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School of Public Health

Risk Factors of Osteoporosis among Adults in Gaza Governorates: Case Control Study

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Dedication

I dedicate this work to my mother a strong and gentle soul who thought me to trust in Allah, believe in hard work and that so much could be done with little.

To my father for earning an honest living and for supporting and encouraging me to believe in myself.

To my dear husband who encouraged and inspired me.

To all my family and friends who appreciate this work.

To everyone in my country could get benefit from this work.

Declaration

I declare that this thesis submitted for the degree of Master is the result of my own research except as cited in the reference. The thesis has been not accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signed:

Name:

Date: 2211/2017

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Researcher: Shimaa Hassan Shagfa
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Abstract

Osteoporosis is one of the most common public health problem affecting adults and elderlies, it called silent disease because most individuals are not aware they have osteoporosis until they actually fracture a bone. This study aim to identify the possible risk factors for osteoporosis among adults in Gaza Governorate. The researcher used a case-control study to identify risk factors of osteoporosis. Cases and controls were selected from Palestinian German Diagnostic Center after doing DEXA scan a standard method for diagnosis of osteoporosis depend on giving T score (Tscore≤ -2.5 osteoporosis, T score ≥-1 normal). Structure interview questionnaire was used and information on socio-demographic characteristics, life style, medical conditions and medication used were collected. Data was processed and analyzed using statistical package for social sciences (SPSS) version 20. Binary logistic regression was used to control confounders. A total of 160 participants were participated in the study 80 cases and 80 controls.The logistic regression analysis adjusted for age, sex and place of treatment showed that there was significant risk factors between development of osteoporosis and breast-feeding [(OR: 1.436, 95%C.I.: 1.436-26.842), P value = 0.015], while BMI >29.9 showed a protective factor for osteoporosis [(OR: 0.871, 95%C.I.: 0.796-0.954), P value= 0.003]. In addition, significant risk factor was shown between family history and development of osteoporosis [(OR: 3.845, 95%C.I: 1.283-11.520), P value= 0.016]. Furthermore, there was a significant risk factor between using loop diuretics (Lasix) and development of osteoporosis [(OR: 6.967, 95%C.I.: 1.362-35.649), P value = 0.020]. Finally, significant risk factor between using antihypertensive drug and development osteoporosis [(OR: 3.004, 95%C.I.: 0.978-9.228), P value= 0.05]. Therefore, the findings from our study suggest the need to pay attention for mother using breast-feeding to improve their nutrition during this period. In addition, special effort need to focus on causes of secondary osteoporosis as using loop diuretics, anti-hypertensive drugs and family history of osteoporosis. Strategies about health education program at primary and secondary level should be started to reduce the incidence of osteoporosis.

ملخص الدراسة

هذه الدراسة بعنوان: "عوامل الاختطار لمرض هشاشة العظام بين البالغين في محافظات غزة: دراسة الحالات والشواهد". على الصعيد العالمي يعتبر مرض هشاشة العظام من مشاكل العظام الأكثر شيوعاً حول العالم والتي تؤثر خاصة على البالغين وكبار السن ويدعى هذا المرض بالمرض الصامت حيث لا يعلم المصاب به حتى يصاب بكسر بأحد عظامه.

تكونت عينة الدراسة من (160) حالة (80 حالة مصابة بمرض هشاشة العظام و 80 حالة سليمة)، حيث استخدم الباحث دراسة مقارنة بين الحالات المرضية والحالات السليمة ، وقد أُخذت جميع الحالات من المركز الفلسطيني الألماني التشخيصي خلال فترة جمع العينة؛ وذلك بعد إجراء فحص الدكسا (DEXA) المختص بكشف مرض هشاشة العظام لكل من الحالات والشواهد.

تكونت أداة الدراسة من استبانة تم إعدادها لقياس متغيرات الدراسة (العوامل الاجتماعية الديموغرافية، نمط العيش، الوضع الصحي الطبي، الأدوية المستخدمة)، وقد قام الباحث بإجراء اختبارات الصدق والثبات للاستبانة من خلال عينة استطلاعية تكونت من 20 حالة (10 حالات و 10 شواهد)، وقد تم تضمينهم في عينة الدراسة، وقد استخدم الباحث الحزمة الإحصائية((Statistical Package of Social Science (SPSS) لإجراء بعض الاختبارات الإحصائية مثل مربع كاي والانحدار المتعدد.

وقد أظهر اختبار الانحدار المتعدد لإيجاد عوامل الاختطار لمرض هشاشة العظام أن هناك علاقة ذات دلالة إحصائية بين الإصابة بمرض هشاشة العظام وبين (الرضاعة الطبيعية، التاريخ العائلي للإصابة بالمرض، استخدام مدرات البول اللازكس، استخدام أدوية الضغط) في حين أن زيادة الوزن اعتبرت كعامل حماية من الإصابة بمرض هشاشة العظام.

كذلك أظهرت نتائج الدراسة أن الحالات التي تستخدم الرضاعة الطبيعية تزداد معدل إصابتهم بالمرض بمعدل (OR: 1.436) أكثر من النساء اللواتي يستخدمن الرضاعة الصناعية لأطفالهن كما وأظهر الانحدار المتعدد أن الحالات التي لديها تاريخ عائلي للإصابة بمرض هشاشة العظام تزداد معدل إصابتهم بالمرض بمعدل (OR:3.845) أكثر من الذين ليس لذويهم تاريخ عائليللإصابة بمرض هشاشة العظام، كما وأظهرت النتائج أن الحالات التي تتناول أدوية مثل مدرات البول اللازكس وأدوية الضغط تزداد معدل الإصابة لديهم بمرض هشاشة العظام بمعدل(OR: 3.004 ; OR: 6.967) على التوالي أكثر من الذين لا يستخدمون مثل هذه الأدوية.

في حيث أظهرت نتائج الدراسة أن زيادة الوزن تشكل عامل حماية من الإصابة بمرض هشاشة العظام (OR: 0.871) من الأشخاص الذين يعانون من النحافة.

وتوصي هذه الدراسة بالاهتمام بعوامل الاختطار الناتجة عن استخدام بعض الأدوية المسببة لمرض هشاشة العظام.

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List of Abbreviation

AOR	Adjusted Odds Ratio
BMD	Bone Mass Density
C.I.	Confidence Interval
DEXA scan	Dual-Energy X-Ray Absorptiometry
GG	Gaza Governorate
GS	Gaza Strip
IOF	International Osteoporosis Foundation
MOH	Ministry of Health
NOF	National Osteoporosis Foundation
OR	Odds Ratio
PCBS	Palestinian Central Bureau of Statistics
POPS	Palestinian Osteoporosis Prevention Society
UNRWA	United Nations Relief and Work Agency
WHO	World Health Organization
OCHA	Office for the Coordination of Humanitarian Affairs

Chapter 1:
Introduction

1.1 Research background

The patient profile in health institutions all over the developing world is changing. Non-communicable diseases (NCDs) have already established themselves as the predominant cause of disease and death inmanymiddle-income countries (WHO, 2010). Bone health is critically important to the overall health and quality of life. Healthy bone provide body with a frame allow for mobility and for the protection against injury (U.S. Department of Health and Human Service, 2004).

Osteoporosis, or porous bone, define by the International Osteoporosis Foundation (IOF) as a disease in which the density and quality of bone are reduced, leading to weakness of the skeleton and increased risk of fracture, particularly of the spine, wrist, hip, pelvis and upper arm (International Osteoporosis Foundation-IOF, 2011).

Osteoporosis is one of the common bone disease occurs most commonly in postmenopausal women whilemale osteoporosis has also gained attention as a growing public health concern (Mauck and Clarke, 2006).

Fracture is the most dangerous aspect of osteoporosis. In the elderly, it may lead to disability, morbidity and early mortality. In Osteoporosis, bone become fragile and may break from minor falls or in serious cases even from simple action as sneezing or bumping into furniture this condition can cause pain, difficulty of breathing and loss of independency and even death (Berry et al., 2010).There were an estimated nine million osteoporotic fractures worldwide in 2000, of which 1.6 million were hip, 1.7 million forearm, and 1.4 million clinical vertebral fractures (Boonen and Singer, 2008).

According to A Report of the Surgeon General (2004), Bone strength related to bone mass density, which refers to the amount of mineralization remaining in bones as people age and the denser the bones, the stronger they are. Factors that determine bone strength include genetic, environment, medication, Ethnicity (African-Americans have higher bone density than Caucasians or Asians), Gender (men have higher bone density than women), Aging

(bone density reaches its peak around age 25, and decreases after age 35)(U.S. Department of Health and Human Service, 2004).

Osteoporosis also called the "silent disease" because most individuals are not aware they have osteoporosis until they actually fracture a bone (usually the hip, spine, or wrist) (National Osteoporosis Foundation-NOF, 2002).

Clinically, bone mass density (BMD) is the main determinant of osteoporosis it can mainly diagnose by dual-energy X-ray absorptiometry (DEXA) scan (Watts et al., 2008). The World Health Organization (WHO) has established criteria for making the diagnosis of osteoporosis, as well as determining levels that predict higher chances of fractures. These criteria is based on comparing the BMD of the patient with that of a typical healthy young female's (WHO, 1994).

According to researcher knowledge there is limited study indicates the prevalence and burden of osteoporosis among people live in Gaza Governorates (GG). Therefore, the researcher conducted this study to determine different risk factors associated with osteoporosis among people live in Gaza Governorate (GG) that might be enable policy maker to make decision to decrease the burden and incidence of osteoporosis.

1.2 Research Problem

As outlined in the Report of the Surgeon General, Osteoporosis is the most common bone disease in humans, and it represents a major public health problem (U.S. Department of Health and Human Service, 2004). Moreover, National osteoporosis Foundation (NOF) consider Osteoporosis behaves as a silent killer therefore, a high percentage of the affected people are not aware they have this chronic condition (NOF, 2002). Despite its importance, the etiology of osteoporosis and the key to its prevention remain poorly understood and studied among people live in Gaza Governorate (GG).

Osteoporosis is globally important health problem with serious consequence in both developed and developing country. In Middle East, the International Osteoporosis Foundation (IOF) considers osteoporosis as a neglected health problem that basic epidemiological studies are lacking; additionally there is an absence of any statistical evidence regarding incidence of major osteoporotic fractures and a lack of government involvement in the prevention of osteoporosis(El-Hajj Fuleihan et al., 2011).Furthermore, vitamin D deficiency is highly prevalent in Middle Eastern countries and might be a strong

contributing factor for osteoporosis in spite of the availability of sun most the time around year (Gannagé-Yared et al., 2000).

The Palestinian Osteoporosis Prevention Society (POPS) conducted a study on the prevalence of osteoporosis among postmenopausal women published in May 2010 and it was found that around 40% of postmenopausal women were affected (Abd-Alhameed et al., 2010).

Gaza Strip (GS) is consider one of these developing country and osteoporosis is a neglected health problem and do not has apriority by Ministry of health (MOH) or United Nations Relief and Work Agency (UNRWA) the main health providers in GS unlike other non-communicable disease that affected high percentage of the population such as diabetes and hypertension. In this study, the researcherhighlight about the different risk factors associated with osteoporosis among people live in GG as people suffer from many crisis results from siege and wars done by the Israel military occupation.

1.3 Justification of the Study

Osteoporosis affects an enormous number of people, of both sexes and all races, and its prevalence will increase as the population ages increase.Approximately 1.6 million hip fractures occur worldwide each year and this number could triple or quadruple and reach between 4.5 and 6.3 million by the year 2050 that make osteoporosis a global disease (Roux et al., 2012).

Although risk factors for osteoporosis have been commonly studied worldwide, neither well-formed study nor systematic survey have been conducted to evaluate either the risk factors of osteoporosis or the short and long term consequence of fractures result from osteoporosis. Greater efforts are need to improve the awareness of risk factors of osteoporosis among people live in the Gaza Governorate.

As there is a limited study, assess the risk factors of osteoporosis among people in Gaza Governorate according to the researcher knowledge, so the burden of osteoporosis will increase dramatically with advancing of age of the population.

The life expectancy is expected to increase during the coming years to reach 74 years for males and 75 years for females (PCBS, 2016). The increase of life expectancy rate resulted in the increase of the elderly number in Palestine, which requires studying and researching the elderly situation in Palestine.

However, if we identify the main risk factors associated with osteoporosis we can made primary prevention of the disease by increase awareness of risk factors for osteoporosis among the population to improve health of the bone. Nevertheless, if factors still neglected the incidence and prevalence of osteoporosis will increase among population.

1.4 Study Objectives

1.4.1 General Objective

The overall objective of this study is to determine the main risk factorsof osteoporosis among adultsin Gaza Governorates.

1.4.2 Specific Objective

1- To identify the main risk factors of osteoporosis among case and control group.
2- To investigate an association between socio-demographic factors and osteoporosis in Gaza governorates.
3- To determine an association between different life style habits and osteoporosis among case and control group.
4- To explore medical condition that contributes to occurrence of osteoporosis.
5- To assess the association between use of certain types of drugs and occurrence of osteoporosis.
6- To suggest recommendation for stakeholder and policy makers in Ministry of Health (MOH) and different health care provider that positively influence reducing of occurrence of osteoporosis among people live in Gaza governorate.

1.5 Research Question

The study will tend to answer these questions:-

1- What are the possible risk factorsof osteoporosis in Gaza governorate?
2- Are there significant associations between the socio-demographic factors such as (occupation, education level, and family income) and occurrence of osteoporosis?
3- Do maternal related factors such as (number of children, abortion and breast-feeding) contributes to osteoporosis?
4- Are there significant associations between life style habits such as (body mass index BMI, smoking,milk and dairy products intake, exercise activity, sun exposure, and using aluminum cookware) and occurrence of osteoporosis?

5- Is there a relation between drinking tea, coffee and soft drinks (cola) and occurrence of osteoporosis?
6- Is there a significant association between family history and developing of osteoporosis?
7- What are the main medical condition associated with developing of osteoporosis?
8- Isthere an association between menstrual history and emerging of osteoporosis?
9- Are there a significant association between using certain type of drug such as (corticosteroid, antihypertensive, anti-diabetic drug, anticoagulant(heparin), proton pump inhibitors drugs and loop diuretics) and developing of osteoporosis?

1.6 Context of the Study

1.6.1 Demographic Context

The entire area of Palestine is 27,000square kilometer. It has an important strategic location as it is situated on the western edge of the continent of Asia, the eastern coastal extremely of the Mediterranean Sea. Palestine is bordered by Lebanon in north Syria and Jordan in the east, the Gulf of Aqaba in the south and by Egypt and Mediterranean Sea west(MOH,2015).

Gaza Strip (GS) is a narrow land, located on the south of Palestine on the coast of Mediterranean sea. GS characterize by high population density with more than 4,500 individuals per square kilometer that create high demand on health services. GS is classified into five governorates, North of Gaza, Gaza city, Mid-Zone, Khan-younis and Rafah. The life expectancy of Palestinian female is 73.34 years and male 70.67 years.By mid-2015, the total population of Palestinian country was 4 682 467, with 61.1% living in the west bank, including east Jerusalem, and 38.9% in Gaza strip. Two million are registered refugees of whose 800 000 live in 27 refugee camp, 19 in the west bank and 8 in the Gaza strip. The population is young with 39.4%of Palestinian aged 0-14 years , 30% aged15-29 years, and 4.5%above 60 years (PCBS, 2016).

