Contribution of Ca and Mg in water is low compared to diet, but hard water "rich in Ca+" provide high mineral bone density, and water poor in Ca+ "soft water of mineral water" may contribute to osteoporosis.

2.7.2.3 Nutritional Factors:

2.7.2.3.1 Malnutrition in elderly:

There is no consensus on how to define malnutrition among elderly and no exact definition of the condition. Many methods have been developed but we still lack a gold standard to define malnutrition and protein-energy malnutrition (PEM) (Akner, 2001).

Many nutritional markers such as serum albumin and IGF-I have shown to be correlated with clinical malnutrition (Omran, 2002). Serum albumin levels are a good predictor of survival or death after fracture (Rico, 1992).

Many different kinds of assessment tests have been introduced. In a review of over 40 different instruments Jones and colleagues found in 2002 that many of the instruments were poorly validated (Jones, 2002).

2.7.2.3.2 Protein. PEM (Protein energy malnutrition)**:**

Protein is important for the growing skeleton and for optimal peak bone mass (Bonjour, 2001). In a recent cross-sectional Danish study among 109 17-year-old boys and girls, a positive association was found between milk protein intake and size-adjusted bone mineral content, which remained significant even after adjustment for energy, calcium and physical activity (Budek, 2007). PEM is related to reduced amounts of muscle mass and subcutaneous fat. The reduced muscle mass combined with osteoporosis also leads to increased propensity for falls (Sinaki, 2004). A Swedish study by Ponzer and co-workers has shown that half of the elderly with hip fractures had signs of PEM (Ponzer, 1999). In the randomised trial by Rizzoli and co-workers, it was shown that a protein supplementation for osteoporotic patients had positive effects and fewer new vertebral fractures were observed (Schurch, 1998). Some studies have also shown decreased risk of fracture and bone density losses with increased intake of protein (Hannan, 2000), (Dawson-Hughes, 2002), (Promislow, 2002), (Wengreen, 2004). In a meta-analysis by Hedstrom and colleagues in 2006, 19 randomised studies were identified where patients with hip fracture were treated with nutritional or anabolic treatment, 12 of them using nutritional or protein

supplementation. Six of the studies showed improved clinical outcome with shorter recovery period in hospital and fewer complications (Hedstrom, 2006).

2.7.2.3.3 Calcium:

The human skeleton contains approximately 1 kg of calcium (for a male of 70 kg) and is the principal mineral of the skeleton. About 150-200 mg of calcium is absorbed from the intestines and the same amount of calcium is excreted mainly via urine every day. Calcium is an important element to mineralize the skeleton (Chapuy, 1996). Whenever the absorbed calcium intake does not meet the demands and the losses, increased bone remodeling will be stimulated by PTH to keep balance in the extracellular fluid calcium ion homeostasis. When the calcium intake is appropriate for the demands, the PTH-stimulated remodelling increases immediately (Wastney, 2000).

A sufficient calcium intake around 1000 mg per day lowers the bone remodelling rate by 10-20% (Elders, 1991). Calcium supplementation reduces both bone loss and tends to affect fracture rate in elderly as shown in the meta-analysis by Shea in 2002 (Shea, 2002).

In a meta-analysis of 31 trials, hormone replacement therapy was found to have greater increases in BMD when combined with calcium than when used without calcium supplementation (Nieves, 1998).

2.7.2.3.4 Vitamin D:

Vitamin D is built under the influence of ultraviolet B rays on skin. This precursor, vitamin D3, is then activated in two steps, first through the liver (calcidiol), followed by the kidney to the active metabolite (calcitriol). The activation in the kidneys is strictly regulated via PTH and the serum concentration of calcium and phosphate among others. Vitamin D is needed for normal mineralisation of the skeleton and a vitamin D deficiency during childhood and adolescence leads to rickets and to osteomalacia during adulthood. Active vitamin D increases the uptake of calcium from the gut.

The use of a sunscreen with a sun protection factor 8 reduces the production of vitamin D3 by 95% (Holick, 1995).

Another source of vitamin D besides the sun is fat fish such as salmon and eel and fat dairy products. Elderly persons and especially those who live in institutions are at risk of vitamin D deficiency (Lips, 2006). In the study by Melin and colleagues, relatively few of the free-living elderly women were found have vitamin D deficiency (Melin, 1999). Many immigrant groups in Scandinavia from countries in Middle East have vitamin D deficiency (Holvik, 2005). In a recent study the vitamin D status was surprisingly low in a large part of the British adult population. The levels were lowest during the winter and spring, in a birth cohort from 1958 with 7437 participants (Hypponen, 2007).

Multiple risk factors in one individual increase the individual risk very rapidly, as shown by Cummings and colleagues in the SOF (Study of Osteoporosis Fractures) study (Cummings, 1995). An international working group has been trying to develop an algorithm for the risk calculation for many years and hopefully we can soon have better risk estimates for the individual risk than we have had previously to support us in our clinical practice (Kanis, 2007). One big step was the calculation of absolute 10-year risks of fracture (Kanis, 2001).

2.7.2.4 Low bone mineral density BMD:

One of the main risk factors for osteoporotic fractures is low bone mineral density, as has been shown in several studies (Cummings, 1990), (Cummings, 1993), (Gardsell, Johnell, 1993), (Cheng, 1997). These studies have established that both axial and peripheral bone density predict fractures in elderly women. Measurement of BMD at the site of the future fracture region is considered to have the best predictive ability. over 80% of the fractures in postmenopausal women occur in those women who did not have a peripheral measurement showing osteoporosis (Siris, 2004). It is also important to remember that the decision about treatment is based on a BMD value showing osteoporosis.

Chapter Three
Methodology

The present study was approved by the medical imaging & osteoporosis department in the Herzog Hospital, and the high studies faculty of Al-Quds University. All the participants provided informed written consent.

The general aim of this research was to evaluate the prevalence of osteoporosis and the risk factors for osteoporosis among Palestinian elderly population in East Jerusalem. The research is a cross-sectional study where the epidemiology and risk factors for osteoporosis were studied.

3.1 The study population:

The targeted sample is the Palestinians residing in East Jerusalem from 45 years of age onwards. The people participating thesis all lived in East Jerusalem.

A convenience sample of participants from Health clinics that serve Palestinians residing in urban, rural and refugee camps will be selected, with no exclusion criteria.

An interview was performed with the medical managers for more than 10 medical centers in the study area. The family doctors in most of these medical centers (some of them have rejected to conduct this study research) sent letters with information about the study and an invitation to participate, or call of them by telephone, in the three regions of the study area.

A total of about 200 women and 90 men born between 1920 and 1963 lived in the study area received the liter or the telephone call. All the people were agreed to participate and show in the primary health care centre and the hospital for the DXA measurements, participated in the study.

A total of 127 (111 women and 16 men) of the 290 invited people participated in the study.

Osteoporosis is 6 times more prevalent in women than in men, in men, osteoporosis appears at a later age than women which had greater bone losses than men, (Nguyen, Kelly, 1994), Because of that, and because the men participants are very little (16 participant). I had show the male results but had to disregarded the data collection of them from the end results.

111 women are participated in the study, 38 women from Jerusalem villages. (Sour Baher, Gabal Ilmkaber), 48 women from Jerusalem city. (Beit Hanina, Al-Tory, Wady Iljoze, ….) and 25 women from the camps in Jerusalem. (Sha'afat camp).

The medical centers that helped my study and send the participants were:

Dr.Hazem Zgaier M.C, Dr.Jihad Ganem M.C, Alshafy M.C, Sour baher M.C, and AlthoryM.C.

3.2 Evaluation of Risk Factors for Osteoporosis:

Risk factors for osteoporosis were evaluated during the study visit, using a questionnaire that the participant had answered during a face-to-face interview. The aim of the interview was to obtain information on demographic, environmental and nutritional factors of each participant.

3.3 Data Collection

All data were collected between January 2008, and January 2009. Data collection procedure was achieved in tow stages:

3.3.1 Questionnaire Design Content

The questionnaire was formulated in English. Its questions were derived from several references. The questionnaire included multiple choice questions. It's basically comprised of main parts:

- Personal information (age, height, weight, place of live,...) questions (1-12)
- Marital status (age of the marriage, number of children,….) questions(13-17)
- Education and work history (years of schooling , work type,..) questions(18-25)
- Physical activity and sun exposure. questions (26-38)
- History of Infertility (menopauses, HRT,……..). questions (39-45)
- Medical history and medication **(**kidney stones, hormones,...) questions (46-55)
- Behavior risk factors (smoking,…) questions (56-61)
- Diet and nutrition questions (62-75)

3.3.2 Diagnostic testing:

The test has tow stages, the anthropometric data, and the DXA measurements, each of these measurements are done at the same time for all participants.

3.3.2.1 Anthropometric Data:

Body height and weight was measured with a manual scale and height measurement instrument (Detecto, WEBB City, MO, USA).

Each participant was lightly clothed and shoeless during height and weight measurements. Standing heights and weights were recorded to the nearest 0.01 m and 0.1 kg, respectively. Body height and weight measurements were used to calculate body mass index (BMI) as weight in kilograms divided by height in square meters (BMI = kg/m2) for each participant.

3.3.2.2 DXA Measurements:

The WHO definition of osteoporosis applies only to DEXA assessments of the hip, spine and forearm (WHO 2005). It does not apply to other sites or technologies. It also did not specify how many skeletal sites should be measured or which skeletal site should be used for diagnosis. It appears that the hip is the best site to be tested, namely because over the age of 60, spinal osteoarthritic changes artifactually increases BMD. The forearm BMD should be measured when hip and/or spine cannot be measured or interpreted.(WHO 2005).

In our study the bone mineral density of the lumbar spine and the both hips were measured by dual-energy X-ray absorptiometry (DXA) (LUNAR cor. Madison WI, BRODIGY manufactured in sep. 2000. USA).

In total 111 women had measurements of the lumbar spine (L2-L4) (anteroposterior projection), total proximal femur including the femoral neck. All scans were analyzed by a single investigator. T-score values were obtained for the measurements using the available reference population for the DEXA-Tscore.