Elderly People in Palestine represent 4.5% of the total population in mid-2015 The Palestinian society is considered a young society where the percentage of children is high and the percentage of the elderly is relatively little. In mid of the year 2015, the percentage of the elderly aged 60 and over reached 4.5% of the population in Palestine (4.9% in West Bank and 3.8% in Gaza strip). Life expectancy has increased about 5-8 years during the

last two decades for both males and females. The life expectancy is expected to increase during the coming years to reach 72.8 years for males and 75.7 years for females in the year 2020. The increase of life expectancy rate at birth resulted in the increase of the elderly number in Palestine, which requires studying and researching the elderly situation in Palestine (PCBS, 2016).

1.6.2 SocioeconomicsSituation

The Palestinian economy has been in decline since 2012 and estimates at the end of 2014 indicated a contraction in gross domestic product of 2.5% compared with 2013. (PCBS, 2015). Restrictions on movement and access, including the blockade of the Gaza Strip, the barrier wall on the West Bank and the permit regime, have contributed to the worsening economic conditions.

Private sector development has also been hindered by the fragmented legal and regulatory business environment, which varies in the Gaza Strip, east Jerusalem and the different areas of the West Bank, and by the restrictions imposed on the movement of people and goods, and on trade between the West Bank, east Jerusalem and the Gaza Strip (World Bank, 2014).

The unemployment rate had declined to 16.0% in the West Bank, but had increased to 45.1% in the Gaza Strip. One quarter of the Palestinian population lives in poverty, with the poverty rate in the Gaza Strip twice as high as in the West Bank. (World Bank, 2014).

1.6.3 Health Profile

The population of the occupied Palestinian territory is in an epidemiological transition, with the burden of non-communicable disease rising. In 2014, heart disease was the leading cause of death causing(31.2%) of all reported death. Cancers when combine together, where the second leading cause of death accounting for (14.2%), followed by cerebrovascular disease (11.3%), diabetes mellitus(8.9%) and prenatal condition(5.2%). This diseases increase the cost in the health sector and necessitatea greater focus for health prevention (MOH, 2015).

1.6.4 Health Care Services Context

Palestinian health care system is a complex system; it has four main provider for health care services: Ministry of Health (MOH), United Nations Relief and Works Agency (UNRWA), Non-governmental organization (NGOs) and private for profit service provider.

MOH is consider the main health provider. However, the Ministry of Health (MOH), UNRWA and nongovernmental organizations (NGOs) together provided geographical coverage of primary and hospital level services. The financial crisis affecting the Palestinian Authority continued to have a serious impact on the scope and quality of Ministry of Health services. Budget shortfalls have resulted in chronic shortages of essential drugs and medical disposables in the Gaza Strip. The restrictions imposed on the movement of health staff and goods hinder the overall functioning and development of the health system (World Bank, 2014).

In 2014, the number of Palestinian fatalities and injuries resulting from war associated with military occupation was the highest since 1967, amounting to 2333 deaths and 15 788 injuries – primarily occurring during the conflict in the Gaza Strip in July–August 2014. The conflict had a significant impact on the daily life of Palestinians, with half a million people being displaced, of whom 100 000 remained homeless at the end of 2014, and some 22 000 homes being either totally destroyed or rendered uninhabitable (OCHA, 2014). In addition, infant and under-five mortality rates continued to decline. In 2013, infant mortality was 12.9 deaths per 1000 live births, compared with 20.8 deaths per 1000 live births in 2005. The under-five mortality rate was 15.5 deaths per 1000 in 2013, down from 24.6 deaths per 1000 in 2005 (MOH, 2016).

The health status of Palestine refugees has shown sizable improvement. Deaths of mothers and children have been considerably decline. Non-communicable diseases or so-called Life-style illnesses are becoming predominant. According to UNRWA report, (2016) Evidence indicates that non-communicable diseases account for 70% to 80% of deaths among Palestine refugees. These are life-long, difficult to prevent and hard to control health conditions. Prevailing social and economic difficulties and political instability also negatively affect health outcomes (UNRWA, 2016).

1.6.5 Palestinian GermanDiagnostic Center

The center was established at 2007. The Palestinian German Diagnostic Center providediagnostic medical services such as MRI, DEXA Scan and X-Ray. The center vision is to raise the level of diagnosis and provide the sophisticatedequipment's that are necessary for early detection of various disease. It is the only center having DEXA scan in Gaza city and the second center among Gaza strip followed Al-Wafa hospital.

1.7 Operational Definition

Osteoporosis case: The researcher define cases group as people whom diagnosed established by physician confirmed by doing DEXA scan. Cases were taken from the Palestinian German Diagnostic Center the only center in Gaza city had DEXA scan instrument.

Osteoporosis control: The researcher define controls as people whom diagnosis confirmed by physician that they are free from osteoporosis after doing DEXA scan. Controls were matched with cases from age, gender and the place of treatment.

Risk factors: Define by the researcher as those factors that may lead to osteoporosis include socio-demographic, life style, medical and medication use factors.

Socio-demographic factors: The researcher define socio-demographic factors operationally as family and social status related condition that have an impact on increased risk of osteoporosis.

Life style factors:The researcher define life style factors operationally as bad habits that increase risk of osteoporosis such as drinking coffee, tea and soft drink (cola), sedentary life style and calcium/ vitamin D deficiency.

Medical condition factors: The researcher define medical factors operationally as medical related conditions that have shown impact on increased risk of osteoporosis such as family history of osteoporosis, rheumatoid arthritis, personal fracture and eating disorder.

Medication factors: the researcher define medication factors operationally as medication used that related to increase risk of osteoporosis.Drugs as anticonvulsant, Lasix, contraceptive, corticosteroid and anti-hypertensive drug.

1.8 Lay Out of the Study

This study consist as a generalform five chapters: introduction, conceptual framework and literature review, methodology, results and discussion,finally conclusion and recommendation.

The first chapter presents ageneral introduction of the study, in which a brief background about the study interest were given, the research problem, justification for study, the general and specific objectives, the context of the study and definition of terms.

The second chapterincludes two parts: the first is conceptual framework where the researcher represents a diagram of the main study variables. The second parts the literature reviewof previous studies related to the study topic and variables.

The third chapter revealed the methodology including study design, study setting, study population, sample size and sampling process, period of the study,eligibility criteria, data collection instrument, validity and reliability, pilot study, data collection, data management and statistical analysis, ethical and administrative considerations and finally the study limitation.

The fourth chapter represent the results and discussion where the researcher display the study result in form of tables and figures with clarifying comments. Then these results were discussed in relation with previous study mentioned in the literature.

The fifth chapter the researcher write her conclusion and recommendation according to the results of the study.

Chapter2

Conceptual Framework and Literature Review

In this chapter, the researcher represents the conceptual framework and literature review of the study themes and variables. In depth information regarding the main concepts and variables, beside previous studies were mentioned.

2.1 Conceptual Framework

Conceptual framework represents a way of thinking about a problem or a study, or away of representing how complex thing work. Researcher constantly uses conceptual framework to guide his work. Conceptual framework illuminate individuals work and illustrates several variables and outcomes, and their interrelation (Bordage, 2009).

In this chapter, the researcher reviews the critical points of the study variables that are related to developing osteoporosis. As well as, the researcher reviews relevant previous studies and experience of other researcher in this field. After that, the researcher was able to sketch map-showing line of the interdependence of the factors, which contribute in the development of osteoporosis.

There are several factors related and affecting the occurrence of osteoporosis. Time restriction and the nature of the study did not allow studying all the factors and therefore the researcher focused on part of these variables and developed new brief model (Figure 2.1).

The first domain consist of socio-demographic risk factors which may influence the occurrence of osteoporosis among people live in Gaza strip which include education, family income, marital status and occupation.While, the second domain consist of life style risk factors which were suggested to developed osteoporosis and these factors are Body Mass Index (BMI), nutrition style (tea, coffee, soft drinks, milk and dairy product), calcium and vitamin D supplement, physical inactivity, smoking, sun exposure and using Aluminum cookware.

The third domain consisted of medical condition that affecting bone and cause osteoporosis and it includes cancer, chronic constipation, chronic diarrhea, depression, diabetes mellitus, hypertension, eating disorder, family history, personal fracture, hyperthyroidism and hyperparathyroidism. The fourth and final domain consist of medication used that

developed osteoporosis and it include of anticoagulant(heparin), Glucocorticoid(Prednisolone), Anticonvulsant, loop diuretics (Lasix), proton pump inhibitorsPPIs, breast and prostate cancer drugs, contraceptive.

The following conceptual framework consists of four domains as shown, each dimension represent multivariable to measure the associated factors.

Conceptual Framework

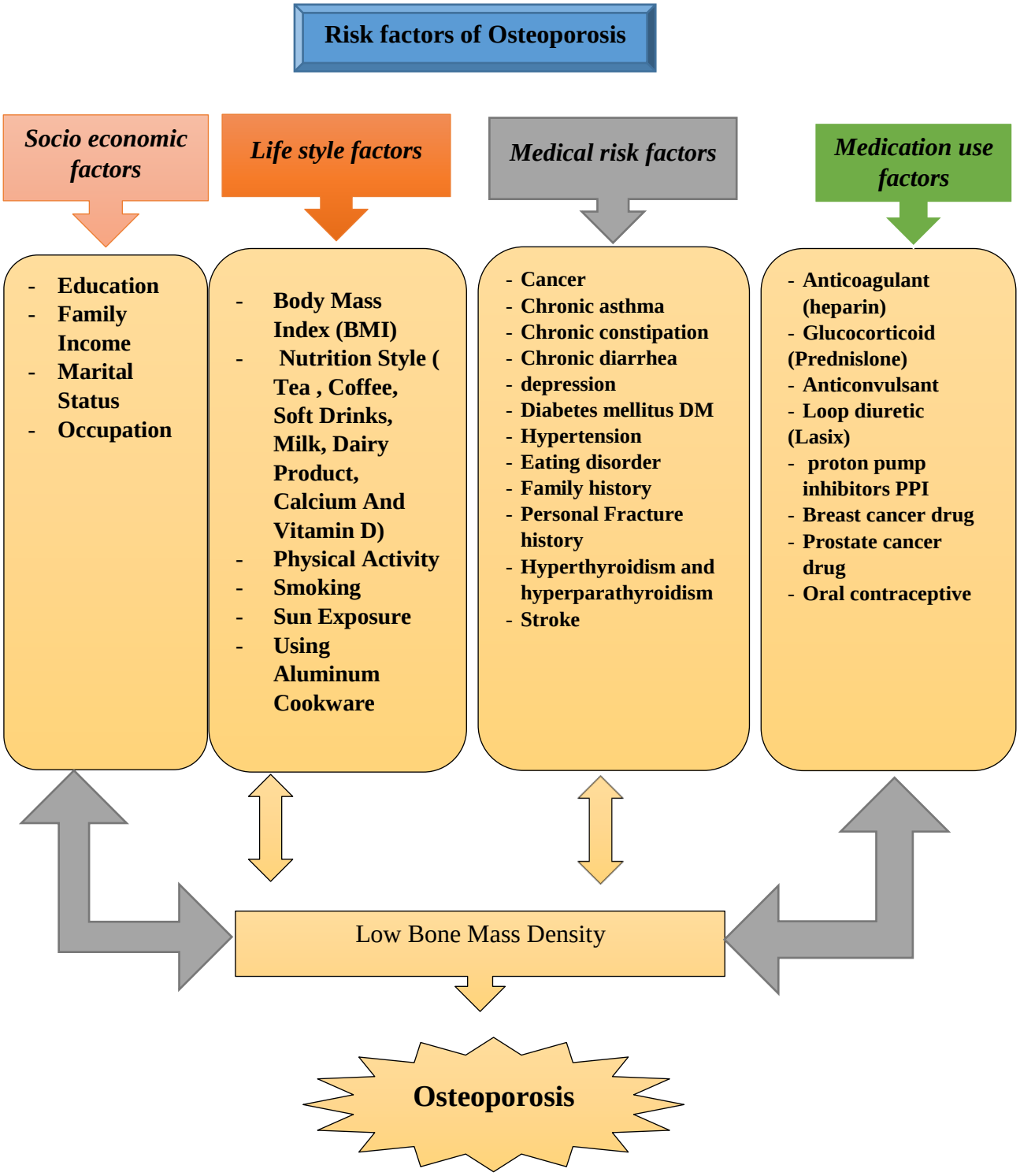

Figure (2.1): Conceptual framework (self-developed model)

This model consists of dependent variable (osteoporosis) and independent variable (risk factors).

2.2 LiteratureReview

2.2.1 OsteoporosisDefinition

Osteoporosis is a disease characterized by low bone mass, micro architectural deterioration of bone tissue, and a consequent increase in fracture risk (NOF, 2002).The word osteoporosis literally means porous bone that is bone density is low and bone become thinner.

The World Health Organization define osteoporosis asa bone density 2.5 standard deviations below the mean for young white adult women at lumbar spine, femoral neck or forearm (WHO, 1994). Thereby, WHO, (1994) criteria defined osteoporosis operationally on the basis of bone mineral density (BMD) assessment, and divided it into four categories:

- Normal (T-score -1.0 and above)
- Low bone mass, referred to as osteopenia (T-score between -1.0 and -2.5)
- Osteoporosis (T-score -2.5 and below)
- Severe osteoporosis (T-score -2.5 and below with history of a fracture) (WHO, 1994).

Therefore, other way for measuring osteoporosis wasthe revised assessment in (2008) called FRAX (Fracture Risk Assessment Tool) includes BMD with selected risk factors for fracture along with height and weight. FRAX is calculated to determine 10-year probability of fracture. Two scores are given, probability of hip fracture and the other for a major osteoporotic fracture, defined as wrist, shoulder, hip, or painful spine fractures (Kanis et al., 2008).

2.2.2 What is Bone?

A report of the Surgeon General of Osteoporosis, recognize bone as a living and growing tissue in which normal bone consists of two layers, cortical bone and trabecular bone. Cortical bone forms the outer layer and is dense and compact, while trabecular bone has a honeycomb structure and is much more porous. Cortical bone provides one-third of total skeletal surface and three-fourths of skeletal mass. On the other hand, trabecular bone provides two-thirds of total skeletal surface but only one-fourth of skeletal mass(U.S. Department of Health and Human Service, 2004).

2.2.3 Beak Bone Mass

Khosla and Riggs. (2005) define beak bone mass, as the maximum mass, accumulated during young adult life that is responsible for the strength of the bone is influence by genetic factor, nutrition, endocrine status, physical activity and health during growth (Khosla and Riggs, 2005).

According to Report of Surgeon, (2004) normal bone is composed of a mixture of calcium and other minerals such as magnesium and phosphate. It is also made up of collagen (protein), which forms the structural framework of bone. Thereby the loss of mineral content of the bone is referred to as a loss of bone mineral density in the bone. Maximum Peak bone mass is reached between 16 and 25 years of age (U.S. Department of Health and Human Service, 2004).According to National Osteoporosis Foundation, bone mass in older adults equals the peak bone mass achieved by age 18-25 years minus the amount of bone subsequently lost (NOF, 2010).

National Institute of Health (NIH). (2001), mention that during childhood and adolescence, much more bone deposited than withdrawn, so the skeleton grows in both size and density and by age, 18 in girls and 20 for boys they acquire up to 90 percent of peak bone mass. The amount of bone tissue can keep growing until around age 30. At that point, bones have reached their maximum strength and density, known as peak bone mass (NIH, 2001)

Despite of women tend to experience minimal change in total bone mass between age 30 and menopause, most women go through rapid bone loss from the bone bank account, which continues throughout the postmenopausal years. This loss of bone mass can lead to osteoporosis (Panel, 2001).

2.2.4 Bone Modeling and Remodeling

Throughout life, bone is constantly renew in a process called remodeling. According to Martin and Seeman. (2008), the remodeling process is complex and includes two main types of cells, osteoclasts and osteoblasts. However, Bonemodelling prevents the occurrence of damage by adapting bone structure and strength but bone remodeling removes damage in order to maintain bone strength. Despite this process successful taken place during growth, it fails during advancing age because of the development of a negative balance between the volumes of bone resorbed and formed during remodeling by

the basic multicellular units (BMUs), the small island in which this process occur (Martin and Seeman, 2008).

Concerning A Report of the Surgeon Generalfor Bone Health and Osteoporosis, (2004) the two main types of bone cell required for modeling and remodeling process are.

***Osteoclasts*:** are bone-chewing cells that remove old bone and get the bone ready for renewal. Osteoclasts release enzymes and acids that carve bones. In this process calcium, phosphorus, and other components of the bone are release into the blood for use by the body. After the osteoclasts carve the bone, it is prepared for action by the osteoblasts.

***Osteoblasts*:** are the building cells that form bone. Bone building occurs when bone is more formed than removed. Bone mass is maintained when bone formation equals bone removal conversely, bone loss occurs when more bone is removed than formed. Deterioration of bone exist either when taken diet low in calcium and vitamin D which is necessary for body to use calcium then body will withdraw the calcium it needs from bone bank or by certain medication and medical condition (U.S. Department of Health and Human Service, 2004).

2.2.5 Epidemiology of Osteoporosis

There are a consensus in the literatures that as the world population life expectancy increase the incidence and prevalence of osteoporosis, and its economic burden on society increase. Dhanwal et al. (2011), recognize that hip fracture is the most serious consequence of osteoporosis because of its complications, which include chronic pain, disability, diminished quality of life, and premature death (Dhanwal et al., 2011).A Study suggest that with rising life expectancy throughout the globe, the number of elderly individuals is increasing in every geographical region, and it is estimated that the incidence of hip fracture will rise from 1.66 million in 1990 to 6.26 million by 2050 (Cooper et al., 1992).
Johnell et al. (1992) mentioned that Studies over the last few decades have demonstrated geographic variation in the incidence of hip fracture across continents as well as among different parts of a region. Incidence of hip fracture is highest in Sweden and North America, with almost seven-fold lower rates in Southern European countries (Johnel et al., 1992). Furthermore, as three quarters of the world population, live in Asia Cooper et al. (1992) estimated that by 2050 more than 50% of all osteoporotic fractures will occur in Asia (Cooper et al, 1992). This variation in the distribution of hip fracture over different

regions of the world demonstrate that genetic and environmental factors play a role in the etiology of hip fracture

2.2.5.1 Prevalence and Burden of Osteoporosis in Developed Country

Osteoporosis is a public health problem worldwide; statistics show that osteoporosis causes about 9 million fractures annually worldwide, of which more than 4.5 million occur in the Americas and Europe (WHO, 2010).

Concerning WHO, (2004), a study for Assessment of osteoporosis at the primary health care level show that in the United States, Europe and Japan, osteoporosis affects about 75 million people. By Using the WHO criteria, 30% of postmenopausal Caucasian women have osteoporosis at the hip, lumbar spine or distal forearm and by the age of 80 years, 70% of women are osteoporotic at the hip, lumbar spine or distal forearm (WHO, 2004). Moreover, National Osteoporosis Foundation, (2002) mentioned that there were 8 million osteoporotic women and 2 million osteoporotic men in the United States alone (NOF, 2002).

The highest incidence of hip fractures from Asia has been reported from Singapore a study carried out by Kohet al. (2001) revealed that hip fracture rates from 1991 to 1998 (per 100 000) were 152 in men and 402 in women; this was respectively 1.5 and 5 times higher than corresponding rates in 1960s (Koh et al., 2001).

Concerning examined by ethnicity,Dhanwal et al. (2011) mention that, since 1960, the main increase in hip fracture rates has been seen in Chinese and Malays, while the rates in Indian ethnic group appear to have decreased. The factors responsible for these racial differences include differences in the demographic profile, body weight, physical activity, prevalence of cigarette smoking and alcohol consumption, calcium intake, and frequency of falls in the community in elderly (Dhanwal et al., 2011).
On the other hand men contributes 20 to 30% of all osteoporotic fractures and this proportion is expected to increase, Eiben et al. (2005) is estimated that in 2025, the number of hip fractures occurring worldwide in men will be similar to that observed in 1990 in women (Eiben et al., 2005).

2.2.5.2 Prevalence and Burden of Osteoporosis in Middle East and Africa

While Hip fracture rates are available from many countries across Asia there is insufficient information about incidence and prevalence of osteoporosis among people in Middle East and Africa.Handa et al.(2014) recognize in a review onprevalence of osteoporosis in developing countries resultthat osteoporosis presents a huge challenge in developing countries due to demographic evolution and aging of the population coupled with limited resources. The exact disease burden is difficult to enumerate because of the lack of data. Civilization affects bone density; as well, as fracture risk. Vitamin D deficiency is common even in sunny countries (Handa et al., 2014).

Furthermore, the prevalence of osteoporosis in less developed and developing countries is not clear because of few studies in these populations. However, racial differences in BMDare well-recognized(Handa et al., 2008).

According tothe 2011 Audit on the Epidemiology, Costs and Burden of Osteoporosis in Middle East and Africa report, demonstrate that there is an extreme lack of solid epidemiological data throughout the region but high fracture rate throughout the region and major increase predicted by 2050. Nevertheless,Iran accounts for 0.85% of the global burden of hip fractures and 12.4% of the burden of hip fractures in the Middle East (Ahmadi- Abhari et al., 2007). Furthermore, Cankurtaranet al. (2005) mention that Osteoporosis in Turkey is extremely common nearly 65% of men and women 65 years old or older have osteoporosis (Cankurtaran et al., 2005). In Morocco, El Maghraouiet al. (2006), is estimated that there are more than 1.5 million vertebral fractures nearly 50% of all postmenopausal women have vertebral fractures, and 60% of women with fractures have at least two fractures (El Maghraoui et al., 2009).

Mortality rates post-hip fracture may be higher in Middle East and Africa than those reported from western populations. While such rates vary between 25-35 % in western populations, they are 2-3 fold higher in populations from this region(Baddoura et al., 2011). Furthermore, the International Osteoporosis Foundation (IOF) report considers osteoporosis a neglected disease in the Middle East, demographic and socioeconomic changes in the region have contributed to the rise of this disease and its burden on the populations and healthcare systems. Unfortunately, the report explore that the level of awareness among health care professionals is poor in many developing countries, and they

are in general ill equipped to take care of patients with osteoporosis in many countries (El-Hajj Fuleihan et al., 2011).

In Palestine, International Osteoporosis Foundation report, consider that osteoporosis is not a health priority yet due to the poor socioeconomic status and the abundance of other health problem, faced Palestinian population as non-communicable disease let osteoporosis has not priority by neither MOH nor UNRWA. There is no epidemiological study norstatistical evidence regarding incidence of major osteoporotic fractures. The Palestinian Osteoporosis Prevention Society (POPS) conducted a study on the prevalence of osteoporosis among postmenopausal women published in May 2010and it was found that around 40% of postmenopausal women were affected andmore than 50% of the studied population wereosteopenic at age 60-69 years. In addition, direct hospital costs for hip fractures are USD 3500- 4500 (Abd-Alhameed et al., 2010).

There is a debate on whether the incidence of fractures increase by the time or decreaseIcks et al. (2008); Hagino et al. (2009) mentioned that despite the trend for increased age-adjusted incidence of fragility fractures has changed over the last 10 years the age-specific incidence of osteoporotic fractures mainly hip fractures continues to increase in some countries (Icks et al, 2008; Hagino et al, 2009). Nevertheless, in other countries, it is slightly decreased (Abrahamsen and Vestergaard, 2009).

Szulc and Bouxsein. (2011) attributes this phenomenon due to several factors:

- As life expectancy increases, at a given age an individual may be healthier.
- Higher prevalence of obesity and lower tobacco smoking habits improve the maintenance of bone mass and greater use of anti-osteoporotic treatment may decrease the number of osteoporotic fractures.

This recent reduction in age-adjusted incidence of fractures has only been observed in Western societies and the greatest increase in the number of osteoporotic fractures can be expected in Middle East, Asia, and Latin America, where the life expectancy is predicted to increase the most in the coming decades (Szulac and Bouxsein, 2011).It is estimated that, in these regions, the total number of hip fractures will increase more than fivefold between 1990 and 2050 (Eiben et al., 2005). In addition, osteoporosis consider as a socioeconomic health problem that increase morbidity, mortality and cost of treatment. Mortality rates post-hip fracture may be higher in the Middle East than those reported from

western populations; they are 2-3 fold higher in populations from the Middle East and Africa region (Baddoura et al., 2011).

2.2.6 Financial Burden of Osteoporosis

On the other hand, Szulc and Bouxsein, (2011) conclude that in all middle east and Africa countries, osteoporotic fractures are expensive and their costs are projected to increase because the total number of fractures are projected to rise. The financial burden of osteoporotic fractures includes direct costs (hospital acute care, in-hospital rehabilitation, outpatient services, long term nursing care) and indirect cost (morbidity, loss of working days).On the other hand, some costs are difficult to quantify as deterioration of quality of life, and time spent by the family on the care of the patient but treatment of co-morbid conditions after a fracture constitutes 75% of the overall healthcare cost of osteoporotic fractures (Szulc and Bouxsein, 2011).

The cost to the healthcare system associated with osteoporosis-related fractures has been estimated at $17 billion for 2005; hip fractures account for 14 percent of incident fractures and 72 percent of fracture costs. In the USA, the estimated direct cost of osteoporosis is 19 billion in the US in 2005 and expected to increase by 50% by 2025.Furthermore, every year in the USA, 3.5 million hospital bed days are attributed to osteoporotic fractures and over 60,000 nursing home admissions are attributed to hip fractures.(Burge et al., 2007).

Similarly in Europe, where the estimated cost of osteoporotic fractures was 36 billion euro in 2000 and is expected to double to 77 billion euro by 2050 (Kanis et al., 2005).It has been estimated by the National Osteoporosis Foundation (NOF) that in 2000 approximately 44 million people aged 50 and over in the United States either had osteoporosis or were at risk of developing the disease; this number is expected to rise to over 61 million by the year 2020. Thereby the burden of osteoporosis on the health care system is estimated to be approximately $17 billion annually, accounting for about $40,000 in total medical costs for each hip fracture (NOF, 2002). Furthermore, the cost is expected to rise as high as $140 billion by the year 2040 (Shuler et al., 2011).

2.2.7 Type of Osteoporosis

2.2.7.1 Primary Osteoporosis

Primary osteoporosis is the most common type of osteoporosis. It is usually age-related and associated with the postmenopausal decline in estrogen levels, or related to calcium and vitamin D insufficiency.

Type I osteoporosis (postmenopausal osteoporosis) generally develops after menopause, when estrogen levels drop precipitously. These changes lead to bone loss, usually in the trabecular (spongy) bone inside the hard cortical bone.

Type II osteoporosis (senile osteoporosis) typically happens in women and men after age 70 and involves a thinning of both the trabecular (spongy) and cortical (hard) bone (NIH, 2001).

2.2.7.2 Secondary Osteoporosis

Secondary osteoporosis has the same symptoms as primary osteoporosis and can occur at any age but it has a direct cause so called secondary osteoporosis so it may occurs because of having certain medical conditions, such as hyperparathyroidism, hyperthyroidism, or leukemia. It may also occur as a result of taking medicines known to cause bone breakdown, such as oral or high-dose inhaled corticosteroids (if used for more than 6 months), too high a dose of thyroid replacement, or aromatase inhibitors (used to treat breast cancer). Life style also contribute to emerge of osteoporosis. (NIH, 2001).

2.2.7.3 Rare Type of Osteoporosis

According to National Osteoporosis Society, (Aspray et al., 2014).

- **Osteoporosis in children**

There is an unusual condition in young children called "idiopathic juvenile osteoporosis" in which broken bones occur following minor levels of trauma without an apparent underlying problem. Sometimes, osteoporosis in children occurs because of other factors such as use of glucocorticoid steroids, brittle bone disease (osteogenesisimperfecta) or because a child being immobile.

- **Osteoporosis associated with pregnancy**

This is a rare condition when bones, usually in the spine or hip, break easily during or after pregnancy.

- **Transient migratory osteoporosis**

This is a rare condition that can cause chronic pain and is associated with sudden loss of bone density, usually in a hip.

2.2.8 Signs and symptoms of osteoporosis

Osteoporosis is consider a silent disease because there is no symptom appear until fracture occurs, but the common osteoporosis symptoms mentioned by (NIH, 2001) are:

Fracture: A fracture is one of the most common signs of fragile bones caused by osteoporosis that may occurs with fall or minor movement also it can even be triggered by a strong sneeze or cough.

Back or Neck Pain: Osteoporosis can cause compression fractures of the spine. These can be very painful because the collapsed vertebrae may pinch the nerves that radiate out from the spinal cord. The pain symptoms can range from minor tenderness to debilitating pain.

Loss of Height: It is one of the most noticeable symptoms of osteoporosis also; the compression fractures in the spine can also cause a loss of height.

Stooped Posture: The compression of the vertebrae may also cause a slight curving of the upper back. A stooped back is known as kyphosis, or more commonly as dowager's hump. Kyphosis can cause back, neck pain, and even affect breathing due to extra pressure on the airway (NIH, 2001)**.**

2.2.9 Consequence of Osteoporosis

Osteoporosis is only painful if fracture have occurred that means osteoporosis increase the risk of fracture because bone become thin and fragile. The main bones expose to fractures are wrist, hip and vertebra. Osteoporotic fractures are:

2.2.9.1 Vertebral Fracture

Vertebral fracture is the most common osteoporotic fracture. They may occur in the absence of trauma or after only minimal trauma, such as bending, lifting or turning. In individuals aged over 50 years, Silman et al. (1997) mention that, the prevalence of vertebral fracture is similar in men and women, largely due to increased presence of traumatic fractures in men that were incurred during their youth (Silman, et al.,1997). In contrast, Felsenberg, (2002)a Prospective epidemiological studies show that the incidence of new vertebral fractures in elderly men is half that occurring in women of the same age (Felsenberg et al., 2002). Moreover, vertebral fractures have a major personal and societal impact in terms of disutility and financial costs (Kanis et al., 2004).