The WHO cut-off points were applied in order to classify subjects as:

Normal	T-score > -1 SD
Osteopenia	-1 ≥ T-score ≥ -2.5 SD
Osteoporosis	T-score < -2.5 SD

3.4 Materials:

- dual-energy X-ray absorptiometry (DXA) machine (LUNAR cor. Madison WI , BRODIGY manufactured in sep. 2000. USA) . shown in figure (3.1) are used to DXA measurement.
- Positioning support materials. Shown in figure (3.2)
- Calibration phantom. Shown in figure (3.6).
- Instrument for Height and Scale measurement

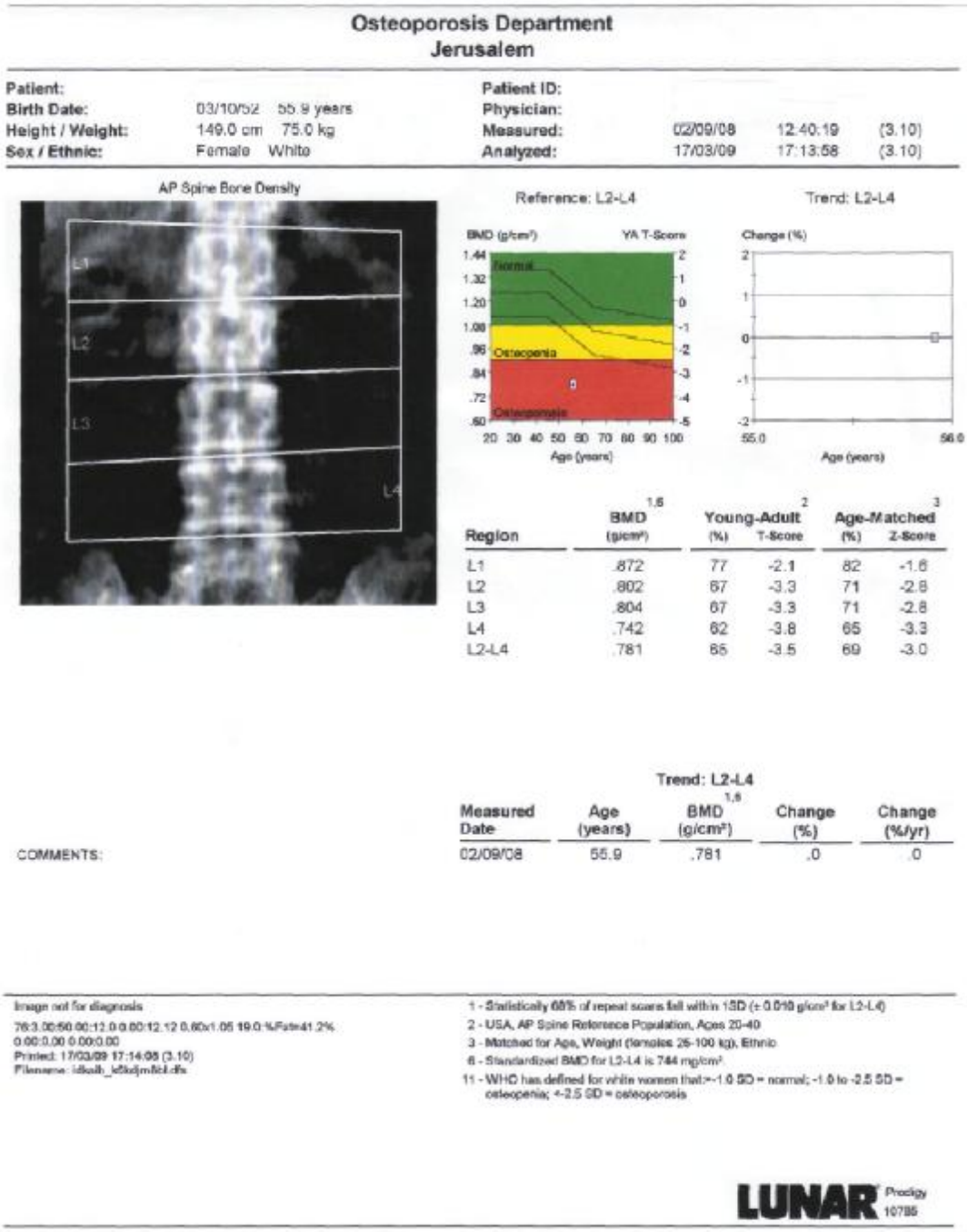
Figure(3.1) LUNAR DXA Machine.
Source: (LUNAR. 2000).

Figure(3.2): Positioning support materials.
Source: (LUNAR. 2000).

Figure(3.3A): femoral neck position.
Source: (LUNAR. 2000).

Figure(3.3B): lumbar spine position.
Source: (LUNAR. 2000).

figure (3.3): The patient positioning for the lumbar spine and the femoral neck measurement.



Osteoporosis Department
Jerusalem

Patient:		**Patient ID:**			
Birth Date:	03/10/52 55.9 years	**Physician:**			
Height / Weight:	149.0 cm 75.0 kg	**Measured:**	02/09/08	12:40:19	(3.10)
Sex / Ethnic:	Female White	**Analyzed:**	17/03/09	17:13:58	(3.10)

AP Spine Bone Density

Reference: L2-L4

Trend: L2-L4

Region	BMD[1,6] (g/cm²)	Young-Adult[2] (%)	Young-Adult[2] T-Score	Age-Matched[3] (%)	Age-Matched[3] Z-Score
L1	.872	77	-2.1	82	-1.6
L2	.802	67	-3.3	71	-2.8
L3	.804	67	-3.3	71	-2.8
L4	.742	62	-3.8	65	-3.3
L2-L4	.781	65	-3.5	69	-3.0

Trend: L2-L4

Measured Date	Age (years)	BMD[1,6] (g/cm²)	Change (%)	Change (%/yr)
02/09/08	55.9	.781	.0	.0

COMMENTS:

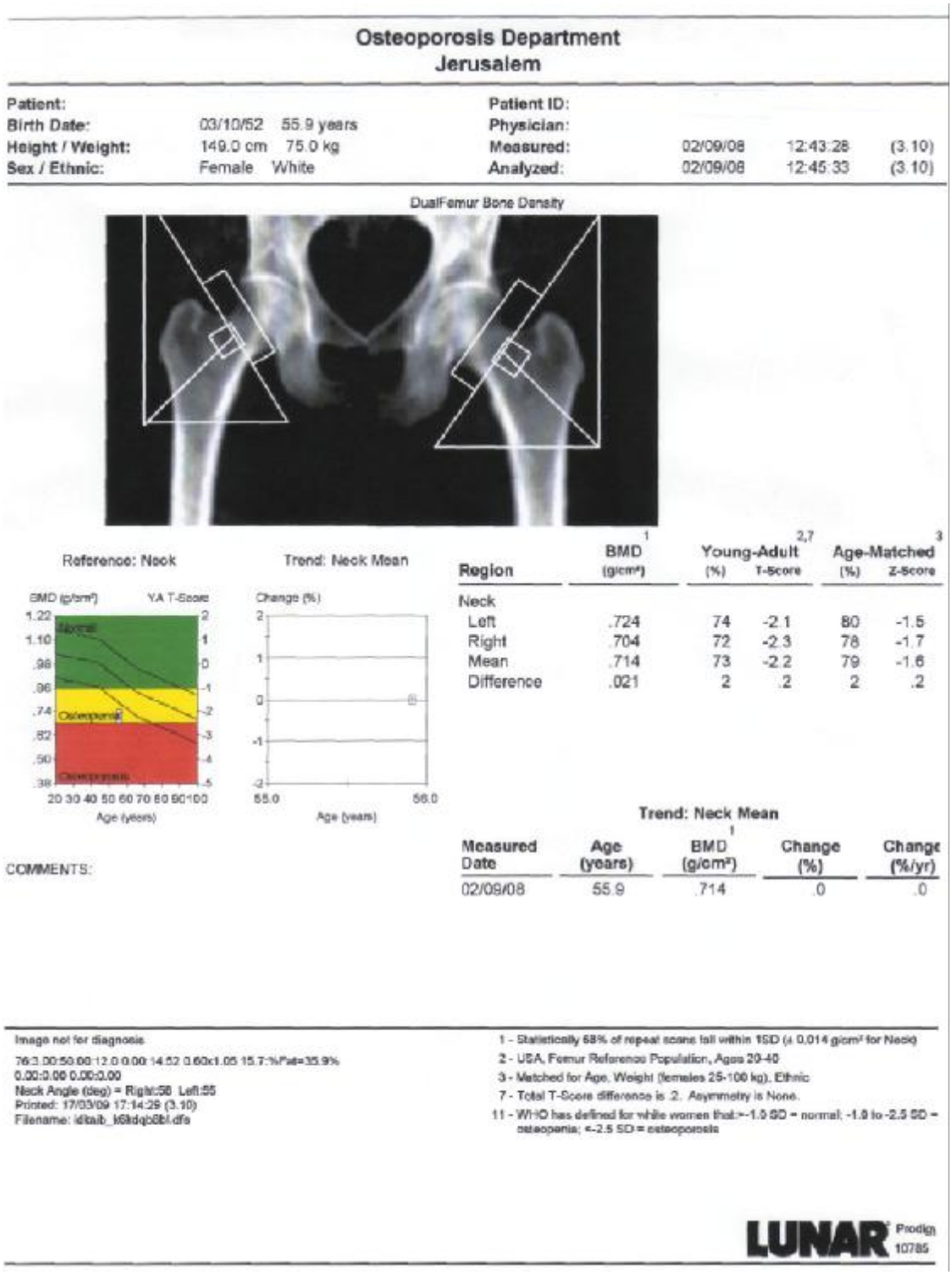
Image not for diagnosis

76:3.00:50.00:12.0 0.00:12.12 0.60x1.05 19.0 %Fat=41.2%
0.00:0.00 0.00:0.00
Printed: 17/03/09 17:14:08 (3.10)
Filename: idkslh_kfdsfjmfkfl.dfs

1 - Statistically 68% of repeat scans fall within 1SD (± 0.010 g/cm² for L2-L4)
2 - USA, AP Spine Reference Population, Ages 20-40
3 - Matched for Age, Weight (females 25-100 kg), Ethnic
6 - Standardized BMD for L2-L4 is 744 mg/cm²
11 - WHO has defined for white women that:>-1.0 SD = normal; -1.0 to -2.5 SD = osteopenia; <-2.5 SD = osteoporosis

LUNAR Prodigy 10785

Figure(3.4): participant lumber spine measurement DXA report.
Source: (LUNAR. 2000).



Figure(3.5): participant femoral neck measurement DXA report.
Source: (LUNAR. 2000).

3.5 Quality Control:

Quality control procedures were completed prior to testing on each testing day throughout the duration of the study. A phantom spine was scanned 49 times(once on each testing day), with a coefficient of variation (CV) of 0.34%.

Figure(3.6) Calibration Phantom.
Source: (LUNAR. 2000)

Osteoporosis Department
Jerusalem

Daily QA Measurement

Date	17/03/09
Time	16:25:41
BMD Medium (3.000 mA)	.997 g/cm
Deviation	-.10%

Trend Summary

Mean BMD Medium (3.000 mA)	.997 g/cm
CV	0.07%
Total Sessions	30

Functional Tests

Test	Value	Status
Peaking	2,380	Pass
Beam Stop	.42 / .25	Pass
Mechanical Test		
Transverse	622.88	Pass
Longitudinal	1,987.45	Pass
Spillover Test		
Mean %	8.02%	Pass
Stability	0.02%	Pass
Reference Counts		
High mA	136,534 / 171,694	Pass
Ratio at High mA	0.80	Pass
Detector Status		**Pass**

Secondary Calibration

Test	Mean	% CV	Status
BMD			
Large	1.493	0.3%	Pass
Medium	0.997	0.5%	Pass
Small	0.504	1.3%	Pass
Tissue			
Lean	7.5%	0.5%	Pass
Mid	36.2%	0.0%	Pass
Fat	61.6%	0.7%	Pass
Calibration Status			Pass
System Status			
Pass			

Figure (3.7): Daily QA Measurement - Calibration Report.
Source: (LUNAR. 2000).

3.6 Statistics:

All the statistical analyses in the study were performed with SPSS statistical software.

Linear regression was used to study the relationship between different sites of DXA measurement. The correlation between T-scores at different sites of measurement was studied with the Pearson correlation coefficient.

Unconditional logistic regression was used to analyze the relationship between osteoporosis and the items in the questionnaire (Kleinbaum, 2002,1994) The items in the questionnaire omitted from the model were not able to significantly improve the model. The logistic regression model was tested for interactions and for collinearity. Likelihood ratio test was performed for model improvement with a *P*-value <0.05 considered as significant model improvement. Model fit was tested with Pearson's goodness-of-fit test. A *P*-value > 0.05 was judged as a good fit. The results are shown as odds ratios (OR) with 95% confidence intervals (CI).

The outcome variable in the logistic regression model was a T-score of < -2.5 SD at the lumber spine and/or total proximal femur into osteoporotic or not osteoporotic.

3.7 Ethics:

Ethical approval was obtained from the University Ethical Committee. Informed consent was obtained from the participants prior to their enrolment.