The clinical symptoms of vertebral fractures are back pain, limitation of spine mobility, loss of height and disability. There is consensus in the literature that vertebral fracture can be associated with difficulty in bending, rising, dressing, climbing stairs, as well as reduced space of walking, reduced independence or even the need to use a walking aid. Furthermore, Silverman, et al. (2001) mention that back pain, disability and difficulties in performing activities of daily living are observed mainly in patients with fractures in lower thoracic and lumbar spine, whereas fractures in the mid-thoracic spine can result in a mild reduction of pulmonary function (Silverman et al., 2001).

In addition, Kado et al. (1999) ؛Cauley et al. (2000) epidemiological studies report a higher mortality in patients with osteoporotic vertebral fractures, with age-adjusted mortality rates increasing with the number of vertebral fractures. In the working population, medical costs associated with vertebral fractures are related to outpatient care and to the loss of working days (Kado, et al., 1999;Cauley, et al., 2000).

However, International Osteoporosis Foundation (IOF), mention that, despite major personal and societal impact of vertebral fractures often do not come to clinical attention due to two main reasons:

Firstly, about two thirds of vertebral fractures do not have clinical symptoms, which means that may confused with osteoarthritis, and may be only detected on a radiograph. Secondly, even on spine radiographs, vertebral fractures are often undiagnosed. Vertebral fractures increase the risk of new vertebral fracture four to five-fold and the risk of other fragility fractures two- to four-fold(Szulc and Bouxsein, 2011).

2.2.9.2 Hip Fracture

Hip fracture is one of the most disastrous consequences of osteoporosis. There are many risk factors for hip fracture but the two main attributable factors are low BMD that increase with age and increase risk of fall. Other factors such as lack of physical activity, poor nutrition, tobacco smoking, chronic alcoholism, gastrectomy, certain diseases, and some medications (mainly glucocorticoids, loop diuretics and thyroid hormones) (Cosman et al., 2014).

Cawthon et al.(2008) consider the risk of falls also increases with age, especially in the frail elderly with compromised neuromuscular function, poor physical performance, visual impairment, or insulin-treated diabetes (Cawthon et al., 2008).The impact of the fall depends on its direction and on the thickness of tissues surrounding the upper part of femur (Bouxsein et al., 2007). No doubt, aging is associated with both decrease in BMD and with an increased risk of falls but also poor nutrition, vitamin D and calcium deficit as well as

protein deficiency are common in the elderly and contribute to bone loss that results in a higher risk of falls and poor protective mechanisms. There are an agreement in the literature that Mortality is increased 15 to 25% in the year following hip fracture, with particularly high rates in men (Bliuc et al., 2009).

Furthermore, Berry et al. (2007) mention that a substantial number of people with hip fracture experience a second hip fracture which is characterized by higher mortality than the first fracture (Berry et al., 2007). The cost of hip fracture is high and includes hospitalization, surgical treatment and rehabilitation as well as the costs of outpatient care, particularly institutionalization.

2.2.9.3 Non-Hip Non-Spine Fracture

Fracture of the distal radius is one of the most frequent osteoporotic fractures in women and one of the earliest manifestations of osteoporosis. Baron et al. (1996) consider that distal radius fracture incidence increases in the early postmenopausal years and then stabilizes while in men, the incidence of distal radius fractures increases with age only slightly and remains low throughout life therefore in elderly men, the incidence is four times lower compared with women of the same age (Baron et al., 1996).

There are many studies mention that risk factors for this fracture in postmenopausal women are advancing age, an early menopause, low BMD, low BMI, falls (mainly falling forward on the hand), prevalent fragility fractures, height loss (often due to vertebral fractures), and a history of parental osteoporotic fractures. Fracture of the distal radius rarely requires hospitalization. However, it is associated with a temporary decrease in independence, deterioration in quality of life and, in working people, loss of working days (Delmas et al., 2007).

On the other hand, Fracture of the proximal humerus is common in osteoporotic patients after 50 years of age, its incidence increases with age in both men and women (Nguyen et al., 2001). Similarly, to other fragility fractures, the two main risk factors for fracture of the proximal humerus are low BMD, mainly at the distal forearm, increased risk of falls and prevalent fragility fracture. Proximal humerus fracture results in a temporary loss of independence, deterioration in the quality of life, increased risk of hip fracture and increased mortality (Bliuc et al., 2009).

Other common sites for fragility fractures include the ribs, pelvis, clavicle, femur and tibia. These fractures are important for two principal reasons according to Delmas et al. (2007)

study. Firstly, they may be the first manifestation of osteoporosis and associated increased bone fragility. Secondly, they may have important personal and societal consequences (Delmas et al., 2007).

2.2.10 Diagnosis of Osteoporosis

According to Szulc and Bouxsein, (2011), different diagnostic criteria of osteoporosis are:

- Dual-energy X-ray absorptiometry (DEXA).
- Quantitative computed tomography (QCT).
- High-resolution peripheral quantitative computed tomography (hr-pQCT).
- Magnetic resonance imaging (MRI).
- Quantitative ultrasound (QUS).
- Bone turnover markers**.**

Routine X-rays can detect osteoporotic bones only when at least 30% of their bone mass has been lost. At this stage of the disease, the affected bones have a much lighter and thinner appearance than normal bones. An earlier and more accurate assessment of bone loss is accomplished through the use of bone densitometry. Bone densitometers measure the absorption of radiation by the skeleton (skeletal calcium) in order to determine bone mass. Measurements of bone mass are generally considered the most valid estimator of an individual's fracture risk. SO, Osteoporosis is usually diagnosed using a procedure called dual energy x-ray absorptiometry (DXA). DXA measures areal bone mineral density (BMD) that is the amount of mineral in a given area of bone. The sites of measurement for diagnostic purposes are the lumbar spine and the hip. A DXA scan provides an indication of a person's BMD in relation to normal, healthy values for a male or female of a particular age. It is a painless procedure, which requires the person to lie on a couch for 5-10 minutes while the scanner moves above the body(Szulc and Bouxsein, 2011).

2.2.11 Men and Osteoporosis

Many people believe that osteoporosis is a disease that affects only women. However, this is not true. The NOF reports mentioned that the occurrence of osteoporosis in men has been greatly underestimated. It was thought that one in eight men would suffer an osteoporotic fracture in their lifetime however; new studies report that the risk has risen to one in four men (NOF, 2002). This underestimation could be due to the fact that men have greater bone mass and present with osteoporotic fractures up to ten years later than women.

A study done by Kiebzak et al.(2002) reported that only 7% of male subjects suffering from a hip fracture were previously diagnosed with osteoporosis and less than 5% were being treated for osteoporosis upon discharge. This is alarming due to the fact that nearly 30% of hip fractures occur in males and they are twice as likely to die after a hip fracture. These numbers emphasize the importance of the need for increased education and awareness regarding the risk of osteoporosis in men (Kiebzak et al., 2002)

2.2.12 Risk Assessment of Osteoporosis

The National Osteoporosis Foundation guide mention that all postmenopausal women and men, age 50 and older should be evaluated clinically for osteoporosis risk in order to determine the need for BMD testing. In general, NOF, (2002) revealed that bone density testing is recommended for:

- All women age 65 or older
- Women under age 65 with one or more risk factors for osteoporosis
- All men over age 70
- Men ages 50 - 70 with one or more risk factors for osteoporosis.

Osteoporosis is preventable and treatable, but because there are no warning signs prior to a fracture, many people are not being diagnosed in time to receive effective therapy during the early phase of the disease. Many factors have been associated with an increased risk of osteoporosis-related fracture (Watts et al., 2008)

2.2.13 Osteoporosis Risk Factors

Nationalosteoporosis foundation, (2002) and many medical journal determine the risk factors that are clinically significant and most frequently associated with an increase the risk of osteoporosis. In this study, the researcher selected the most suitable risk and classified as socio-demographic, life style, medical, and medication factors.

2.2.13.1 Socio-Demographic Factors

Theselectedsocio-demographic factors in our study, which may influence the incidence of osteoporosis, include education, income, marital status and occupation.

Education level

Education is one of the most commonly used measures of socioeconomic status (SES) in epidemiological studies (Winkleby et al., 1992). A study carried out by Maddah, et al, (2011) conclude that that post-menopausal women with low education were more likely to

have osteoporosis than high educated women and it was approximately five times more than high educated women (Maddah et al., 2011). This finding is concur with the findings of western countries indicating that low educated women are more prone to low density bone and osteoporosis than high educated women (Leslie et al.,2007; Brennan et al., 2011).

Woo et al.(1999) have reported that a higher level of education is associated with a healthier diet and lower cardiovascular risk(Woo et al., 1999). However, inconsistent findings between educational level and osteoporosis have been noted (Lauderdale et al., 2001).

In better-educated individuals might tend to have better health knowledge and behavior indeveloped countries and regions. On the other hand, increasing affluence and education in developing regions might lead to better nutrition(Brecher et al., 2002).

Income

There are a debate in the literature about the effect of poverty on emerging osteoporosis.Poverty has been shown to be a definite risk factor for osteoporotic fractures in a study performed in Spain(Navarro et al., 2009). Another study evaluating Canadian women has shown that lower income was found to correlate with a greater likelihood of qualifying for osteoporosis treatment, based on an assessment of the probability of hip fracture (Brennan et al., 2014). However, a systematic review conducted in 2009 concluded that conflicting evidence exists regarding the relationship between osteoporotic fractures and levels of income and education(Brennan et al., 2009). Another systematic review published in 2011 identified evidence for a positive association between educational level and bone mineral density (BMD) only in women, but no relationship between income and BMD in either gender (Brennan et al., 2011).

Marital status:

Pregnancy- and lactation-associated osteoporosis (PLO) is a rare condition affecting pregnant or breastfeeding women and it is an important type of osteoporosis causing a significant morbidity (Smith et al., 1995). The incidence of PLO is 0.4 in 100,000 women. It is considered that the number of undiagnosed patients is even higher (Hellmeyer et al., 2003). Although its etiology is unclear, the presence of PLO in first degree relatives, low BMI, physical inactivity, poor nutrition, insufficient calcium intake, and smoking have been determined as risk factors (Terzi et al., 2014). The patients present with severe low

back pain in the last trimester of the pregnancy or in the postpartum period or height decrease secondary to fragility fractures in the vertebra. However,Pregnancy and lactation associated osteoporosis is often confused with other causes of low back pain during pregnancy (Akyuz and Bayindir, 2013).

There is no consensus about bone loss during lactation or the long-term effects of pregnancy and lactation on bone. Black et al., 2000; Karlsson et al., 2005 showed that pregnancy is associated with bone losses of approximately 3 to 5 percent at the spine and hip (Black et al., 2000;Karlsson et al., 2005). While other studies have found that bone density remains stable during this period of increased calcium, demand or declines significantly only at the trochanter (Kaur et al, 2003). However, women are at risk of pregnancy-associated osteoporosis, if they use unfractionated heparins for thromboembolic disorders(Barbour et al., 1994; Dahlman., 1993).

Moreover, the strongest finding in a previous systemic review of associations between socioeconomic status and osteoporotic fracture was an increased risk of fracture in the unmarried, single, divorced, or widowed population compared to married couple (Brennan et al., 2009). Thus, living alone may be assumed a risk factor for osteoporotic fracture even though it is not included in the World Health Organization (WHO) risk assessment for fracture.

Breast-feeding

In contrast, lactation has more consistent and profound effects on bone density that bone loss of 3 to 10 percent at the spine and hip are seen over three to six months of lactation. Bone loss is related to duration of lactation and duration of amenorrhea and is not prevented by calcium supplementation (Karlsson et al., 2005).National Institute of Health (NIH) represent that bone loss during breast-feedingmay be caused by the growing baby has increased need for calcium, which is drawn from the mother's bones. The amount of calcium the mother needs depends on the amount of breast milk produced and how long breastfeeding continues. Moreover, women also may lose bone mass during breastfeeding because they are producing less estrogen, which is the hormone that protects bones (National Institute of Health-NIH, 2015).

Okyay et al. (2013) study concluded thatwomen who had a breast-feeding period per child more than 1 year under age 27 was higher in osteoporosis group. In multivariate analysis, women who breast-feeding more than 1 year per child had the highest risk for osteoporosis

(odds ratio: 12.92; 95% confidence interval, 3.1-52.6) (Okyay et al., 2013). Other study revealed that a significant increase in the risk of osteoporosis was apparent in postmenopausal women with prolonged breast-feeding histories (≥24 months) (OR 2.489; 95 % confidence interval = 1.111 to 5.578, p = 0.027) particularly in those with inadequate serum vitamin D levels and calcium intakes (<800 mg/day) (Yun et al., 2016).

Abortion history

Ozdemir et al.(2005) mention that women who had five or more abortions were found to have significantly lower spine BMD values compared to women who had no abortions or women who had one or two abortions. These findings indicate that the increased risk of osteoporosis is associated with the increased number of pregnancies and abortions and higher age at first pregnancy (Ozdemir et al., 2005).

2.2.13.2 Life Style Risk Factors

Risks that may have a strong influence for developing osteoporosis among people live in Gaza Strip attribute to life style. In this study, theresearcher mention life style risk factors, which include:

Physical Activity

According to WHO sedentary lifestyles increase all causes of mortality, double the risk of cardiovascular diseases, diabetes, and obesity, and increase the risks of colon cancer, high blood pressure, osteoporosis, lipid disorders, depression and anxiety. Moreover, 60 to 85% of people in the world from both developed and developing countries lead sedentary lifestyles, making it one of the more serious yet insufficiently addressed public health problems of our time. It is estimated that nearly two-thirds of children are also insufficiently active, with serious implications for their future health (WHO, 2002). People who spend a lot of time sitting have a higher risk of osteoporosis than do those who are more active. Any weight-bearing exercise and activities that promote balance and good posture are beneficial for bones. Furthermore, walking, running, jumping, dancing and weightlifting seem particularly helpful (Heyward & Gibson., 2014).

Body Mass Index (BMI)

BMI is a person's weight in kilograms divided by the square of height in meters(Samz, 2009).BMI Categories according to WHO were,

Body mass index (BMI)	Weight status
Below 18.5	Under weight
18.5 - 24.9	Normal
25 – 29.9	Over weight
30 – 39.9	Obese
Above 40	extreme obesity

BMI below 19 is considered underweight and a risk factor for osteoporosis. Osteoporosis is more common in people who have a small, thin body frame and bone structure. Low body weight (less than 58 kg) is associated with increased risk of osteoporosis and fractures, possibly related to small bone size (Green et al., 2004). Weight loss after age 50 years in women and decreased height also raise the risk of hip fracture, while weight gain decreases it (Ensrud et al., 2003). The mechanism of weight loss may influence the effect on bone physiology. In one small, randomized trial, done by Villareal et al, (2006) mentioned that subjects who lost weight by calorie restriction had decreases in total hip BMD, whereas subjects who lost the same amount of weight via exercise without reduced caloric intake had no changes in BMD (Villareal et al., 2006). A study done by Asomaning et al. (2006) explore that BMI was inversely associated with BMD status. After adjustment for age, prior hormone replacement therapy use, and other factors, odds ratios (OR) for low, high, and obese compared with moderate BMI women were 1.8 (95% CI 1.2-2.7), 0.46 (95% CI 0.29- 0.71), and 0.22 (95% CI 0.14-0.36), respectively, with a significant linear trend ($p < 0.0001$) across BMI categories (Asomaning et al., 2006).