The consent form was formulated in Arabic, and included the following explanation and information:

Who is conducted the study, aims of the study, confidentially of the collected information and potential benefits from participation on the study.

Each subject examined received the results of the DXA examination, as well as a recommendation to the treating physician for prevention or treatment as shown by the results.

3.8 Operationalization:

The operational definition of osteoporosis is based on the assessment of bone mineral density (BMD), and the diagnostic criteria that were established by the WHO for the classification.

3.8.1 Demographic variables:

The demographic information was classified into:

- Menopause: pre menopause, post menopause. (non modifiable)
- Age group: (44- 49), (50- 54), (55- 59), (60- 64), (65 +) years of age. (non modifiable)
- Body Mass Index (BMI): normal (BMI 20-24.9), over weight (BMI 25-29.9), and obese (BMI ≥30)
- Marital status: Married, single, divorced, separated, widowed.
- Educational level: low education, (≤12 years of schooling), and high education (more than12 years of schooling),
- Parity: (no children), (1-3), (≥4).
- Pregnancies: (no pregnancies), (1-3), (≥4).

3.8.2 Environmental Factors:

The environmental factors were classified into:

- Place of live: city, village, camp
- Sun exposure factor:

  Low exposure to the sun light: (<1) hour per day.

  Medium exposure to the sun light: (1-2) hour per day.

  Height exposure to the sun light: more than 2 ours per day.

  About how much time did you spend out door each day?

  Never, 1(H/day), 2 or more (H/day).

- Smoking habits: Never smoked, light or moderate smoker, heavy smoker, Passive smoker.
- Physical parameters factor:

  Light physical activity: (≤3) hour per week.

  Medium physical activity (4-7) hour per week.

  Height physical activity: (>7) hour per week.

3.8.3 Nutritional factors:

The nutritional factors were classified into:

- Milk consumption: (never, 1cup, 2-3cups per day).
- Caffeine consumption:

  Coffee: (never, 1cup, 2-3cups, 4+ cups per day).

  Tea: (daily, mostly, occasionally, never)

  Soft drinks: (daily, mostly, occasionally, never)
- Eating habits: "Diet style"

  Dairy Products: (daily, mostly, occasionally, never).

  Animal Proteins: (daily, mostly, occasionally, never)

  Plant Proteins: (daily, mostly, occasionally, never)

  Cereal: (daily, mostly, occasionally, never)

  Fruits: (daily, mostly, occasionally, never)

  Vegetables: (daily, mostly, occasionally, never)

  Sweets and confectionary, honey and jam: (daily, mostly, occasionally, never)

  Oil, butter and ghee: (daily, mostly, occasionally, never)

  Nuts: (daily, mostly, occasionally, never)

3.8.4 Medicinal factors:

- Vitamins: 1.YES 2.NO
- calcium tablets: 1.YES 2.NO
- Hormone replacement Therapy (HRT): 1. Yes, but not taking it now. 2. Yes, taking it now. 3. No, never
- Over active thyroid gland.
- Ever had sugar diabetes.
- Ever had kidney stones.
- Ever broken any bones in the last.

Chapter Four

Results

4.1 Data analysis

The general aim of this research was to evaluate the prevalence of osteoporosis and the risk factors for osteoporosis among Palestinian elderly population in East Jerusalem. The research is a cross-sectional study, where the epidemiology and risk factors for osteoporosis were studied.

In our study the bone mineral density (BMD) measured by dual-energy X-ray absorptiometry (DXA). Both T-score and Z-score were measured but only T-score was used for analysis based on World Health Organization criteria.

In total 127 participants (111 women, 16 mean) had measurements of the lumbar spine (L2-L4) and the femoral neck of both sides.

T-score values were obtained for the measurements using the available reference population for the DXA-T score.

4.2 Prevalence of osteoporosis

Table (4.1): Prevalence of osteoporosis for female participants (n=111).

Measurement	Result	N	%
Spine Bone Density	Normal	29	26.1
	Osteopenia	66	59.5
	Osteoporosis	16	14.4
Femur Bone Density	Normal	36	32.4
	Osteopenia	65	58.6
	Osteoporosis	10	9.0
Result	Normal	39	35.1
	Osteopenia	53	47.7
	Osteoporosis	19	17.1

The above table indicate that the osteoporosis in the lumber Spine more prevalence than the osteoporosis in the neck of Femur.

The figure below shows the comparison between the prevalence of osteoporotic, osteopenic and normal. Depending to BMD T-score results.

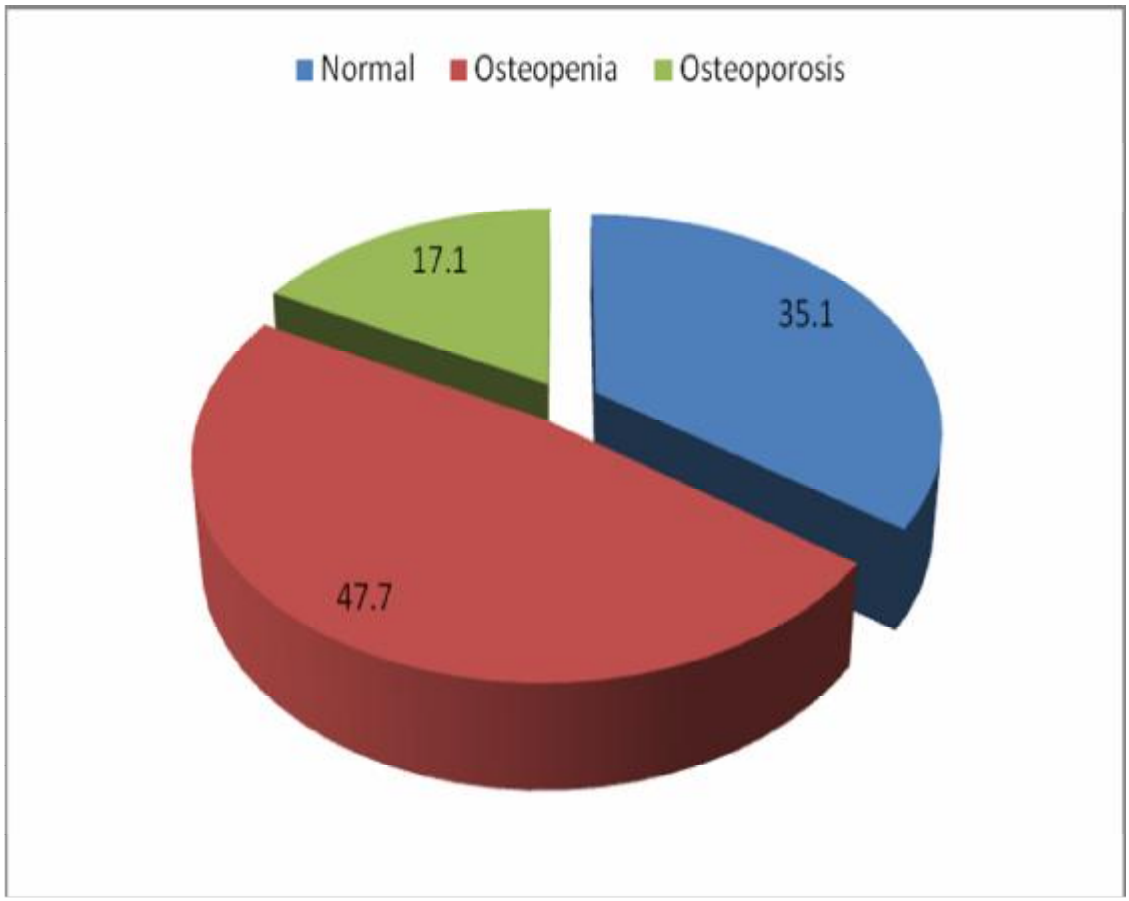


Fig (4.1): The percentage of osteopenia, osteoporosis, and the normal cases depending on the BMD results. Female sample 111 cases.

Table (4.2): general characteristics of study population**.** Whole sample (Male & Female) The sample (127).

variables	Categories	N	%
Gender	**Male**	**16**	**12.60**
	Female	**111**	**87.40**
Education Level	**<= 12 Years**	**97**	**76.40**
	>12 Years	**30**	**23.60**
Smoking	**Never Smoked**	**82**	**64.60**
	Ever Smoked	**45**	**35.40**
Tea	**Daily**	**83**	**65.40**
	Mostly	**17**	**13.40**
	Occasionally	**18**	**14.20**
	Never	**9**	**7.10**
Cups of Milk per Day	**Never**	**47**	**37.00**
	1 cup	**62**	**48.80**
	2- 3 cups	**18**	**14.20**
Cups of Coffee per Day	**Never**	**31**	**24.40**
	1 cup	**26**	**20.50**
	2- 3 cups	**49**	**38.60**
	4 + cups	**21**	**16.50**
Body Mass Index	**Normal (20- 24.9)**	**12**	**9.40**
	Overweight (25- 29.9)	**45**	**35.40**
	Obese (30- 39.9)	**61**	**48.00**
	Severely Obese >40	**9**	**7.10**
25- 45 Y Walking	**NEVER**	**23**	**18.10**
	1- 2 H/W	**22**	**17.30**
	3- 5 H/W	**32**	**25.20**
	6+ H/W	**50**	**39.40**
Last year Walking	**NEVER**	**50**	**39.40**
	1- 2 H/W	**29**	**22.80**
	3- 5 H/W	**28**	**22.00**
	6+ H/W	**20**	**15.80**
Swimming	**NEVER**	**124**	**97.60**
	1-2 H/W	**3**	**2.40**
	3+ H/W	**0**	**0.00**
Home sport	**NEVER**	**103**	**81.10**
	1-2 H/W	**13**	**10.20**
	3+ H/W	**11**	**8.70**
Gymnastics	**NEVER**	**117**	**92.10**
	1-2 H/W	**6**	**4.70**
	3+ H/W	**4**	**3.20**

distribution of the study population according to risk variables shown in the table (4.2) which describe all the sample, male and female, the male cases results shown just in the above, and next table, other tables and results are shown the female cases and the sample of the female participants is 111case.

4.3 Gender and Osteoporosis:

Table(4.3): Gender and Osteoporosis (prevalence of osteoporosis of all the sample, male and female"127"participant):

RESULTS	Male		Female		Total	
	N	%	N	%	N	%
Normal	8	50 %	38	34.20%	46	36.2%
Osteopenia	8	50 %	54	48.60%	62	48.8%
Osteoporosis	0	0.00%	19	17.10%	19	15%

Osteoporosis is 6 times more prevalent in women than in men, in men, osteoporosis appears at a later age than women which had greater bone losses than men, (Nguyen, Kelly. 1994).In this study the relationship between gender and osteoporosis was shown in table (4.3). in the table shows osteoporosis rates in female more than in males, there is no any man have osteoporosis in our participants. Wile the osteoporosis are show in 19 women (17.1%) of all the study subject. And the normal participants in the males [n(%)] [8(50%)] compared with the females, [38(34.2%)]

Because of that, and because the men participants are very little (16 participant) (12.6 % from the sample). The males data were omitted from the study results.

The number of the participants that analyze is 111 female case (29- pre menopause and 82- post menopause).

4.4 Demographic Variables:

The demographic variables of the subject were classified according to:

Menopause, Age group, Body mass index, Marital status, Educational level, Parity, and Number of Pregnancies. The tables(4.4, 5, 6, 7, 8, 9,10) shows the relationship between the demographic variables and osteoporosis.