Cigarette Smoking

Smoking also increases the risk of osteoporotic fractures. Studies of nearly 60,000 people in Canada, U.S.A., Europe, Australia and Japan show that smoking increases the risk of hip fracture by up to 1.5 times. Although the risk of fracture from smoking increases with age, cigarette smoke has an early effect on bones(Kanis et al., 2005). Studies carried out in Sweden showed that young male smokers, 18-20 years old, have reduced bone mineral density and an increased risk of osteoporosis later in life (Gregg et al., 2000).

Furthermore, meta-analyses have shown that cigarette smoking is associated with reduced BMD and increased risk of fracture The risk of fracture was increased with a smoking history and current smoking, but was higher for current smokers(Tamaki et al., 2011).A

study in the United States revealed that a high proportion of women were unaware of the association between cigarette smoking and osteoporosis(Roth and Taylor, 2001).

Milk and Dairy Consumption

Matthews et al. (2011) mentioned thatwomen whose dairy intake was once a day or more had a 62% reduction in the likelihood of having osteoporosis (OR=0.38, 95%CI: 0.17–0.86, p value 0.02) compared to women whose dairy intake was less than twice a week. Among individual dairy products, only cheese showed an independent and significant protection (OR=0.28, 95%CI: 0.12–0.66, p value 0.004) for women eating cheese more than once per week compared to those who ate cheese less than once a week. In contrast, a 2005 review published in Pediatrics showed that milk consumption does not improve bone integrity in children (Lanou et al., 2005). Similarly, the Harvard Nurses' Health Study, which followed more than 72,000 women for 18 years, showed no protective effect of increased milk consumption on fracture risk (Feskanich et al., 2003).

Low Calcium and Vitamin D Intake

Calcium is essential for building strong bones while vitamin D helps the body to absorb calcium both of them are needed to prevent developing of osteoporosis. Our bodies produce vitamin D when the skin is exposed to sunlight. There is a consensus in the literature indicate that Low calcium and vitamin D intake contributes to diminished bone density, early bone loss and an increased risk of fractures. Unfortunately, 90% of women may not be getting enough calcium and over 50% of women treated for bone loss have inadequate vitamin D levels (Holick et al., 2005; Sunyecz, 2008). The US Surgeon General report has outlined a 'pyramid approach' to treating bone diseases. Prevention of falls with maintenance of bone health through adequate calcium, vitamin D, and physical activity represent the base of the pyramid for all individuals, including those with bone disease. The second tier of this pyramid relates to identifying and treating secondary causes of osteoporosis. Lastly, the third tier revolves around pharmacotherapy (US Department of Health And Human Service, 2004).

A study done by Tang et al. (2007) concluded that calcium, or calcium in combination with vitamin D supplementation, was effective in the preventive treatment of osteoporosis in people aged 50 years or older. It appeared that the best effect was seen with minimum doses of 1200 mg of calcium and 800 units of vitamin D daily (Tang et al., 2007).Other

meta-analysis study mentioned that using vitamin D dose of 700 to 800 units per day result in reduced the relative risk of hip fracture by 26% and any non-vertebral fracture by 23% (Bischoff-Ferrari et al., 2005). Subsequently, an enhanced meta-analysis was done to define the need for additional calcium supplementation in individuals receiving vitamin D for the prevention of hip fractures the findings suggested that oral vitamin D appears to reduce the risk of hip fractures only when calcium supplementation is added (Boonen et al., 2007).

The Recommended dietary intake of calcium and vitamin D.

Age (years)	Calcium (mg/day)	Vitamin D (IU/day)
4–8	800	200
9–13	1300	200
14–18	1300	200
19–30	1000	200
31–50	1000	200
51–70	1200	400
≥70	1200	600

Source: (Sunyecz, 2008)

Caffeine and soft drink intake

Coffee, tea and soft drinks (sodas) contain caffeine, which may decrease calcium absorption and contribute to bone loss. NOF recommend that drinking more than three cups of coffee every day may interfere with calcium absorption and cause bone loss. A study carried out by Hallstorm et al. (2006) indicate that a daily intake of 330 mg of caffeine, equivalent to 4 cups (600 ml) of coffee, or more may be associated with a modestly increased risk of osteoporotic fractures, especially in women with a low intake of calcium (Hallström et al., 2006).

Some expert mention that there is an association between people who have high soda intake and risk of fracture, that is probably due to the fact that if they have a high soda intake, they have a low milk intake. Furthermore, NOF notified that certain soft drinks and sodas, especially colas, contain phosphorous in the form of phosphoric acid and caffeine. However, Colas may have other chemicals, besides phosphoric acid and caffeine that can affect the bones. People with osteoporosis should not drink more than five cola drinks a week (NOF, 2002).

Additionally National Osteoporosis Foundationrecommended that for bone health, it is best not to drink too many soft drinks or cups of coffee every day. To maintain bone healthfor adults under age 50 get 1,000 mg of calcium every day, and adults age 50 and older get 1,200 mg of calcium every day.

Using Aluminum Cookware:

Aluminum cookware is cheap and widely available and it has a negative consequence for health.A study published in the International Journal of Electrochemical Science has discovered that cooking with aluminum increases the risk of developing Osteoporosis and alzehaimers disease(Bassioni,et al., 2012). In addition, Asiedu-Gyekye et al. (2016) study explore thathigh aluminum levels in the body alter bone mineralization, matrix formation, as well as parathyroid and bone cell activity. Ironically, one of the most common signs of excessive aluminum accumulation is hypercalcemia or high calcium levels in the blood.This happens because the presence of aluminum impedes calcium deposition in bone, thus leading to elevated blood calcium levels. As a result, parathyroid hormone (PTH) secretion, the hormone secreted by the parathyroid hormone, is greatly depressed. Additionally, chronic aluminum toxicity greatly reduces osteoblast population and inhibits bone mineralization, resulting in osteoporosis (Asiedu-Gyekye, et al., 2016).

Sunlight Exposure

Our skin makes vitamin D from the ultra-violet light in sunlight. Ourbodies store the vitamin and use it later. The amount of vitamin D in skin makes depends on time of day, season, latitude, skin pigmentation and other factors. Depending on where you live, vitamin D production may decrease or be completely absent during the winter.Because of concerns about skin cancer, many people stay out of the sun, cover up with clothing and use either sunscreen or sunblock to protect their skin. The use of sunscreen or sunblock is probably the most important factor that limits the ability of the skin to make vitamin D. Because of the cancer risk from the sun, most people need to get vitamin D from other sources, including eating foods rich in vitamin D and taking vitamin D supplements (NOF, 2002).

2.2.13.3 Medical History of Disease

Many medical diseases are associated with low BMD and increased risk of fracture, due to underlying inflammation, malabsorption, renal excretion of calcium, or medications used to treat the diseases. The researcher select the most known and spread condition**.**

Rheumatoid arthritis (RA)

Osteoporosis of the hip or lumbar spine is common in adults with RA. This was illustrated in a study of 287 Norwegian patients among whom the prevalence of osteoporosis, as indicated by a bone mineral density of more than 2.5 standard deviations below the average for healthy young people at one or both sites, was 22 percent (Haugeberg et al., 2002). Other study recognize that patients with RA have a 30 percent increased risk of major osteoporotic fracture and 40 percent increased risk of hip fracture (Kanis, 2008).

Hyperthyroidism

According to National Osteoporosis Society, bone is continuously being broken down and replaced by cells known as osteoclasts and osteoblasts where each cycle of bone 'turnover' takes about 200 days and excess thyroid hormone will hasten this rate of bone turnover. However, if thyroid hormone levels stay too high for too long, there is an increased risk of developing low bone density and osteoporosis, particularly post-menopausal woman. Moreover, hyperthyroidism can also be associated with muscle weakness and loss of lean body mass, which can be quite severe in some cases. This can then lead to an increased risk of falling and subsequent broken bone (Aspray et al., 2014). In a population-based study of 17,684 individuals taking thyroxin in Scotland, there was no increase in osteoporotic fractures in the 3731 individuals whose thyroid stimulating hormone(TSH) was low but detectable (between 0.04 and 0.4 mU/L), while those with undetectable TSH (below 0.03 mU/L) had a twofold increased risk (Flynn et al., 2010).

Hyperparathyroidism

In primary hyperparathyroidism, the diseased gland makes too much parathyroid hormone (PTH), which in turn causes an increased breakdown of normal bone. As the bone breaks down, the bone density decreases which in turn increases the risk of fractures or broken bones (Mechanick et al., 2013). Women are three times more often affected by primary hyperparathyroidism than men, and its incidence is as high as 1:500 in elderly women in which consider a high-risk population for osteoporosis. Furthermore, either osteoporotic

fractures or a *T* scores of <−2.5 is an indication for parathyroid surgery in otherwise asymptomatic patients (Bilezikian et al., 2009).A recent observational study over the course of 15 years showed that parathyroidectomy normalized biochemical indices of bone turnover and preserved BMD, whereas cortical bone density decreased in the majority of subjects without surgery during long-term follow-up (Rubin et al., 2008).

Menstrual history for female

According to North American Menopause Society,(2007)premature menopause refers to menopause that occurs before age 40 years, and early menopause refers to menopause that occurs at or before age 45 years, both ranges being well below the median age of natural menopause age 51 years. Menopause is a major risk factor for osteoporosis where the incidence of fractures increases by about 40% with menopause in developing countries (Sadat-Ali et al., 2004). The relationship between osteoporosis and hypertension can be understood through menopause, the underlying mechanism is through hormonal changes as part of the aging process and the accompanying reduction in estrogen and progesterone(El-Heis et al., 2013).

Having both ovaries removed before age 45 is strongly associated with low-bone mineral density and arthritis in later years, according to a new study by Johns Hopkins oncologists and epidemiologists, (2011).

Diabetes Mellitus

Patients with diabetes typically have low bone turnover with reduction in bone formation and, to a lesser degree, bone resorption.Insulin, which is deficient in type 1 diabetes, may promote bone growth and strength. The onset of type 1 diabetes typically occurs at a young age when bone mass is still increasing. So, it is possible that people with type 1 diabetes achieve lower peak bone mass, the maximum strength and density that bones reach(Urs and Rosen, 2012).

A study explore that Diabetes mellitus (DM) is associated with increased incidence of osteoporosis fractures via visual impairments resulting from diabetic retinopathy and cataract (Wongdee and Charoenphandhu, 2011). Other study mention that the risk of osteoporotic fractures is increased by 12-fold in patients with type 1 diabetes(Nicodemus and Folsom, 2001). Furthermore, Hofbauer et al.(2007) concluded that diabetic complications such as retinopathy, polyneuropathy, and nephropathy, are the major

determinants of low bone mass and increased fracture risk, in part due to the enhanced propensity of falls (Hofbauer et al., 2007).

On the other hand, National Institute of Health NIH mentioned thatincreased body weight could reduce one's risk of developing osteoporosis. Since excessive weight is common in people with type 2 diabetes, affected people were long believed to be protected against osteoporosis. However, although bone density is increased in people with type 2 diabetes, fractures are increased this may be due to increased falls because of vision problems and nerve damage. Moreover, the sedentary lifestyle common in many people with type 2 diabetes also interferes with bone health(NIH, 2001).

Data from the Women's Health Initiative Observational Study also indicate a 20% higher risk for fractures after adjustment for frequent falls and increased BMD (4–5% higher at the hip) in women with type 2 diabetes mellitus (Bonds et al., 2006). An important additional risk factor for fractures in postmenopausal women with type 2 diabetes mellitus is the use of a thiazolidinedione(TZD) type insulin sensitizer, associated with fractures of the hip, humerus, and small bones of the hands and feet (Schwartz et al., 2006).A meta-analysis of 12 studies reported a relative risk (RR) of 1.7 (95% CI: 1.3–2.2) for hip fracture in both men and women with TZD(Janghorbani et al., 2007).

Personal History of Fracture:

A history of a fragility (low-trauma) fracture is another important risk factor for subsequent fracture in men and women (Cauley et al., 2007; Center et al.,2007).Kanis et al, (2004) explore in meta-analysis of 11 prospective cohort studies of fracture risk in men or women with prior fracture. They reported increased risks of any fracture (relative risk [RR] 1.8, 95% CI 1.6-1.9), osteoporotic fracture (RR 1.8, 95% CI 1.6-1.9), and hip fracture (RR 1.6, 95% CI 1.3-2.0) in both men and women, even after adjustment for BMD (Kanis et al., 2004). In a prospective cohort study of 4005 Australian men and women followed for 16 years, the RR of subsequent fracture in women with any initial low-trauma fracture (after age 60 years) was 2.0 (95% CI 1.7-2.2) and for men was 3.5 (95% CI 2.7-4.5) (Center et al., 2007).

Moreover, Mackey et al, (2007), mention that in women, a history of a high-trauma fracture may also be a risk factor for subsequent fracture. In a nine-year study of 8022 women participating inStudy of Osteoporotic Fractures, women with a previous history of

high- and low-trauma non-spine fractures had a similarly elevated risk of subsequent fracture compared with women who had not had such fractures . The risk of a subsequent fracture was 34 percent (95% CI 7-67) and 31 percent (95% CI 20-43) greater among women with a history of high- and low-trauma fracture, respectively(Mackey et al., 2007).

On the other hand, a history of premenopausal fracture significantly increases the risk of a postmenopausal fracture. Data from the Study of Osteoporotic Fractures demonstrate that women with a history of premenopausal fracture are 35 percent more likely to fracture during the postmenopausal years compared with women without a history of premenopausal fracture (Hosmer et al., 2002).

There are many studies recognize a number of factors influence the rate and degree of premenopausal bone loss including age, weight changes, BMI, calcium and vitamin D intake, physical activity, family history of osteoporosis, smoking, and number of pregnancies(Macdonald et al., 2005;Leib, 2005;Uusi-Rasi et al., 2002).

Family History of Fracture:

In a first-degree relative parental, history of hip fracture is associated with a twofold increased risk of hip fracture in women, regardless of BMD (Cummings et al., 1995). A study of Prevalence, family history, and prevention of reported osteoporosis in U.S. women conclude that women with a family history of osteoporosis were:

- 2.4 times more likely to have osteoporosis than women without such history
- 8.5 times more likely to have osteoporosis when two or more relatives were affected, for women aged 35 years or older
- more likely to report preventive behavior such as, taking calcium supplements, vitamin D, or both; increased physical activity; and estrogen use (Robitaille et al., 2008).

Furthermore a study done by Keen et al.(1999) showed that family history of osteoporotic fracture was associated with an increased total risk for osteoporotic fracture, with an odds ratio (95% confidence interval) of 2.02 (1.02, 3.78). Site-specific analysis showed that a positive family history of wrist fracture was associated with a considerably elevated risk of wrist fracture, with an odds ratio of 4.24 (1.44, 12.67). These increases in risk remained after adjustment for BMD, suggesting that other genetic factors account for the familial risk of osteoporosis and fracture (Keen et al,.1999).Other study from seven prospectively studied cohorts a parental history of fracture was associated with a modest but significantly increased risk of any fracture, osteoporotic fracture and hip fracture in men and women

combined. The risk ratio (RR) for any fracture was 1.17 (95% CI=1.07-1.28), for any osteoporotic fracture was 1.18 (95% CI=1.06-1.31), and for hip fracture was 1.49 (95% CI=1.17-1.89). The risk ratio was higher at younger ages but not significantly so. No significant difference in risk was seen between men and women with a parental history for any fracture (RR=1.17 and 1.17, respectively) or for an osteoporotic fracture (RR=1.17 and 1.18, respectively). For hip fracture, the risk ratios were somewhat higher, but not significantly higher, in men than in women (RR=2.02 and 1.38, respectively). A family history of hip fracture in parents was associated with a significant risk both 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 et al., 2004).

Chronic Asthma

National institute of health NIH osteoporosis and related disease mention that People with asthma tend to be at increased risk for osteoporosis, especially in the spine, for several reasons. First, anti-inflammatory medications, known as glucocorticoids, are commonly prescribed for asthma. When taken by mouth, or inhaled form these medications can decrease calcium absorbed from food, increase calcium lost from the kidneys, decrease bone formation, and increase bone loss. Corticosteroids also interfere with the production of sex hormones in both women and men, which can contribute to bone loss, and they can cause muscle weakness, which can increase the risk of falling and related fractures(NIH, 2001).

Gastro-Intestinal Tract (GIT) Problem

Osteoporosis is common in GIT diseases, particularly those associated with malabsorption and maldigestion (celiac disease, postgastrectomy, short gut, pancreatic insufficiency); inflammatory bowel disease; Crohn's disease and ulcerative colitis). (Katz and Weinerman, 2010).

Furthermore, People with low weight anorexia nervosa are at special risk of developing osteoporosis, and at a much younger age than people with no history of eating disorder (Klibanski et al., 1995; Hotta et al., 1998). Osteoporosis is less common in individuals with bulimia nervosa than in those with anorexia nervosa, primarily because weight history tends be significantly higher in bulimic individuals. Fractures are also more common in people with anorexia nervosa, or those with a history of the illness (Biller et al., 1989; Klibanski et al. 1995).

Washington University School of Medicine mention that celiac disease is an intestinal disorder caused by intolerance to wheat flour (gluten)**.** Our results suggest that as many as three to four percent of patients who have osteoporosis have the bone disease as a consequence of having celiac disease, which makes them unable to absorb normal amounts of calcium and vitamin D **(**Washington University School Of Medicine, 2005)

Stroke

Loss of bone mineral density (BMD) and osteoporotic fractures, particularly of the hip, are common complications after stroke.Osteoporosis after stroke differs from age-related osteoporosis or bone loss secondary to endocrine diseases, nutritional disorders and drug-related factors, since it is more evident on the paretic side and involving the upper extremities usually, more than the lower (worthen et al., 2005).

In addition, the clinical significance of osteoporosis after stroke is that it results in skeletal fragility and in an increased risk of fractures, mainly of the hip (Dennis et al., 2002; Ramnemark et al., 1998). However, Complications from fractures lead to increased morbidity and mortality where the pathogenesis of osteoporosis after stroke remains unclear but several factors appear to have an influence on bone mass in stroke patients, such as the degree of paresis, gait disability and the duration of immobilization (carda et al., 2009).

Cancer

Nearly all cancers can have significant negative effects on the skeleton. Cancer is a major risk for both generalized and local bone loss, with bone loss as assessed by bone mineral density (BMD) testing substantially higher in cancer patients than in the general population, independent of cancer type (Reuss-Borst et al., 2012).Cancer-associated bone loss is the result of multiple, inter-related factors. These include both the direct effects of cancer cells, and the effects of therapies used in cancer treatment including chemotherapeutics, corticosteroids, aromatase inhibitors, and androgen deprivation therapy. Further, the skeleton is also the most common site of metastatic disease, as cancer cells growing within bone induce osteoblasts and osteoclasts to produce factors, which stimulate further cancer growth(Roodman, 2004).

Depression

Major depression is associated with low bone mass and increased incidence of osteoporotic fractures. However, causality between depression and bone loss has not been established.In a recent meta-analysis study done by Bab and Yirmiya. (2010)comparing depressed with non-depressed individuals they report that BMD is lower in depressed than non-depressed subjects. The association between depression and BMD is stronger in women than men and in premenopausal than postmenopausal women. The study demonstrate a causal relationship between depressive-like behavior and bone loss. The depression-induced bone loss is associated with increases in skeletal norepinephrine and serum corticosterone levels. Hence, depression appears as a significant risk factor for low BMD, causing bone loss through stimulation of the sympathetic nervous system (Bab and Yirmiya, 2010).

A substantial proportion of depressed patients receive antidepressants, mostly selective serotonin reuptake inhibitors (SSRIs). Some of these have been linked to decreased BMD (SSRIs) and increased fracture risk (SSRIs and tricyclic agents). Current use of SSRIs and tricyclics increases fracture risk by as much as twofold versus nonusers, even after adjustment for potential confounders (Rizzoli, et al., 2012).

2.2.13.4 Medication Use Factors

Drug-induced osteoporosis is a significant health problem and many physicians are unaware that many commonly prescribed medications contribute to significant bone loss and fractures.In this study the researcher, mention the most common used drug that literature suggest there effect on bone health.

Glucocorticoid Therapy

Glucocorticoids increase bone resorption and reduce bone formation, Glucocorticoid therapy is associated with clear risk of bone loss, which is most pronounced in the first few months of use. In addition, glucocorticoids increase fracture risk, and fractures occur at higher bone mineral density values than occur in postmenopausal osteoporosis. Furthermore, it decrease intestinal calcium absorption, and increase renal calcium excretion(Canalis et al., 2007). A retrospective cohort study in 244,235 oral glucocorticoid users in the United Kingdom General Practice Research, database showed a dose-dependent relationship between chronic glucocorticoid use and fracture risk, with high doses (prednisolone 7.5 mg/day or greater) having the highest risk . Low doses of

glucocorticoids (prednisolone less than 2.5 mg/day) were also associated with increased fracture risk (Van Staa et al., 2000).

Proton Pump Inhibitors (PPI)

PPIs appear to increase the risk of hip fracture, but not in those without preexisting fracture risk. Data from the Women's Health Initiative did not demonstrate an increased risk of hip fracture with PPI use but There was a 47% increased risk for clinical spine fracture and a 26% increased risk for forearm or wrist fracture associated with PPI use (Gray et al., 2010)**.**

Epidemiologic studies have found an increased risk of fracture with long-term PPI use (≥1 year) (Yang et al., 2006).while the effects do not appear to be dose dependent (Pitts and Kearns, 2011). A large meta-analysis found that PPI but not H_2-receptor antagonist use was associated with an increased risk of fracture (Eom et al., 2011). Another study also failed to find an association between PPI use and a reduction of BMD in a Manitoba population consisting primarily of women aged >65 years (Targownik et al., 2010).

Mazziotti et al., (2010) consider that the risk of fracture appears to reverse 1 year after discontinuing the drug. A decrease in calcium absorption is thought to be the mechanism contributing to the increased fracture risk (Mazziotti et al., 2010). Because of the lack of evidence demonstrating a loss of BMD with PPI use, randomized controlled trials are needed to definitively prove a causal effect between PPI use and increased risk of fracture (Ngamruengphong et al., 2011).

Loop Diuretics (LDs)

There is evidence that LDs are associated with a loss of BMD. Loop diuretics increase the renal excretion of calcium, which can result in a hypocalcaemia state. Compensatory processes are thought to be responsible for the loss of bone. One study showed a significant increase in parathyroid hormone a few hours after a dose of bumetanide, which promotes bone resorption .BMD loss appears to be dose-dependent (Rejnmark et al., 2003).A study of men aged ≥65 years using LDs demonstrated BMD loss, which also appeared to be dose dependent. The loss was not as great as has been observed with postmenopausal women. Bone loss was larger in continuous users than in intermittent users or nonusers (Lim et al., 2008).

Rejnmark et al, (2006) mention in a randomized, controlled trial of postmenopausal women supplementing with calcium and vitamin D, BMD loss was observed after 1 year in the active group (bumetanide 2 mg/day). The decrease of BMD at the hip, forearm, and lumbar spine was 1.6%, 2.0%, and 1.0%, respectively. After bumetanide was discontinued, BMD appeared to recover. Six months post treatment; there was no significant difference between the treatment group and the control group. Furthermore, the study concluded that ever use of LD was associated with a crude 51% (OR 1.51; 95% CI 1.48–1.55) increased risk of any fracture and a 72% (OR 1.72; 95% CI 1.64–1.81) increased risk of hip fracture. Use of furosemide was associated with higher risk estimates than use of bumetanide(Rejnmark et al., 2006)

AnticoagulantDrug

Unfractional heparin: A Long-term unfractionated heparin (UH) use is associated with an increased risk of osteoporosis, up to one-third of patients on long-term UH therapy have a subclinical reduction of BMD, and approximately 2% to 3% experience a symptomatic fracture. Because heparin remains on the bone so reduced, BMD may not be readily reversible (Rajgopal et al., 2008). Vertebral fractures are most common with heparin-induced osteoporosis. The loss of bone while using UH is time and dose dependent (Handschin et al., 2005).

Low-molecular-weight heparin(LMWH): LMWH is often prescribed for thromboprophylaxis in pregnant women. LMWH has a more predictable clinical response, greater bioavailability, and possibly lower incidence of adverse effects when compared to UH. BMD loss may occur in pregnant women without adequate calcium and vitamin D intake (Casele et al., 2006). LMWH may also be associated with a lower risk of osteoporosis, but the evidence is conflicting. Long-term LMWHs are most often used in pregnant women, making clinical study difficult due to ethical issues. Some studies demonstrate a lower risk of bone loss with the use of LMWHs when compared to UH. Other studies find subclinical loss of BMD with the use of LMWHs (Wawrzyńska et al., 2003).

Anticonvulsant Drug

the majority of published studies and evidence establish that use of anticonvulsant drug include phenytoin (PHT), carbamazepine (CBZ), primidone (PRM), and phenobarbital (PB) are associated with altered bone metabolism and decreased bone density which consider as inducers of the cytochrome P450 enzyme system which convert vitamin D to an inactive form (Verrotti et al., 2000). National osteoporosis society explore that many risk factors associated with anticonvulsant drug induce osteoporosis include, high dose of drug, multiple drug regimens (more than one drug used), long term use and staying indoor with little exposure to sun light resulting in vitamin D deficiency (National osteoporosis Society, 2012).

Contraceptive

Oral contraceptives are a safe and acceptable form of contraception in perimenopausal women and may be effective in maintaining bone mass prior to menopause. Studies of the bone-sparing properties of oral contraceptives are difficult to interpret because of confounding variables, such as age, smoking, duration of use, exercise, menstrual function and endocrine diseases. Nevertheless, the results of many studies suggest that premenopausal use of oral contraceptives is associated with higher bone density than is nonuse. Long-term premenopausal oral contraceptive use allows women to enter menopause with bone density that is 2-3% higher than in nonusers. The optimal duration of use and dosage of estrogen and the clinical importance of this effect remain to be determine (corson, 1993).However, the long-acting progestogen injectable contraceptives depot medroxyprogesteroneacetate (DMPA) and norethisteroneenthate have been found to adversely affect bone mineral density in adult premenopausal women and adolescents. While Bone loss occurring with DMPA use is reversible and is not likely to be an important risk factor for low bone density and fractures in older women, although data on fracture risk in DMPA users are lacking(Kaunitz et al., 2008).

Anti-Hypertensive Drug

Osteoporosis and hypertension are two frequent diseases among the aging population and often coexist. Moreover, treatment ofhypertension affects bone mineral density and, therefore, can worsen osteoporosis.

The most relevant non-genetic factors in the etiology of osteoporosis and hypertension are low calcium intake, vitamin D and vitamin K deficiency, high consumption of sodium salt,

and the effects of different forms of nitric oxide. Thiazide diuretics are the only antihypertensive that have a positive influenceon bone mineral density. For other antihypertensive drugs, the data are conflicting, indicating that they may have a potentially negative or positive influence on bone mineral density and fracture risk reduction. Some studies did not find a correlation between the use of antihypertensive and bone mineral density. Due to the frequent coexistence of hypertension and osteoporosis (Ilić etal., 2013).
Chen et al., (2016)longitudinal cohort study found that Antihypertensive drugs have been linked to new-onset osteoporotic fracture, and different classes of antihypertensive drugs may alter the risk for the development ofosteoporotic fracture. The risk of new-onset osteoporotic fracture after adjusting age, sex, comorbidities, and concurrent medications was higher among the users of angiotensin-converting enzyme (ACE) inhibitors (OR, 1.64; 95% confidence interval [CI], 1.01–2.66) than among nonusers. Patients who took calcium channel blockers (CCBs) (OR, 0.70; 95% CI, 0.49–0.99) were at a lower risk of developing new-onset osteoporotic fracture than nonusers. Loop diuretics, thiazide diuretics, angiotensin receptor blocker, beta-blocker, and alpha-blocker were not associated with the risk ofnew-onset osteoporotic fracture (Chen et al., 2016).
On the other hand, statistical significant differences (P value = 0.008) were observed between the beta-blocker and calcium channel blocker groups (Ağaçayak et al., 2014).

2.2.14 Osteoporosis Treatment

Several effective medicines are approved for the prevention and treatment of osteoporosis. These agents have been demonstrated to reduce vertebral, and in some cases non-vertebral, fracture risk in women with osteoporosis. They can be broadly divided into two categories: anti-resorptive (or anti-catabolic) or anabolic agents. Anti-resorptive agents, which include estrogen, the selective estrogen receptor modulator raloxifene, bisphosphonates and the human monoclonal antibody to receptor activator of NFκB ligand reduce bone resorption (and subsequently bone formation), leading to an increase in BMD to varying degrees. In comparison, anabolic agents, which include full-length parathyroid hormone (PTH1-84) and teriparatide (PTH1-34) stimulate bone formation (and subsequently bone resorption), thereby increasing BMD (Szulc et al., 2011).
According to a clinical practice guideline by the American College of Physicians, because of the significant disability, morbidity, mortality, and expenses associated with osteoporotic fractures treatment aimed at fracture prevention (Qaseem et al., 2008).Furthermore, preventive measures include modification of general lifestyle factors,

such as increasing weight-bearing and muscle-strengthening exercise, which have been linked to fractures in epidemiologic studies, and ensuring optimum calcium and vitamin D intake as adjunct to active anti-fracture therapy (Sandhu et al., 2011),

A 2008 literature review suggested that the use of reminders plus education targeted to physicians and patients can lead to increased bone mineral density (BMD) testing and greater use of osteoporosis medications (Kastner et al., 2008).

Chapter 3

Methodology

These chapters illustrate the methodology use in this study. It clarify the study design, study population, study setting, period suggesting for study, sampling process, inclusion criteria and date collection. Further, it present the validity and reliability of the instrument that it use for data collection. Additionally, it includes method of data collection, limitation of the study and ethical consideration.