4.4.1 Menopause and Osteoporosis:

The table (4.4) below shows that the relationship between Menopause and Osteoporosis is significant, *P*-value = (0.004), and this result are advocate the hypothesis of my study and agree with most of the studies were don in this case. From the table below we see that there is [N(%)] [18(22%)] from Post-Menopause woman have osteoporosis compared with [1(3.4%)] of Pre-Menopause woman have osteoporosis. And (58.6%) of the Pre-Menopause woman are normal, wile just (26.8%) of Post-Menopause woman are normal. The result accent the hypothesis that the prevalence of osteoporosis was higher in Post-Menopause woman.

Table (4.4) Menopause and Osteoporosis.

Menopause	categories	Normal		Osteopenia		Osteoporosis	
		n	%	n	%	n	%
	Pre-Menopause	17	58.60	11	37.90	1	3.40
	Post-Menopause	22	26.80	42	51.20	18	22.00

(*P*-Value = 0.004)

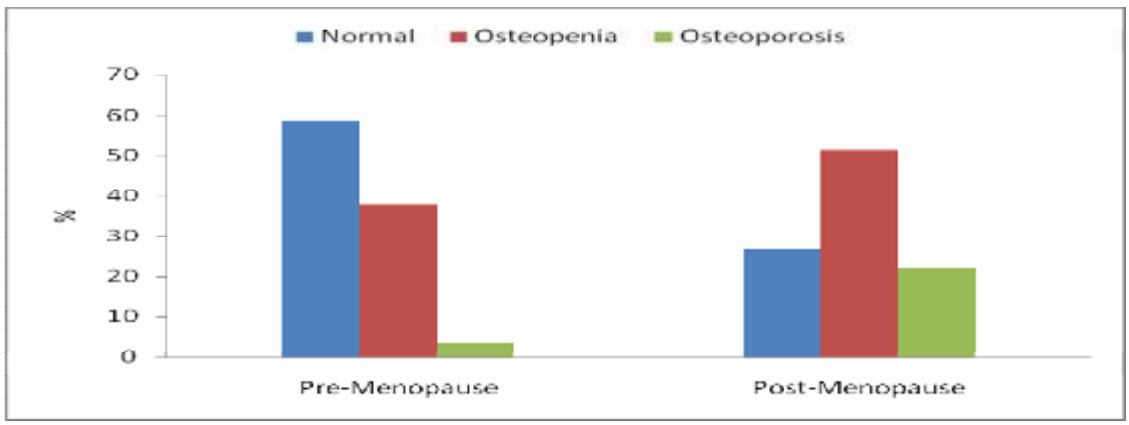


Fig (4.2): Menopause and Osteoporosis

4.4.2 Age effect on Osteoporosis:

The mean age of the pre-menopause woman in the study subject was 51.38 ± 7.15 SD. And in the post-menopause woman was 62.59 ± 9.78 SD. The minimum age of the study subject was 45 and the maximum age was 83 years old.

The hypothesis of the study is: the risk of osteoporosis increase with age increases. The table below shows that the hypothesis is correct and the relationship between the age and osteoporosis is statistically significant. *P*-value = (0.000).

The respondents who are 65 years old and older, had higher percentage of osteoporosis [N(%), 10 (32.3)] and the normal in the same age group [3(9.7)], compared with The respondents who are 49 years old or younger[1(4.3)] had osteoporosis, and [13(56.5)] normal. So the result agree the hypothesis.

Table (4.5): Age and osteoporosis association.

Age Group	categories	normal		osteopenia		osteoporosis	
		n	%	n	%	n	%
	44- 49	13	56.50	9	39.10	1	4.30
	50- 54	13	50.00	9	34.60	4	15.40
	55- 59	6	30.00	12	60.00	2	10.00
	60- 64	4	36.40	5	45.50	2	18.20
	65 +	3	9.60	18	58.10	10	32.30

[*P*-value= 0.000]

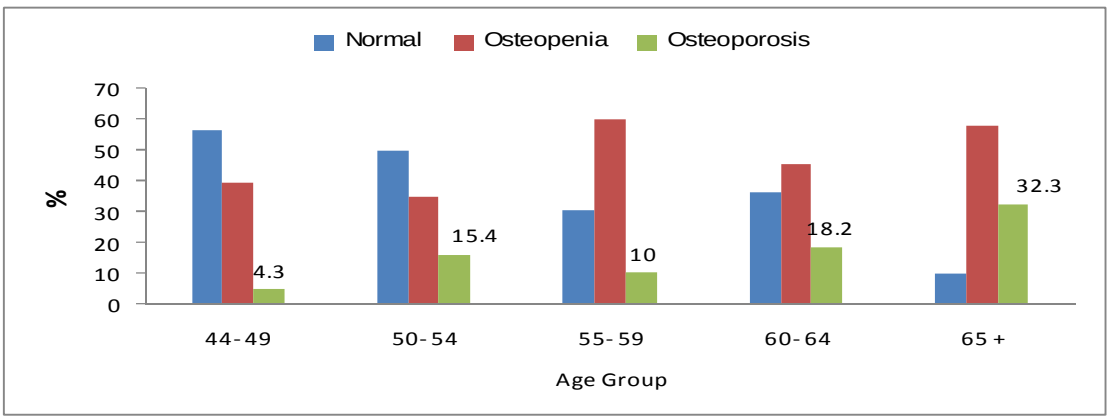


Fig (4.3): Age and osteoporosis association.

4.4.3 Body Mass Index (BMI) and Osteoporosis:

The hypothesis of the study is the obese and over weight women must have less percentage of osteoporosis. This hypothesis are agree the study result, and table (4.6) shows the significantly relationship *P*-value = (0.043). from the table we can see that the obese women who had osteoporosis [8(14)] less than those women have normal (BMI) [4(40)]. And the normal Body Mass Index participants who had normal result of (BMD) [3(30)],less than the obese women have a good T-score results [24(42.10)]. So the study data result are accord the hypothesis of the study.

Table (4.6): Body Mass Index (BMI) and Osteoporosis.

Body Mass Index	categories	normal		osteopenia		osteoporosis	
		n	%	n	%	n	%
	Normal (20- 24.9)	3	30.00	3	30.00	4	40.00
	Overweight (25- 29.9)	8	22.90	20	57.10	7	20.00
	Obese (30- 39.9)	24	42.10	25	43.90	8	14.00

P-value= (0.043)

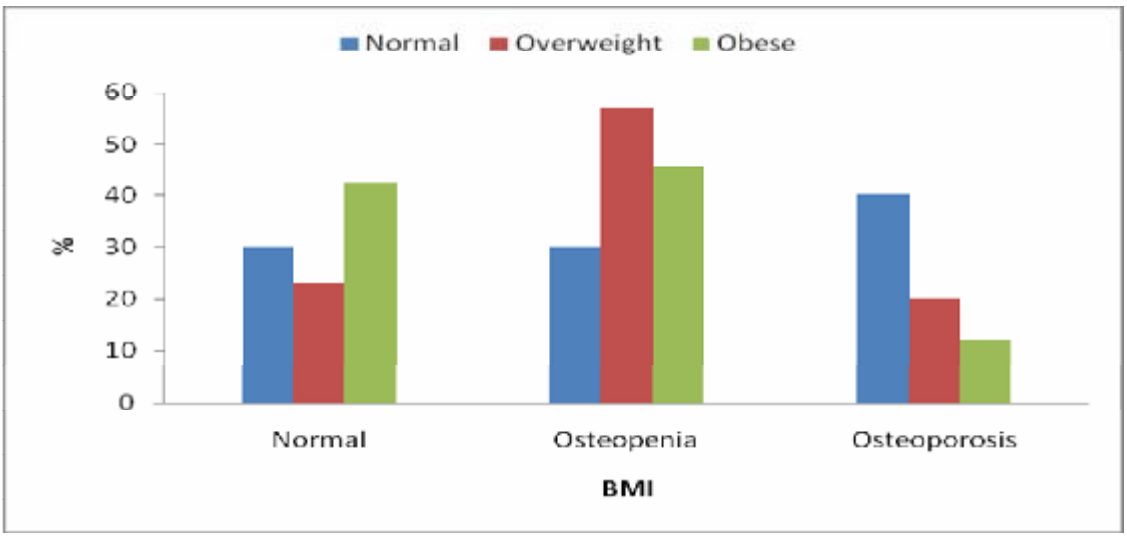


Fig (4.4): Body Mass Index (BMI) and Osteoporosis.

4.4.4 Marital Status and Osteoporosis:

There is no hypothesis describe the relationship between the marital status in my mind, but in the results as shown in table (4.7) the result appears significant association. from the table we see that the highest percentage of osteoporosis is in the widowed women (44%), may be there is some psychological factors "stress factor", lead to hormone changes.

Table (4.7): Marital Status and osteoporosis.

MARITAL STATUS	categories	normal		osteopenia		osteoporosis	
		n	%	n	%	n	%
	Married	31	38.30	40	49.40	10	12.30
	single	6	54.50	4	36.40	1	9.10
	divorced	0	0.00	1	100.00	0	0.00
	separated	0	0.00	0	0.00	0	0.00
	widowed	2	11.10	8	44.40	8	44.40

P value= (0.003)

4.4.5 Educational Level and Osteoporosis:

The educational level effect on the prevalence of osteoporosis is not significant as seen in the table below, witch describe the relationship between educational level and osteoporosis. From the table (4.8), there is a negatively relationship, 20 % of those women had low educational level (less than 12 year of schooling), was osteoporotic patients, compared 7.7% osteoporosis women with those hade high educational level. and the normal percentage is 46.2 % from the participants had a high education, compared with 31.8 % from the woman had low educational level.

The hypothesis of the study: the percentage of osteoporosis decreased with more educational level participant. The result of the sample is agree the hypothesis but it not significant *P*-value = (0.228). The relationship described as week relationship.

Table (4.8): Educational Level and Osteoporosis.

Education Level	categories	normal		osteopenia		osteoporosis	
		n	%	n		n	%
	>12 Years	12	46.20	12	46.20	2	7.70
	≤12 Years	27	31.80	41	48.20	17	20.00

P value= (0.228)

4.4.6 Parity (number of children) and Osteoporosis:

77 % of the married or had married women in the study subject had more than four children's. Table (4.9) shows that; the women had four children or more 20.8 % of them had osteoporosis, and 32.5 of them normal BMD, compared with women had no children, 57.1% of them normal, and just 7.1% of them described as osteoporotic cases. The hypothesis of the study is, increasing the number of children will lead to increase the osteoporosis prevalence. The results of the study accent the hypothesis, but its not significantly relationship, and the *P*- value is (0.199).

Table (4.9): Parity (number of children) and Osteoporosis:

Number of children	categories	normal		osteopenia		osteoporosis	
		n	%	n		n	%
	0	8	57.10	5	35.70	1	7.10
	1- 3	6	30.00	12	60.00	2	10.00
	4 +	25	32.50	36	46.80	16	20.80

P value= (0.199)

4.4.7 Number of Pregnancies and Osteoporosis:

91% of the married or had married women in the study subject, had more than four pregnancies. Number of pregnancies have the same relationship of the parity, that we can see some relationship with osteoporosis distribution from the results but its not significantly and the P- value = (0.290).As shown in table (4.10).

Table (4.10): Number of Pregnancies and Osteoporosis.

Number of pregnancies	categories	normal		osteopenia		osteoporosis	
		n	%	n		n	%
	0	8	57.10	5	35.70	1	7.10
	1- 3	1	16.70	4	66.70	1	16.70
	4 +	30	33.00	44	48.40	17	18.70

P value= (0.290)

4.5 Environmental Variables:

The environmental variables of the subject were classified according to:

Place of live, exposure to the sun light, smoking habits and the Physical parameters. The tables of this section shows the relationship between the environmental variables and osteoporosis. This relationship are shown, that the environmental factors has an effect on the osteoporosis disease prevalence. Some of these variables has a significant effect and others has a week effect.