3.1 Study Design

Thedesign of this study is case-control study with matching of three variables, gender, age and place of treatment. Case control study is an observational type of study in which two exciting groups are differs in outcome. The first group is patients who have the disease or outcome of interest (cases) and compare them to people who have not experience to the disease or outcome (controls). Case control study also known as "retrospective study" because it aim to determine the exposure to the risk factor of interest from each of the two groups' case and control. The mainly advantages of case control study are studying rare condition or disease, relatively inexpensive with less time as the condition or disease has already occurred. Additionally, it let the researcher look at multiple risk factors so establish an association between risk factor and disease. Thereby, it can answer questions that could not be answered by other study design. However, the major disadvantage of retrospective study is in the quality of data that rely on memory with past events so it potential for recall bias. Additionally, it is difficult to evaluate diagnostic tests because it is already clear that the cases have the condition and the controls have not.

3.2 Study population

The study population consists of theosteoporotic patients diagnosed during data collection period in which diagnosis confirm by physician measuringbone mass density (BMD) by DEXA scan. The researcher determined each of case and control groups as follows. The case group consisted of participants with osteoporosis diagnosed by physician and confirmed by doing DEXA scan, while control group consisted of participant matched with gender, age and location of treatment without history of osteoporosis confirmed by doing DEXA scan. For every osteoporotic patient (a case) diagnosed, a non-osteoporotic participantwas taken from the same center (a control) which diagnosis confirm him/her as osteoporosis free.

3.3 Study Setting

Thisstudy was conducted in the Palestinian German Diagnostic Center, which has DEXA scan for measuring bone mass density (BMD). For each case, control had been taken from the same center.

3.4 Sampling

Sample defines as a subset of a population selected for measurement, observation or questioning, to provide statistical information about the population. Thesample size for this study determined by using the statistical calculator of the EPI-Info software V.20 based on the literature review. The sample size is 146 participant will divided into 73 cases and 73 controls with a ratio of one case to one control at ($\alpha = 0.05$, power = 0.8) matching was done by age, gender and location of the treatment. The researcher increased the actual sample size to 160 participant to compensate the missing and non-responders (annex-2).The researcher selected each case and control during time of data collection and therefore after doing DEXA scan to identify participants who have osteoporosis (cases) and those whose are free (controls) then face-to-face interview questionnaire were done for each participant.The researcher used convenience sample to select the case and control groups.

3.5 Period of the study

Thestudy consumed 14 months; it started on April 2016 after the acceptance of the proposal, then conducting the administrative procedures and gaining ethical approval. Pilot study conducted in September 2016. Data collecting continue to January 2017, data analysis and writing final report continued to march 2017, data analysis and writing final report continued to May 2017. (Annex 3) describe the activities of the research and duration of each activity.

3.6 Eligibility criteria

3.6.1 Inclusion Criteria for Case

Case participant male and female that diagnosis of osteoporosis confirmed by specialized physician using DEXA scan in which T score be $\leq$ -2.5.The study done by matching gender, age and place of treatment between case and control groups.

3.6.2 Exclusion

- Pregnant women.
- Participants aged more than 70 years.

3.6.3 Inclusion criteria for control

A control is a participant male and female whom diagnosis confirmed by specialized physician after doing DEXA scan in which T score $\geq$ -1. Controls were chosen from the previous mentioned centers and matching with case from the same center.

3.7 Study instrument:

After reviewing previous studies and literature,the questionnaire was arranged in a logical sequence to facilitate the interview and was written in both English and Arabic language (Annex 4,5). The question was closed- ended questions.

The researcher used self- administered structured interview questionnaire. The questionnaire divided into four domains as following:

1. Socio-demographic factors contains information about age, gender, education, occupation, marital status and family income.
2. Life style factors contains BMI, nutrition habits(tea, coffee, cola, milk, dairy product), physical activity, smoking, calcium and vitamin D supplement, exposure to sun and cooking in Aluminum cookware.
3. Medical history factor which include family history, menstrual history(female),personal fracture, eating disorder, rheumatoid arthritis (RA), Diabetes Mellitus (DM), depression, chronic constipation ,chronic diarrhea and cancer.
4. Medication use factors contain drugs used as corticosteroid (prednisolone), contraceptive, breast cancer therapy,anticonvulsion, prostate cancer therapy, Lasix, proton pump inhibitors PPI, antidiabetic and antihypertension drug.

3.8 Data collection

Data was collected through direct and indirect methods. Direct methods include anthropometricmeasurement (measurement of weight and height for both case and control groups). Indirect data collection carried out through structured interviews (face-to-face interviews questionnaire). The researcher collected the data with two expert and qualified

assistants. The assistants trained well on how to interview the clients in the same way as the researcher.

3.9 Data entry and analysis

The collected data introduced to the computer using SPSS (Statistical Package for Social Science version 20).

Statistical methods carried out as follow:

- Reviewing the records and filling out the questionnaire.
- Developing an appropriate data entry model.
- Coding the participant data.
- Defining and recording the variables.
- Cleaning the data.
- Descriptive statistics frequencies, percentage, means and standard deviation(SD) analysis were used in the study.
- Bivariate analysis was used via Odds Ratio to show if there are statistical significant association between factors and osteoporosis.
- Multivariate analysis was used by binary logistic regression to determine which pure independent variables affect the probability of an outcome of osteoporosis and results were presented with beta coefficient, OR with CI 95% and p value.

3.10 Scientific Rigor

3.10.1 Validity of Instrument

Validity of an instrument is a determination of the extent to which the instrument reflect the abstract being examined.

Face and content validity: The researcher submitted the questionnaire to group of experts panel (Annex 6) in order to evaluate its quality and to make the needed suggestions. All suggestion from each expert are taken in concern by the researcher and added as extra question in the questionnaire.

Reliability of instrument

❖ **Pilot study**

Small-scale experiment conducted before starting data collection in order to know the extent of ambiguity in the instrument. Additionally, piloting allows the data collectors to

gain experience dealing with data collection instrument. Piloting performed on 20 client, 10 cases and 10 control, where obtained from the selected center that allow for further improvement of validity and reliability of the instrument. After that, the piloting cases and controls were added to the sample.

3.11 Ethical Consideration

The researchercommitted to all ethical considerations required to conduct a research, which includes:

- An official letter of approval to conduct the study obtained from theHelsinki committee (Annex 7) and school of public health at Al-Quds University.
- An official letter of request obtained from the general director of Palestinian German Diagnostic Center (Annex 8).
- To guarantee participant rights, a covering letter indicating that the participation is voluntary and the right to refuse was preserved.
- Confidentiality was given and maintained until the end of the study.
- Every participant in the study was provided by complete explanation about the research purpose and benefits of the result on community health.

3.12 Limitation of the Study

The main constraints faced the researcher

- Selected the case group with osteoporosis and the diagnosis confirmed by DEXA took too much time.
- Selected the controls after doing DEXA scan took too much time.
- Matching more than two characteristics between case and control groups.
- Limited scientific resource like books and journal.
- Lack of local research about the study topics.
- Limited time available to conduct the study

Chapter 4

Results and discussion

4.1 Introduction

This chapter illustrates the results of statistical analysis of the data; firstly include descriptive analysis that presents the participant characteristics and demonstrates the variation between cases and controls including frequencies and percentage. In addition, it showed the different risk factors of socio-demographics, life style, medical and medication factors that related to the development of osteoporosis among adults in Gaza Strip. Chi-square statistical test was used to show the differences between categorical variables, in addition,multiple logistic regression model was presented to show most important risk factors of osteoporosis. Finally, these results were discussed in comparison with literature review and related previous studies.

4.2 Descriptive Analysis

4.2.1 Selected socio-demographic characteristics of the study population

The study sample consisted of 160 participants, divided into two groups; case group consisted of (80) male and female participants who had osteoporosis and control group consisted of (80) male and female participants without osteoporosis.

Table (4.1): Frequencies of study population according to gender, age and place of treatment

Variable		Case		Control	
		N	%	N	%
Gender	Female	65	81.2%	65	81.2%
	Male	15	18.8%	15	18.8%
	Total	**80**	**100**	**80**	**100**
Age	20-30years	11	13.8%	11	13.8%
	31-40 years	18	22.5%	18	22.5%
	41-50 years	18	22.5%	18	22.5%
	51-60 years	20	25%	20	25%
	More than 60	13	16.2%	13	16.2%
	Total	**80**	**100**	**80**	**100**
Place of treatment	Palestinian German Diagnostic Center	80	100%	80	100%
	Total	**80**	**100**	**80**	**100**

Table (4.1) showed that the study population consisted of 65 (81.2%) females and 15 (18.8%) males had osteoporosis among the case group were 65 (81.2%) female and 15 (18.8%) male without osteoporosis among the control group. Age was divided into five groups each group was matched between case and control group, 11(13.8%) cases and

11(13.8%) controls their age between 20- 30 years. In addition, 18 (22.5%) cases and 18 (22.5%) controls their age between 31-40 years; the same number and percentage age from 41-50 years. While the highest number were between 51- 60 years 20 (25%) cases and 20 (25%) controls. Finally,13(16.2%) cases and 13 (16.2%) controls were aged more than 60 years. The researcher noted that more than two third of our sample were over age of 40 years, this result was expected because mainly osteoporosis affected people over this age group.

Concerning place of treatment 80 (100%) cases and 80(100%) controls were taken fromPalestinian German Diagnostic Center in which their diagnosis confirmed by DEXA scan technique that they are osteoporotic (case) or osteoporosis free (control). The equality in the number of cases and controls groups in gender, age and place of treatment were due to matching.

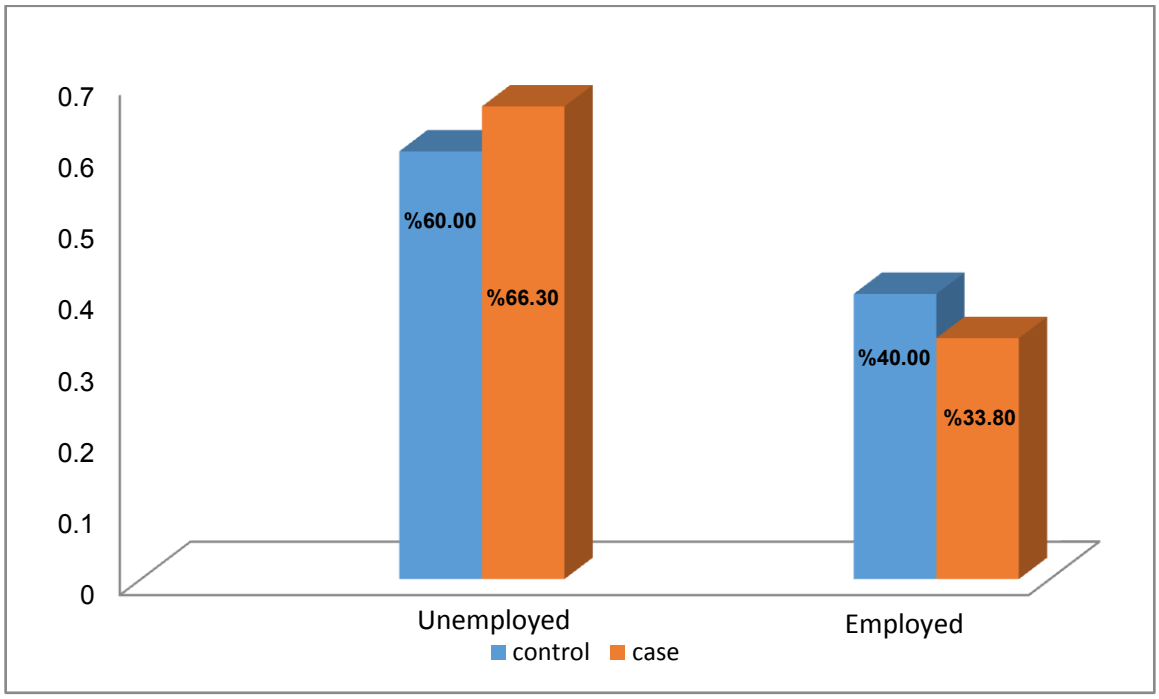

Figure (4.1): Percentage distribution of study population according to participant occupation.

Figure (4.1) showed that 27 (33.8%) casesand 32 (40%) controls were employed while 53 (66.3%)cases and 48 (60%) controls were unemployed.This result was expected, only about one third of our sample were employed due to sanction, low economic status and siege.This result is consistent with the report of World Bank, (2017)which mentioned that Palestinian poverty rate remains at about one quarter of its population. Unemployment has gone up from 25% in 2015 to 27% in 2016, though it varies from a high 42% in Gaza to 18% in the West Bank.

Table (4.2): Percentage distribution of study population according to education level

Variable		Case		Control	
		N	%	N	%
Education level	Illiterate	5	6.3%	2	2.5%
	primary	6	7.5%	2	2.5%
	Preparatory	6	7.5%	7	8.8%
	Secondary	30	37.5%	26	32.5%
	Diploma	7	8.8%	10	12.5%
	University	25	31.1%	28	35%
	More	1	1.3%	5	6.2%
	Total	**80**	**100**	**80**	**100**

According to the table (4.2),five(6.3%) from cases and two(2.5%)from controls were illiterate, 6(7.5%) cases and 2(2.5%) controls were primary education, 6(7.5%) cases and 7(8.8%)controls were preparatory education. Also, 30(37.5%) from cases and 26(32.5%) from controls were secondary education. In addition, 7(8.8%) cases and 10(12.5%) controls were diploma education and 25(31.3%) of cases and 28(35%) from controls were have university education. Finally, one(1.3%) from cases and five (6.2%) from controls were have more than university degree.Our result showed that more than two third (79%) of our sample were educated and have at least secondary school certificate, this result consistent with the PCBS,(2017) report which mentioned that literacy rates are highest in the Gaza Strip, with a literate population of 96.8%, compared to 96% in the West Bank

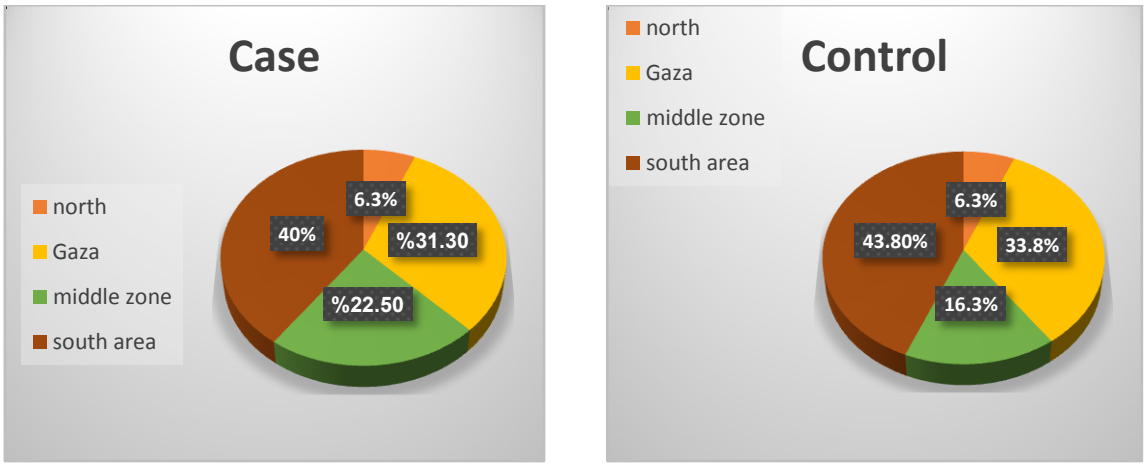

Figure (4.2): Percentage distribution of study population according to living area

Figure (4.2) showed tht (40%)cases and (43%) controls of the study population were from south area. (31.3%) of cases and (33.8%) of controls from Gaza city. The lowest percentage group were from north (6.3%) of cases and (6.3%) from controls. Middle zone account for (22.5%) of cases and (16.3%) from controls.