Table (4.11):The Environmental Variables Distribution.

	Village				City				camp			
	normal		Osteoporosis		normal		Osteoporosis		normal		Osteoporosis	
	n	%	n	%	n	%	n	%	n	%	n	%
Physical activity in the past (age 25- 45)												
Non active	1	50.0	1	50.0	5	55.6	4	44.4	1	20.0	4	80.0
Moderate Active	5	26.3	14	73.7	5	35.7	9	64.3	2	25.0	6	75.0
Strongly Active	7	41.2	10	58.8	9	36.0	16	64.0	3	25.0	9	75.0
Physical activity in the last year												
Non active	1	20.0	4	80.0	4	26.7	11	73.3	4	28.6	10	71.4
Moderate Active	2	13.3	13	86.7	5	50.0	5	50.0	0	.0	1	100.0
Strongly Active	10	55.6	8	44.4	10	43.5	13	56.5	2	20.0	8	80.0
like to be under the sun directly												
Yes	12	54.5	10	45.5	12	52.2	11	47.8	5	50.0	5	50.0
No	1	6.3	15	93.8	7	28.0	18	72.0	1	6.7	14	93.3
Out door (Hour /Day)												
never	0	.0	10	100.0	4	28.6	10	71.4	1	14.3	6	85.7
1	0	.0	9	100.0	9	56.3	7	43.8	2	22.2	7	77.8
2+	12	66.7	6	33.3	6	42.9	8	57.1	2	50.0	2	50.0
Are you go with head cover												
Yes	11	32.4	23	67.6	13	39.4	20	60.6	6	25.0	18	75.0
No	2	50.0	2	50.0	6	40.0	9	60.0	0	.0	1	100.0
Do you usually watch TV												
Yes	12	34.3	23	65.7	18	41.9	25	58.1	5	22.7	17	77.3
No	1	33.3	2	66.7	1	20.0	4	80.0	1	33.3	2	66.7
Average time Watching TV (Hour /week)												
0-14	6	42.9	8	57.1	8	32.0	17	68.0	2	22.2	7	77.8
15- 21	4	40.0	6	60.0	2	25.0	6	75.0	2	50.0	2	50.0
22 +	3	21.4	11	78.6	9	60.0	6	40.0	2	16.7	10	83.3

4.5.1 Locality (Place of live) and Osteoporosis:

The place of live is an important variable in my study, and my hypothesis in the study is: the osteoporosis prevalence will be high in the city, as an effect of the life style level. And high in the Palestinian camps as a result of the unhealthy and stress life and low exposure of the sun light. And low prevalence of osteoporosis in the rural regions because the participant from villages have more healthy life, more physical activity and more sun exposure. From the tables below we see that the relationship of these variables is very low effect and no insignificant relationship.

Table (4.12): Locality and Osteoporosis.

Age Group	Living Place	Normal		Osteopenia		Osteoporosis		P-Value
		n	%	n	%	n	%	
<60	city	16	47.10	13	38.20	5	14.70	0.708
	Village	10	50.00	9	45.00	1	5.00	
	Camp	6	40.00	8	53.30	1	6.70	
	Total	32	46.40	30	43.50	7	10.10	
60 +	city	3	21.40	7	50.00	4	28.60	0.295
	Village	4	22.20	11	61.10	3	16.70	
	Camp	0	0.00	5	50.00	5	50.00	
	Total	7	16.70	23	54.80	12	28.60	
Total	city	19	39.60	20	41.70	9	18.80	0.473
	Village	14	36.80	20	52.60	4	10.50	
	Camp	6	24.00	13	52.00	6	24.00	
	Total	39	35.10	53	47.70	19	17.10	

From the above table (4.12) we can see the effect of locality in the participants are 60 years or older, 50 % of the participants from the camp has osteoporosis (very high percentage). And 28.6 % from the woman lived in the city has osteoporosis which is high percentage too. But in the villages there is just 16.7 % from all the 60 years old or more woman.

Table (4.13): Living place and Osteoporosis.

Locality	Normal		Osteoporosis or Osteopenia	
	n	%	n	%
City	19	50.00	29	39.70
Village	13	34.20	25	34.20
Camp	6	15.80	19	26.00
Total	38	100 %	73	100 %

P value= (0.412)

4.5.2 Exposure to the Sun Light and Osteoporosis:

The rapport of low exposure of sun light and the prevalence of osteoporosis is statistically significant in the study results, and these results consort with the study hypothesis which said that the prevalence of osteoporosis increase with decrease the exposure of the sun light.

Table (4.14): Sun Light Exposure and Osteoporosis.

like to be under the sun directly	categories	Normal	Osteoporosis or Osteopenia		
		n	%	n	%
	Yes	29	52.70%	26	47.30
	No	9	16.10%	47	83.90

P-value= (0.000)

The above table shown that, the participants like to be under the sun directly has high prevalence of normality (52.7 %) of women's answer yes, and those unlike to be under the sun directly has very high prevalence of osteoporosis (83.9 %) of them, has osteoporosis or osteopenia.

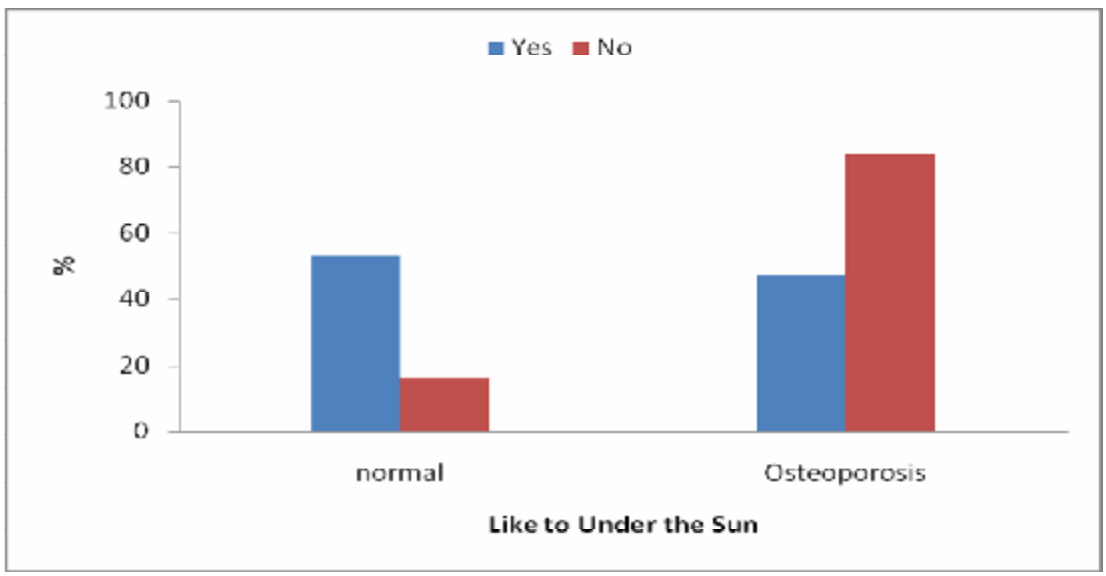


Fig (4.5): sun light exposure and osteoporosis (like to be under the sun).

From the table (4.15), we see the results of the out door hours per day. (83.9%) of the woman are not be out door regions daily has osteoporosis or osteopenia, and this percentage are decrease with increase the daily out door hours.

So the hypothesis of the study is correct, and the relationship between the exposure to the sun light and osteoporosis significantly. The *P*-value of the table (4.14 and 4.15) are (0.000,and 0.003) respectively.

Table (4.15): Sun Light Exposure (Hours/day)and Osteoporosis.

Out door (Hour /day)	Categories	Normal		Osteoporosis / Osteopenia	
		n	%	n	%
	<1	5	16.10%	26	83.90
	1	11	32.40%	23	67.60
	2+	20	55.60%	16	44.40

P-value= (0.003)

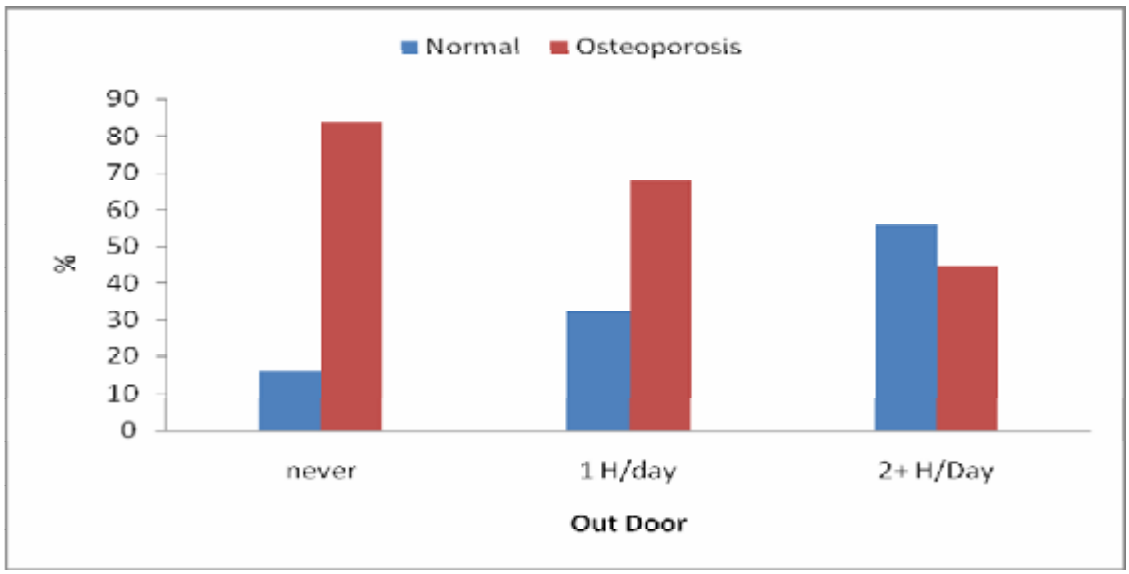


Fig (4.6): Sun Light Exposure (Hours/day)and Osteoporosis prevalence.

4.5.3 Smoking Habits and Osteoporosis:

Smoking habits are very important factor to increase the osteoporosis risk, this is the study hypothesis concerning cigarette smoking or other forms of tobacco smoking.

Table (4.16): Distribution of the study population according to Smoking habits:

Variables	Categories	n	N %
Smoking	Never Smoked	75	67.60
	Ever Smoked	36	32.40

The above table shows that 75 woman (67.6 %) from the participants are never smoked. and just 36 (32.4 %) woman from all the subject are passive or current smoker.

Table (4.17) indicate that (9.6%) of the participants non smoker have osteoporosis, while (31.6%) of participant who smoker have osteoporosis. And (41.1%) of the participants non smoker have normal result, while (23.7%) of participant who smoker are normal.

Table (4.17): smoking habits and Osteoporosis.

Smoking	categories	normal		osteopenia		osteoporosis	
		n	%	n		n	%
	Non-Smokers	30	41.10	36	49.30	7	9.60
	Smokers	9	23.70	17	44.70	12	31.60

P value= (0.009)

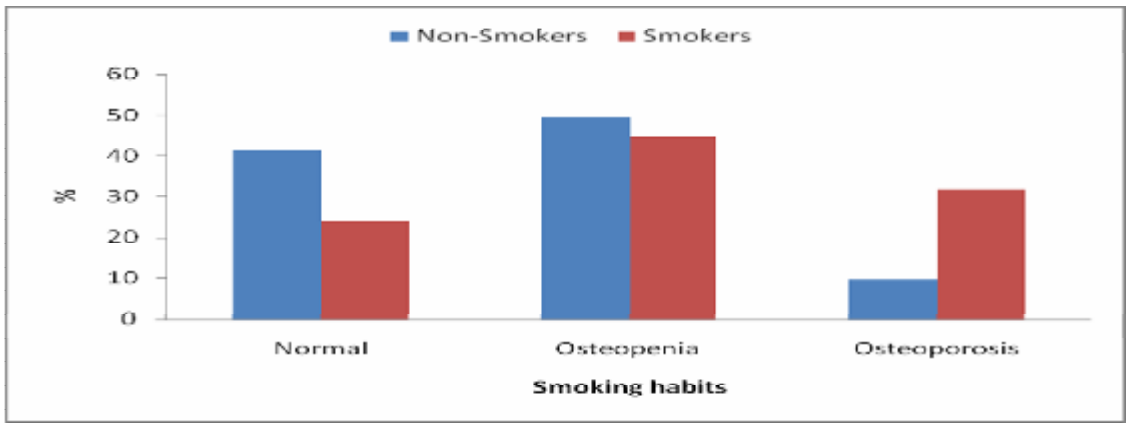


Fig (4.7): smoking habits and Osteoporosis.

So there is a significant relationship between smoking habits and osteoporosis, *P*-value equal (0.009), this result record the correct of the hypothesis.

4.5.4 Physical Activity parameters and Osteoporosis:

The hypothesis of the study regarding the physical activity was strongly physical active women have to be strongly Bone Marrow Density and this factor will decrease the developing of osteoporosis. The physical active women in the study subject are 50.5% from all the subject, nearly the same percentage of the non active women (49.5%). Tables (4.18,19) shows the relationship between women's participation in various activities such as (walking, swimming, home sport, and gymnastic sports hours per day) when they were between 25 and 45 years of age and in the last year, and osteoporosis.

Table (4.18): Physical activity (age 25- 45) and Osteoporosis

Physical activity (age 25- 45)	Categories	Normal		Osteoporosis / Osteopenia	
		n	%		n
	Non active	7	43.80%	9	56.30
	Moderate Active	12	29.30%	29	70.70
	Strongly Active	19	35.20%	35	64.80

P-value= (0.573)

From the above and below tables (4.18,19) the relationship between physical activity and osteoporosis are not significant, *P*-value = (0.573) and (0.190) respectively ,and the tables shown that there is no relationship. Which disagree the hypothesis of the study**.**

Table (4.19): Physical activity in the last year and Osteoporosis

Physical activity In the last year	Categories	Normal		Osteoporosis / Osteopenia	
		n	%		n
	Non active	9	26.50%	25	73.50
	Moderate Active	7	26.90%	19	73.10
	Strongly Active	22	43.10%	29	56.90

P-value= (0.190)

4.6 Nutritional Factors:

The nutritional factors of the subject were classified according to:
Milk consumption, Caffeine consumption (Coffee, Tea, and Soft drinks), eating habitués (Dairy Products, Animal Proteins, Plant Proteins, Vegetables, Fruits, Cereal). The tables of this section shows if there is a relationship between the nutritional factors and osteoporosis.

Table(4.20): Distribution of the study population according to Milk and Caffeine consumption.

Variables	Category	n	%
Soft drinks	Daily	19	17.10
	Mostly	16	14.40
	Occasionally	44	39.60
	Never	32	28.80
Tea	Daily	72	64.90
	Mostly	16	14.40
	Occasionally	14	12.60
	Never	9	8.10
Cups of Coffee per Day	Never	30	27.00
	1 cup	24	21.60
	2- 3 cups	39	35.10
	4 + cups	18	16.20
Cups of Milk per Day	Never	40	36.00
	1 cup	53	47.70
	2- 3 cups	18	16.20

About 65% of the subject are drinking tea daily, and 73% are drinking 1 cup or more of coffee daily, and 64% of the study subject are drinking 1 cup or more of milk, but just (16.2%) are drinking more than 1 cup of milk per day, compared to (51.3 %) of the subject are drinking more than 1 cup of coffee per day. All this data are shows in the above table, table (4.20).

4.6.1 Milk Consumption and osteoporosis prevalence:

Study hypothesis, that increase of the milk consumption will decrease osteoporosis development. Milk will increase the amount of calcium, which bone need to osteoporosis prevention.

A highly statistically significant association *P*-value = (0.000) between milk consumption and osteoporosis prevalence was shown in table (4.21).

Table (4.21): Milk Consumption and osteoporosis prevalence.

Milk Consumption	categories	normal		osteopenia		osteoporosis	
		n	%	n		n	%
	Never	9	22.50	19	47.50	12	30.00
	1 cup	16	30.20	30	56.60	7	13.20
	2- 3 cups	14	77.80	4	22.20	0	0.00

P-value = (0.000)

From the table we see that the participant who drinking 2-3 cups of milk per day did not had osteoporosis. And (77.5 %) of the participants never drink the milk, had osteoporosis or osteopenia.

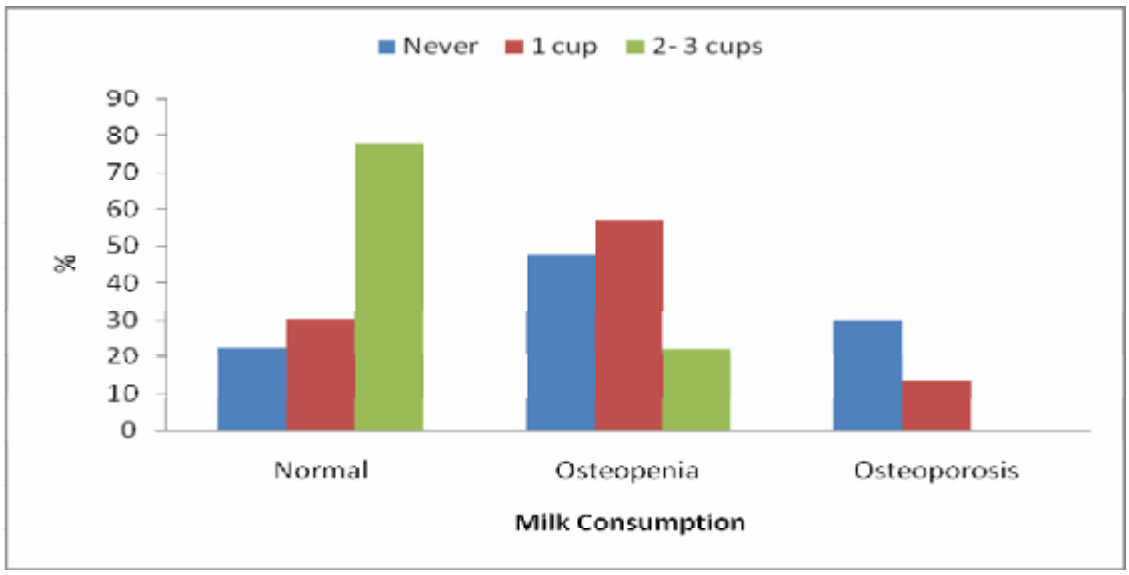


Fig (4.8): Milk Consumption and osteoporosis prevalence.

4.6.2 Caffeine Consumption and osteoporosis prevalence:

Caffeine consumption of the subject, classified according to: Coffee, Tea, and Soft drinks intake. We have to decrease the amount of caffeine, to prevent our skeletons from osteoporosis. This is the hypothesis regarding the relationship between caffeine consumption and osteoporosis. Positively significant associations were not found between caffeine consumption and osteoporosis. Table (4.22) shows these negative results.

But regarding the tea intake we see that 33.3% from the women were never drinking tea had osteoporosis. And those women drinking tea daily or Mostly recorded just 15.9% of them with osteoporosis. This result are supported with many studies has the same result, (Hoover, 1996), (Wu CH, 2002), (Hegarty, 2000).

Table (4.22): Caffeine Consumption and osteoporosis.

Variables	Categories	Normal		Osteopenia		Osteoporosis	
		n	%	n	%	n	%
Coffee Consumption	Never	11	36.70	11	36.70	8	26.70
	1 cup	9	37.50	12	50.00	3	12.50
	2- 3 cups	9	23.10	22	56.40	8	20.50
	4 + cups	10	55.60	8	44.40	0	0.00
P-value = (0.181)							
Tea intake	Never	3	33.30	3	33.30	3	33.30
	Occasionally	6	42.90	6	42.90	2	14.30
	daily/Mostly	30	34.10	44	50.00	14	15.90
P-value = (0.479)							
Soft Drink	Never	11	34.40	17	53.10	4	12.50
	Occasionally	20	45.50	17	38.60	7	15.90
	daily/Mostly	8	22.90	19	54.30	8	22.90
P-value = (0.420)							

4.6.3 Eating habits:

From the table (4.23) below, we see that, eating habits are not significant relationship with osteoporosis, except the animal products, this variable witch have a significant association (*P*-value = 0.003) with osteoporosis and osteopenia.

Another variables shown some logical distribution, like the dairy products, those women are have occasionally consumption of dairy products, 90% of them had osteoporosis and osteopenia. All the participants never eating plant proteins had osteoporosis and osteopenia. On the other hand, 88.9% of the women never eat oil or butter and ghee have osteoporosis and osteopenia

Table (4.23): eating habitués and the prevalence of osteoporosis.

variables	categories	normal		osteoporosis		*P* value
		n	%	n	%	
Dairy Products	Daily	28	36.40%	49	63.60%	
	Mostly	9	37.50%	15	62.50%	
	Occasionally	1	10.00%	9	90.00%	
	Never	0	0.00%	0	0.00%	0.237
Animal Proteins	Daily	17	32.70%	35	67.30%	
	Mostly	21	47.70%	23	52.30%	
	Occasionally	0	0.00%	15	100.00%	
	Never	0	0.00%	0	0.00%	0.003
Plant Proteins	Daily	1	12.50%	7	87.50%	
	Mostly	13	36.10%	23	63.90%	
	Occasionally	24	39.30%	37	60.70%	
	Never	0	0.00%	6	100.00%	0.135
Cereal	Daily	27	33.80%	53	66.30%	
	Mostly	7	33.30%	14	66.70%	
	Occasionally	4	40.00%	6	60.00%	
	Never	0	0.00%	0	0.00%	0.921

Variables	Categories	Normal		Osteoporosis		*P* value
		n	%	n	%	
Vegetables	Daily	26	32.90%	53	67.10%	
	Mostly	9	47.40%	10	52.60%	
	Occasionally	3	23.10%	10	76.90%	
	Never	0	0.00%	0	0.00%	0.327
Fruits	Daily	31	36.00%	55	64.00%	
	Mostly	5	27.80%	13	72.20%	
	Occasionally	2	28.60%	5	71.40%	
	Never	0	0.00%	0	0.00%	0.756
Sweets and confectionary, honey and jam	Daily	10	45.50%	12	54.50%	
	Mostly	8	44.40%	10	55.60%	
	Occasionally	13	26.00%	37	74.00%	
	Never	7	33.30%	14	66.70%	0.311
Oil, butter and ghee	Daily	23	33.80%	45	66.20%	
	Mostly	8	44.40%	10	55.60%	
	Occasionally	5	33.30%	10	66.70%	
	Never	1	11.10%	8	88.90%	0.393
Nuts	Daily	8	50.00%	8	50.00%	
	Mostly	5	25.00%	15	75.00%	
	Occasionally	22	37.30%	37	62.70%	
	Never	3	18.80%	13	81.30%	0.215

4.7 Medicinal history factors:

From the table (4.24) below we see that the medical history are not significant relationship with osteoporosis for all the variables of it. But some medication or medical history sine some effect on the prevalence of osteoporosis, that we can see in the over active thyroid gland, 90.9% from the participant had over active thyroid gland, whom had osteoporosis and osteopenia, P value = 0.064

80.8% from the women ever broken any bones in the last had osteoporosis.

Table (4.24): Medical history and osteoporosis.

variables	Category	normal		Osteoporosis		P value
		n	%	n	%	
use vitamins	Yes	12	35.30%	22	64.70%	0.876
	No	26	33.80%	51	66.20%	
use calcium tablets	Yes	14	32.60%	29	67.40%	0.767
	No	24	35.30%	44	64.70%	
HRT Use	No	30	34.50%	57	65.50%	0.916
	Yes	8	33.30%	16	66.70%	
over active thyroid gland	No	37	37.00%	63	63.00%	0.064
	Yes	1	9.10%	10	90.90%	
ever had sugar diabetes	No	27	36.00%	48	64.00%	0.571
	Yes	11	30.60%	25	69.40%	
ever had kidney stones	No	36	34.60%	68	65.40%	0.744
	Yes	2	28.60%	5	71.40%	
ever broken any bones in the last	No	33	38.80%	52	61.20%	0.065
	Yes	5	19.20%	21	80.80%	

Chapter Five

Discussion

5.1 Introduction:

Osteoporosis is generally a silent and asymptomatic disease until a fracture occurs. It is estimated that more than one-third of the adult women will sustain one or more osteoporotic fractures in their life time (Sandison, 2004). They cause significant burden to health care systems worldwide.

This chapter aims to discuss the results of the study. The findings in our study clearly demonstrate that the prevalence of osteoporosis among females in east Jerusalem is comparable to other countries. The results demonstrate that osteoporosis is significantly associated with menopause, The results is significantly associated also with gender, age, low BMI, Marital Status, low Milk Consumption, Smoking, low Sun Light Exposure. And more factors are affected osteoporosis developing but it not shown as significant factors.

5.2 Prevalence of osteoporosis:

The present study revealed that among Palestinian pre and postmenopausal women, Based on the definition of World Health Organization (WHO), the T-score value was considered for analysis, the prevalence of osteoporosis was found to be 17%. Our result is higher than the study findings in Jordan where 13% of women aged 40–60 had osteoporosis(Al Qutob, 2001),

this result is similar to the study of Qatar where 12.3% of the Qatari women had osteoporosis (Abdulbari, 2007). That's may be for the reason of the age of the sample, or the difference of the stress life style in Palestinian women.

In the USA, 16% of postmenopausal Caucasian women are estimated to have osteoporosis in the lumbar spine. In comparison, a higher prevalence was observed among Japanese women aged between 50 and 79 years; 35% in the spine and 12% in the hip.(Iki M, 2007).

Among Saudi women, it was documented that 24% had osteoporosis(EL-Desouki. 2003). Which similar to our results "22% from the postmenopausal women have osteoporosis".

Another study involving healthy postmenopausal women in Denmark indicated 50% prevalence of osteoporosis in those older than 50 years (Vestergaard, 2005).

Another study was conducted by Miss Smoom from Al quds University shows that in association with BMD 75% of the postmenopausal Palestinian woman in Bethlehem District had osteopenia rather than osteoporosis . (Smoom, 2005).

In our study of Palestinian women, 64.75% of all the participants (male and female) had osteopenia rather than osteoporosis, and 73.2% of the post menopausal women have osteopenia rather than osteoporosis and its similar to Miss Smoom study results, the osteoporosis and osteopenia prevalence in the participants at age 65 years old or more is 90.4%, in my study, and this result is extremely high.

Prevalence provides a measure on how common a disease is spread in the population. The finding in our study clearly demonstrate that the BMD of female subjects in east Jerusalem reaches 17% lower than the peak BMD, and the prevalence of osteopenia reaches 48.6%, whereas only 34.2% have a normal results. It was concluded that the prevalence of this worldwide public health problem among the Palestinian female population is high. and is even found in younger age categories compared to previous international surveys, the osteoporosis prevalence in the participants at age from 50 to 54 years old is 15.4%, may be that the effect of the stress life style of the Palestinian women which had a positive environmental factors like the tough home work, and some environmental factors from the Palestine legacy, like the land work, which lead to higher physical activity and higher exposure to the sun.

5.3 Risk Factors.

5.3.1 Gender effect on Osteoporosis:

Osteoporosis is 6 times more prevalent in women than in men, in men, osteoporosis appears at a later age than women which had greater bone losses than men, (Nguyen, Kelly, 1994).

in Saudi Arabia, the prevalence of osteoporosis was studied in a randomly selected group of 1980 Saudi males and females aged 20 to 79 years. less Saudi men are diagnosed with osteoporosis. Thus, the prevalence of osteoporosis in the Saudi Arab population is overestimated in women and underestimated in men.(EL-Desouki. 2003).

In our study the relationship between gender and osteoporosis was shown the osteoporosis prevalence rates in female more than in males, there is no any man have osteoporosis in our

participants. Wile the osteoporosis are show in 19 women (17.1%) of all the study subject. And the normal participants in the males 8 participants (50%) compared with the females, 38 participants (34.2%).

5.3.2 Demographic Variables:

One of the finding in this study is the statically significant association between menopause and osteoporosis, with *P*-value=(0.004) as shown in table (4.4). 22% from Post-Menopause woman have osteoporosis compared with 3.4% of Pre-Menopause woman have osteoporosis. This result are agree with most of the studies were don in this case.

A population-based study was done at Kuopio University Hospital, in Finland. The study evaluated the effects of menopause on osteoporosis. Menopause had a major effect on BMD. Postmenopausal women had significantly lower BMD in both spine (-6.2%) and femoral neck (-3.9%) as compared with pre menopausal women. (Kröger, 1994). For women, the estrogen deficiency initiated by menopause accelerates the bone losses between age 50 and 60. Thereafter, the decrease is slower, resembling that of men but even between 60 and 80, women had greater bone losses than men, 19% in women compared with 10% in men in the study by Nguyen and colleagues (Nguyen, 1994). And The rate of bone losses in the first ten postmenopausal years varies from 1-5% per year, it's a result of the study were done by Hansen. (Hansen, 1991). And the Peak bone mass of women is not as high as that of men (Looker, 1995).

The prevalence of osteoporosis and osteopenia significantly increased with advancing age were find in our study. In fact, the respondents who are 49 years old or younger had 4.3% percentage of osteoporosis, and 56.5% normal. Compared with the respondents who are 65 years old or older had higher percentage of osteoporosis lead to32.3%, and the normal in the same age group 9.7%. (table 4.5). these result are consistent with other relative studies. A study was done among rural and urban women in Poland. the prevalence of osteoporosis In women younger than 45 years osteoporosis was not observed, and the prevalence of osteopenia was 12.6%. In women between 45-55 years the prevalence of osteoporosis was 5.7 % and of osteopenia 25.6%. In women older than 55 years, osteoporosis was observed in 18.5% and osteopenia in 40.7%. (Filip. 2001).

In Thailand, data from measuring BMD, showed a statistically significant association between age and osteoporosis (Supawitoo, 2005).

A pilot study against Saudi women were done. The results shows that, there were 42.3% normal, 33.4% osteopenia and 24.3% osteoporosis, in age 50-59 years; 11% normal, 27% with osteopenia and 62% with osteoporosis, in age 60-69 years while in older age 70-79 years only 4.6% had normal BMD, 21.5% had osteopenia and 73.8% had osteoporosis (EL-Desouki, 2003).

There was a negative association between BMD and age. The most powerful predictor of osteoporosis was increased age (Kim, Chung, 1990), (Kanis, 2003). Eastell et al, reported that age-induced decrease of bone density could be the result of decrease of kidney function, deficiency of vitamin D, increase of parathyroid hormone, decrease of testosterone or decrease of both calcium uptake and absorption.(Eastell, 1998).

On the other hand the Body Mass Index (BMI) and osteoporosis has a significant association showed in our study , an Osteoporotic obese women percentage was 14%, this percentage less than the percentage of those women have normal (BMI) 40%. And the normal Body Mass Index participants who had normal result of (BMD) was 30%, but the obese women have a good T-score results was 42.10%.

The relationships between BMI and BMD are expected given the dependence of BMI measures on weight. Positive associations between fat mass and BMD are supported by other investigations as well (Barr. 1998), (Houtkooper. 1995), (Mazess, 1990). This relationship clear in varies studies; BMI below 19-20 in elderly is often associated with osteoporosis while individuals with a weight over 70 kg are seldom affected (Michaelsson, 1996). Low body weight and low body mass index (BMI) have consistently been shown to be associated with an increased risk of osteoporosis (Brot, 1997), (Dargent, 2000). In the age category of the subjects in our study, low body weight rather than low BMI has the strongest association with osteoporosis. This may due to the fact that many individuals lose height due to the deformities in spine, and perhaps also due to vertebral fractures, often undiagnosed (Cooper, 1992), (O'Neill, 1996). A reduction in height over 4—5 cm may be caused by vertebral fractures (Kantor, 2004).

A statically significant relationship was found in my study between marital status and osteoporosis. the highest percentage of osteoporosis is in the widowed women 44%, and 44% had osteopenia. And the highest percentage of normal women is in the single participants 54.5%.this association are found significantly with *P*-value = (0.003). there is clear association between marital status and osteoporosis in other studies, and the reasons exactly unknown, may be there is some psychological factors, lead to hormone changes, witch affect the bone formation.

Regarding the educational level issue, we detect that, the disease is more prevalence among participants had low educational level, 20 % of those women had low education was osteoporotic patients, compared 7.7% osteoporotic women, from those hade height educational level. and the normal percentage is 46.2 % from the participants had a height education, compared with 31.8 % from the woman had low educational level. But in the statistical analysis of data, its clearly seen that there is no statistically significant association, and the *P*-value= 0.228. We notice that 76.6% from the subject had a low educational level. However, we need larger studies with a larger number of patients for further validation.

Regarding the parity (number of children) and the number of Pregnancies relationship with osteoporosis, no significant association was found. A cross sectional study among Jordanian women were done, no evidence of increased risk of osteoporosis among ever-pregnant women was noted. Though, the number of pregnancies in the multifarious female population showed a negative impact on femoral neck BMD, (Sireen, 2003). Conversely, our data analysis highlight many potential risk factors including associated medical illnesses, from the table (4.9,10) can notice that the women had four children or more 20.8 % of them had osteoporosis, and 32.5 of them normal BMD, compared with women had no children, 57.1% of them normal, and just 7.1% of them described as osteoporosis cases.
The number of pregnancies have the same relationship of the parity, that we can see some relationship with osteoporosis distribution from the results but its not significantly association and the *P*-value of the parity and the number of Pregnancies is (0.199, 0.290) respectively.

5.3.3 Environmental Factors:

One of the main aims of the study is the environmental factors effect on the prevalence of osteoporosis. These factors of the subject were classified according to the place of live, exposure to the sun light, smoking habits and the Physical activity parameters.

This is the first study in Palestine among normal women living in rural, camps and urban environments, witch describe the relationship between the locality and osteoporosis.

The marked variation in fracture incidence within specific countries suggests that environmental factors are important. The higher incidence of hip fractures in urban as opposed to rural districts has been explained on the basis of the lower bone mass of urban residents (Gardsell, 1991). However, regional differences in the USA do not seem to be accounted for by differences in the levels of physical activity, obesity, cigarette smoking or alcohol consumption or by Scandinavian descent. (Jacobsen, 1990). A similar study was done in Poland, among normal women living in rural and urban environments. No statistically significant differences were observed in mean values of BMD between urban and rural populations, nor between farmers and other occupations in the study. (Filip RS, 2001). Although, there is no significant association in my study results , some differences we can see in this study in table (4.12). The effect of locality in the participants are 60 years or older, 50 % of the participants from the camp has osteoporosis (very high percentage). And 28.6 % from the woman from the city has osteoporosis which is high percentage too. But in the villages there is just 16.7 % from all the 60 years old or more woman. Further studies are needed to identify the environmental factors responsible for such marked regional differences, especially the environmental factors shown in chapter tow like toxic metals and substance, estrogen exposure, air pollution and water hardness.

There was no statistical association between risk of osteoporosis and level of physical activity shown in my study. One study proved that physical activity as a way to prevent osteoporosis is based on evidence that it can regulate bone maintenance and stimulate bone formation including the accumulation of mineral, in addition to strengthening muscles, improving balance, and thus reducing the overall risk of falls and fractures (Borer, 2005). Another study found that weight-bearing physical activity may reduce the risk of

osteoporosis in women by augmenting bone mineral during the early adult years and reducing the loss of bone following menopause. Another study observed repetitive activities, such as walking, may have a positive impact on bone mineral when performed at higher intensities (Levis 1998). A study were done in Italy, reported that there were no statistically significant differences between the physical activity and osteoporosis among the categories analyzed (Amelio, 2005). Another study were done among pre and post menopausal Qatari women. The study proved that there is no statically significant association between physical activity and osteoporosis prevalence (Abdulbari, 2007).
According this previous studies results, there is difficult to conduct who's a physical activity person and who's not , the physical activity description, and the number of hours per day or week, depending on the accuracy and the sincerely memory of the participant. And the physical activity which affect the bone of the human is this we are doing in the young age to increase the PBMD.

A very little researches were done to study the relationship of Exposure to the Sun Light and Osteoporosis. This is the first study in Palestine discuss the effect of this factor on osteoporosis. The rapport of low exposure of sun light and the prevalence of osteoporosis is statistically significant in our study results, according to table (4.14,and 4.15). the *P*-value <(0.001), and (0.003) respectively.
Exposure to the Sun Light, is very important source to increase the amount of vitamin D in our body, and vitamin D is required for optimal calcium absorption and for bone healing. Vitamin D insufficiency and deficiency can be prevented by encouraging responsible exposure to sunlight. It is now recognized that vitamin D insufficiency and vitamin D deficiency are common in elderly people, especially in those who are infirm and not mediated cholecalciferol during the winter months. Vitamin D insufficiency and deficiency exacerbate osteoporosis .(Am J Clin Nutr.1995)

Findings from the current study support other studies in which smoking habits has demonstrated negative associations with BMD measurements.
Smoking is a strong risk factor which doubles the risk of osteoporosis, as shown in the results of several studies (Kanis, 2003). In contrast to the large number of studies

documenting the adverse effects of cigarette smoking on peak bone mass,. A recent meta-analysis of the results of 48 published studies showed that, although no significant difference in bone density at age 50 years between smokers and non-smokers existed, bone density in women who smoked diminished by about 2% for each 10-year increase in age, with a 6% difference at age 80 years between smokers and nonsmokers (Law MR, 1997). Smoking habits increase bone loss and increase risk fracture of bones as a result of reduced intestinal calcium absorption efficiency. In line with this, our study documented a positive significant association with prevalence of osteoporosis, *P*-value (0.009). Table (4.17) indicate that 9.6% of the participants in our subject non smoker, have osteoporosis, while 31.6% of participant who smoker have osteoporosis.

5.3.4 Nutritional Factors.

There is no consensus on how to define malnutrition among elderly and no exact definition of the condition. Many methods have been developed but we still lack a gold standard to define malnutrition. (Akner, 2001).

5.3.4.1 Milk and Caffeine Consumption:

A highly statistically significant association *P*-value < (0.001) between milk consumption and osteoporosis prevalence was fined in this study. Milk is very rich of calcium witch increase the risk of bone formation and decrease the risk of osteoporosis development. From the table(4.21) we see that the participant who drinking 2-3 cups of milk per day did not had osteoporosis for all the subject. And 77.5 % of the participants never drink the milk, had osteoporosis or osteopenia.

On the other hand, Significant associations were not found between caffeine consumption and the disease development. Most studies of the health risks of coffee and caffeine have focused on cardiovascular disease, but some data indicate that these substances promote osteoporosis. A study analysis assessed caffeinated coffee consumption and bone mineral density, the finally result of the study that indicate that, caffeinated coffee can lead to reduced bone mineral density, but suggest that milk consumption can offset the increase (Barrett-Connor. 1994). In our study there is no significantly association between caffeine consumption and the osteoporosis development may be the results of Barrett-Connor study

affect my statistical analysis, as made known that, 64% of the study subject are drinking 1 cup or more of milk, as shown in table (4.20).

Regarding the tea intake found a positive trend between daily or mostly consumption of regular tea and total body bone mineral density . In table (4.22) we see that 33.3% from the women were never drinking tea, had osteoporosis. And those women drinking tea daily or mostly, recorded just 15.9% of them with osteoporosis, This result is consistent with findings from other researchers among postmenopausal women in Canada (Hoover, 1996), older women (65–76 years) in the United Kingdom (Hegarty, 2000), and adult women and men in Asia (Wu CH, 2002), which have shown an increased axial bone mineral density (hip and spine) and/or increased total body bone mineral density among tea drinkers. And similar result are obtained in cross-sectional analysis, total hip BMD was 2.8% greater in tea drinkers than in non-tea drinkers. In the prospective analysis over 4 year, tea drinkers lost an average of 1.6% of their total hip BMD, but non-tea drinkers lost 4.0%. Adjustment for covariates did not influence the interpretation of results (Amanda Devine, 2007). So, Tea drinking is associated with preservation of hip structure in elderly women. This finding provides further evidence of the beneficial effects of tea consumption on the skeleton.

5.3.4.2 Eating Habits:

Both positive and negative associations have been reported between eating habitues and BMD. A study was done in 1998 by Teegarden, shows a positive associations (Teegarden, 1998), the same analysis result reported by Michaelsson (Michaelsson, 1995). Wile, a negative associations are shown in another studies. (Metz, 1993). Eating habitués is needed for proper synthesis, maintenance, and repair of bone (Anderson, 2000).

The result of our study concerning relationships between dairy products intake and BMD are equivocal. The study remarked that animal proteins are positive significant association with BMD formation, (*P*-value = 0.003), we can notice that (59.8%) of the participants were daily or mostly animal proteins intake are osteoporotic patients, while all the participants (100%) were never or occasionally animal proteins intake have osteoporosis. but in the plant protein, a significant association are not seen in the study analysis. A randomized trial study was shown that a protein supplementation for osteoporotic patients

had positive effects and fewer new vertebral fractures were observed (Schurch, 1998). Some studies have also shown decreased risk of fracture and bone density losses with increased intake of protein (Dawson-Hughes, 2002), (Wengreen, 2004).

In a meta-analysis by Hedstrom and colleagues in 2006, 19 randomized studies were identified where patients with hip fracture were treated with nutritional or anabolic treatment, 12 of them using nutritional or protein supplementation. Six of the studies showed improved clinical outcome with shorter recovery period in hospital and fewer complications (Hedstrom, 2006).

Another variables shown some logical distribution, like the dairy products, those women are have occasionally consumption of dairy products, 90% of them had osteoporosis and osteopenia. All the participants never eating plant proteins had osteoporosis and osteopenia. On the other hand, 88.9% of the women never eat oil or butter and ghee have osteoporosis and osteopenia, see table (4.23).

The results of investigations concerning relationships between other eating habits and osteoporosis development are equivocal, and there is unclear association. So more investigations and studies were need in this issue.

5.3.5 Medicinal Factors:

Table (4.24) shows that the medical history are not significant relationship with osteoporosis for all the variables of it. But some medication or medical history, are the reason of some effect on the prevalence of osteoporosis, that we can see in the over active thyroid gland, 90.9% from the participant had over active thyroid gland, whom had osteoporosis and osteopenia, *P*-value = 0.064

80.8% from the women ever broken any bones in the last had osteoporosis or osteopenia.

Regarding calcium tablets intake are not shown any deferent's data between those taking or not. Because some of the participants whose taking calcium tablets as a treatment against osteoporosis, this mean him an Osteoporotic patients, and others are taking this tablets as preventable medication, this mean that these group didn't have osteoporosis or osteopenia.

Chapter six

Conclusion and Recommendations

6.1 Conclusion:

A cross sectional study was conducted in east Jerusalem, to examine the prevalence of osteoporosis, and assess the effect of environmental, demographic, nutritional and medicinal factors among the Palestinians residing in East Jerusalem from 45 years of age onwards. In light of the present finding the following conclusions can be drown:

The prevalence of osteoporosis in Palestinian women is comparable or more than other countries. By using T-scores from two bone sites; the prevalence of osteoporosis (T-scores ≤-2.5) was 3.4% and 22 % in pre-and post-menopausal women, respectively. and The finding in our study clearly demonstrate that the BMD of all the female subjects (pre-and post-menopauses) in east Jerusalem reaches 17% lower than the peak BMD, and the prevalence of osteopenia reaches 48.6%, whereas only 34.2% have a normal results.

These data suggest that, apart from advancing age and lower BMI, cigarette smoking، low Exposure to the Sun Light and low milk consumption is an important modifiable determinant of bone mineral density in the Palestinian women society.
The results also demonstrate that osteoporosis is significantly associated with gender, menopause, marital status and the animal proteins intake.

Secondly, bone mass is accumulated during the developmental years. Because this study included a retrospective account of just 1 year in that developmental process, physical activity, medicinal factors, eating habits and overall health during the previous year may not adequately reflect current BMD status.

The present study revealed that the environment have a considerable role to develop or prevent osteoporosis prevalence in Palestinian women society.

6.2 Recommendations:

From the data results of the study I made the following recommendations:

- These findings can potentially contribute toward the development of more effective public health strategies for the health promotion and osteoporosis prevention in Palestinian population.

- Family doctors have to use risk factors for request testing, mainly DXA.

- The Palestinian population should:
  - Maintain a healthy lifestyle with adequate exposure to sunlight; this applies particularly to the elderly in extreme latitudes.
  - Avoid smoking, and make sure that milk consumption is a good source of calcium.
  - Maintain an appropriate body weight.
  - Considering that, reducing the risk of fracture by environmental measures such as enriching widely used foods with calcium, vitamin D, or both if necessary.

- The national osteoporosis programs instituted in association with the WHO and with other national and international organizations, should to be supported.

- We should supporting the patient education and the establishment of self-help groups regionally and locally, and raise awareness of risk factors for osteoporosis and prevention strategies in our country.

6.3 Suggestion for future studies:

Further studies are required to investigate:

- More researches to study the effect of changing environmental exposures which can influence osteoporosis prevalence and fracture risk in Palestinian population.
- Fundamental aspects of bone biology, taking into account progress in molecular genetics.
- Factors influencing the acquisition of bone mass during growth and bone loss during adult life in our country.
- The development of cheap diagnostic tools for osteoporosis and their assessment in monitoring treatment.
- The effectiveness of combination therapies and comparisons between therapies, as shown by controlled trials.
- A survey of the prevalence of osteoporosis and osteopenia in Palestinian male and female population.
- Further studies are required to investigate the relationship between the locality and the life style and the osteoporosis development in Jerusalem, and the effect of the stress life in Palestinian camps on population health.
- Further studies to evaluate the environmental factors and osteoporosis including exposure to toxic metals and substances “lead, cadmium, aluminum, fluoride”, estrogen exposure, air pollution and water hardness.

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