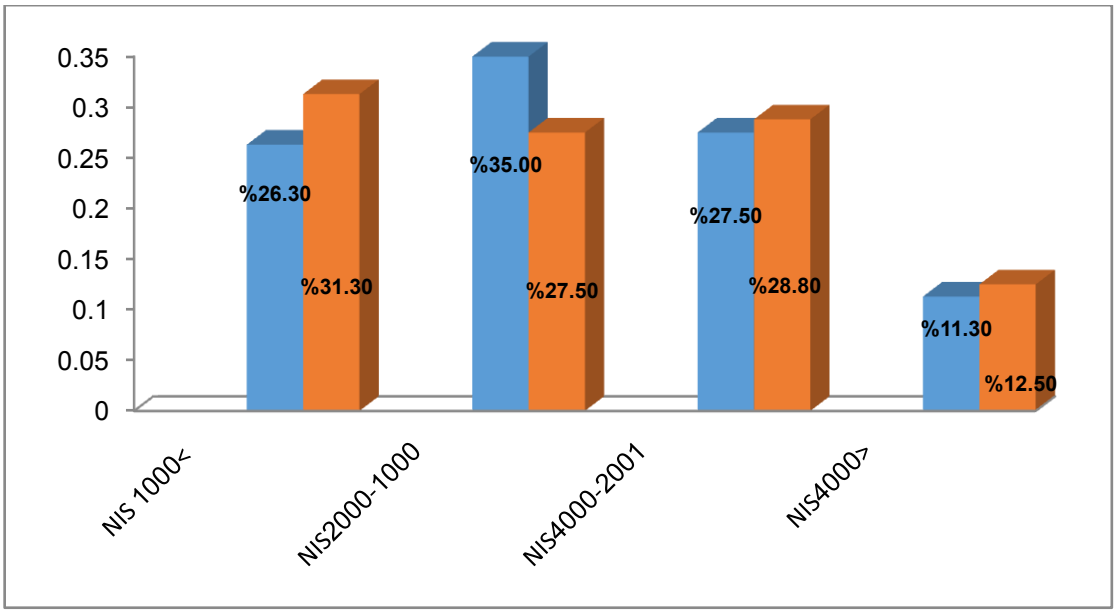

Figure (4.3): Percentage distribution of study population according to level of income

Figure (4.3) showed that (31.3%) of cases and (26.3%) of controls their income less than 1000NIS while (27.5%) cases and (35%) of controls their income were between 1000-2000NIS. (28.8%) of cases and (27.5%) of controls their income were from 2001-3000 NIS. The lowest percentage of study population their income were more than 4000NIS, (12.5%) cases and (11.3%) controls. Our result showed that two third of our participants

their income less than 2000NIS which consistent with UNRWA (2014) report, which estimate that the average monthly salary in Gaza amounted to US$ 174; with a poverty rate of 39 percent, an 11 percent increase since 2013.

4.3 Inferential Statistics

Inferential statistics usedto show the relationship between variables by using statistical tests.

4.3.1 Bivariate Analysis

4.3.1.1 Risk factors of osteoporosis

4.3.1.1.1 Socio-Demographic Variables

The researcher supposed that the socio- demographic variables of the participant might play a role as predisposing risk factors for osteoporosis. These variables include participant occupation, marital status, level of income and education level.

Table (4.3): Socio-demographic factors and development of osteoporosis

Variable		Case		Control		Chi-Square Test	P-value
		N	%	N	%		
Living area	North	5	6.3%	5	6.3%	1.018	0.797
	Gaza	25	31.3%	27	33.8%		
	Middle Zone	18	22.5%	13	16.3%		
	South Area	32	40.0%	35	43.8%		
	Total	**80**	**100**	**80**	**100**		
Level of income	<1000	25	31.3	21	26.3	1.143	0.767
	1000-2000	22	27.5	28	35		
	2000-4000	23	28.8	22	27.5		
	>4000	10	12.4	9	11.2		
	Total	**80**	**100**	**80**	**100**		
Education level	Illiterate and primary	11	13.8%	4	5%	4.989	0.288
	Preparatory	6	7.5%	7	8.8%		
	Secondary	30	37.5%	26	32.5%		
	Diploma	7	8.8%	10	12.5%		
	University	26	32.4%	33	41.2%		
	total	**80**	**100**	**80**	**100**		

Table (4.3) showed that there is no statistical significant difference between living area and having osteoporosis (chi square 1.018, P value 0.797). Also level of income showed that no statistical significant difference with having osteoporosis (chi square = 1.143 with P value = 0.767). Our result is inconsistent with study done by Navarro et al (2009) in Spain concluded that poverty has been shown to be a definite risk factor for osteoporosis. While there were a debate in the literature on the relation between level of income and osteoporosis, a study evaluating Canadian women has shown that lower income was found to correlate with a greater likelihood of qualifying for osteoporosis treatment, based on an assessment of the probability of hip fracture (Brennan et al., 2014).

In addition, the result showed that there is no statistical significant difference between education level (x^2 = 4.989, P value = 0.288) and having osteoporosis. This result is inconsistent with study of Maddah et al. (2011) which conclude that those post-menopausal women with low education were more likely to have osteoporosis than high-educated women and it was approximately five times more than high educated women. The researcher estimate that most of the people who are living in Gaza strip were educated and have enough knowledge about a well balance diet.

Table (4.4): Maternal factors and development of osteoporosis among case and control groups

Variable		Case		Control		Chi square	P value
		N	%	N	%		
Marital status	Single	2	2.5%	9	11.3%	5.272	0.153
	Married	66	82.5%	62	77.5%		
	Widow	8	10%	5	6.3%		
	Divorced	4	5%	4	5%		
	Total	**80**	**100**	**80**	**100**		
Having children	Yes	73	93.6%	65	90.3%	0.558	0.455
	No	5	6.4%	7	9.7%		
	Total	**78**	**100**	**72**	**100**		
Number of children	4 and less	30	41.9%	32	48.4%	0.745	0.388
	5 and more	43	58.1%	33	51.6%		
	Total	**73**	**100**	**65**	**100**		
History of abortion	Yes	39	60%	29	44.6%	3.083	0.079
	No	26	40%	36	55.4%		
	Total	**65**	**100**	**65**	**100**		
Mother feeding	Breast	58	93.5%	41	78.8%	5.35	**0.021***
	Bottle	4	6.5%	11	21.2%		
	Total	**62**	**100**	**52**	**100**		
Breast feeding duration	1 year and less	32	54.2%	22	53.7%	0.003	0.954
	More than 1year	26	45.8%	19	46.3%		
	Total	**58**	**100**	**41**	**100**		

*the relationship is significant at 0.05 level

** Fisher-Exact test is used for 2*2 tables

Table (4.4) showed that there was no statistical significance differences between marital status and osteoporosis (chi square 5.272, P value = 0.153). These finding was inconsistent with the result of Brennan et al. (2009)which showed that there is a strong association between increase risks of fracture inunmarried, single, divorced, or widowed population compared to married couple.In addition, the table showed that there was nostatistical difference between either having children or number of children and osteoporosis(chi square = 0.558, p value = 0.455; chi square = 0.745, p value= 0.388) respectively.Our results were consistent with kaur et al. (2003) which revealed that bone density remains stable during pregnancy and not affecting Body Mass Index (BMD). Also, pregnancy and lactation associated osteoporosis is often confused with other causes of low back pain during pregnancy.

For participants having a history of abortion, 39 (60%) from the case group while 29 (44.6%) from the control group. The Pearson Chi-squared value of 3.083 with p-value 0.079 indicates no statistical differencebetween having a history of abortion and the status of having osteoporosis.This result indicates that the proportion difference between the case and control groups is insignificant at 0.05 level. Our result is inconsistent with, Ozdemir et al.(2005) study, which illustrate that women who had five or more abortions were found to have significantly lower spine BMD values compared to women who had no abortions or women who had one or two abortions. Our findings indicate that the increased risk of osteoporosis is not associated with the increased number of pregnancies and abortions.

Concerning breast-feeding, 58 (93.5%) of the case group and 41(78.8%) of the control groupused breast-feeding while 4 (6.5%) from case group and 11(21.2%) from control groupused bottle-feeding. The Pearson Chi-squared value of 5.35 with p-value 0.021 indicates statistical differencesbetween using breast-feeding and the having osteoporosis. This result indicates that the proportion difference between the case and control groups is significant at 0.05 level. Our study results were congruent with Karlsson et al. (2005) study which concluded that lactation has more consistent and profound effects on bone density that bone loss of 3 to 10 percent at the spine and hip are seen over three to six months of lactation. Moreover, Bone loss is related to duration of lactation and duration of amenorrhea and is not prevented by calcium supplementation.

In contrast, the table showed there is no significant difference between breast-feeding duration and having osteoporosis (x^2 = 0.003, P value = 0.954).

4.3.1.1.2 Life StyleVariables

The researcher supposed that the life style factors might play role as predisposing factors for osteoporosis. These variables include BMI, smoking, exercise activity, sunexposure, cooking in aluminum cookware, drinking (tea, coffee,soft drinks and milk) and taking calcium and vitamin D supplement.

Table (4.5): Life style factors and developing of osteoporosis among case and control groups.

Variable		Case		Control		Chi square	P value
		N	%	N	%		
BMI	≤29.9	51	63.8%	48	60%	0.238	0.625
	>29.9	29	36.2%	32	40%		
	Total	**80**	**100**	**80**	**100**		
Exercise activity	Don't do	52	65%	41	51.3%	3.682	0.298
	Daily	19	23.8%	24	30%		
	Weekly	9	11.3%	15	18.8%		
	Total	**80**	**100**	**80**	**100**		
Sun exposure	Yes	56	70%	55	68.8%	0.029	1.000
	No	24	30%	25	31.3%		
	Total	**80**	**100**	**80**	**100**		
Cooking in Aluminum cookware	Yes	53	66.3%	43	53.8%	2.604	0.146
	No	27	33.7%	37	46.2%		
	Total	**80**	**100**	**80**	**100**		

*The relationship is significant at 0.05 level

** Fisher-Exact test is used for 2*2 tables

In regarding to Body Mass Index (BMI), table (4.5) showed that the chi -square value of 0.238 with P value 0.625 indicate nostatisticaldifference between BMI and having osteoporosis. This result indicates that the proportion difference between the case and control groups is insignificant at 0.05 level.

In addition,in exercise activity more than half of our study case (65%) and (51.3%) control groups are not doing any type of exercise. the Pearson chi square value 3.682 with P value 0.298 indicate nostatistical differencebetween exercise activity and having osteoporosis. the proportion difference between case and control groups wereinsignificant at 0.05 level. Our result is inconsistent withHeyward & Gibson (2014) who revealed thatpeople who spend a lot of time sitting have a higher risk of osteoporosis than do those who arewalking,

running, jumping, dancing and weightlifting.For participants who are expose to sun light, the Pearson chi square and P value are (0.029 and 1.00) respectively which indicate nodifference between sun exposure and having osteoporosis.The researcher attributes absence of significant due to the abundant of sunshine all time of the year in Gaza strip and to the smaller size of study sample.

In addition, the table showed that there was nostatistical significant difference between cooking in Aluminum cookware and having osteoporosis (x^2 = 2.604, P value = 0.146). This result is inconsistent withBassioni,et al.(2012) study that showed that cooking with aluminum increases the risk of developing Osteoporosis and alzehaimers disease.

Table (4.6): Drinking coffee, tea and soft drinks and development of osteoporosis among case and control groups

Variable		**case**		**Control**		**Chi square**	**P value**
		N	%	N	%		
Drinking coffee	Not drink	36	45%	38	47.5%	3.299	0.192
	1-3 cups/day	32	40%	37	46.3%		
	4 and more/day	12	15%	5	6.3%		
	Total	80	100	80	100		
Drinking Tea	Non	17	21.3%	13	16.3%	1.129	0.569
	1-5 cups/day	55	68.8%	61	76.3%		
	6 and more/day	8	10%	6	7.5%		
	Total	**80**	**100**	**80**	**100**		
Soft drink(cola)	Non	55	68.8%	58	72.5%	0.271	**0.603**
	1 or more cups/week	25	31.2%	22	27.5%		
	Total	**80**	**100**	**80**	**100**		

*The relationship is significant at 0.05 level

** Fisher-Exact test is used for 2*2 tables

Table (4.6) showed that 36(45%) of cases were not drink coffee, 32(40%) drink 1-3 cups daily and 12(15%) drink more than 4 cups daily.While 38 (47.5%) of control groups were not drink coffee, 37 (46.3%) drink 1-3 cups daily and 5 (6.3%) drink more than 4 cups

daily.Our result showed that drinking coffee had notsignificant association with osteoporosis (x2 = 3.299, p value = 0.192). National Osteoporosis Foundation (NOF), (2002) recommended that drinking more than three cups of coffee every day may interfere with calcium absorption and cause bone loss. Our results inconsistent with a study carried out by Hallstorm et al. (2006) indicate that a daily intake of 330 mg of caffeine, equivalent to 4 cups (600 ml) of coffee, or more may be associated with a modestly increased risk of osteoporotic fractures, especially in women with a low intake of calcium.

Furthermore, the study showed that showed that 17(21.3%) of cases and 13(16.3%) from controls not drink tea while 55(68.8%) cases and 61(76.3%)from controls drinking 1-5 cups per day. Also, 8(10%) of cases and 6 (7.5%) from controls drink more than 5 cups per day. This result indicates that nodifference between drinking tea and having osteoporosis (x^2 =1.129, P value = 0.569).

On the other hand, drinking soft drink as cola illustrate that 55(68.8%) of cases 58 (72.5%) of controls not drink cola at all while 25(31.2%) of cases and 22 (27.5%) from control group drink one or more cups per week. This result showed that (x^2 = 0.271, p value = 0.603) which indicateno statistical difference between drinking soft drinks and osteoporosis. This result indicate that the proportion difference between case and control groups isinsignificant at 0.05 level.

4.3.1.1.3 MedicalCondition Variables

The researcher suppose that number of medical factors might be predisposing factors for osteoporosis. These factors include family history of having osteoporosis, menstrual history for female, personal hip and vertebral fracture, Rheumatoid Arthritis RA, eating disorder, hyperthyroidism and cancer disease.

Table (4.7): Family history of medical condition and development of osteoporosis

Variable		Case		Control		Chi square	P value
		N	%	N	%		
Family history of osteoporosis	Yes	31	38.8%	12	15%	11.481	**0.001***
	No	49	61.3%	68	85%		
	total	80	100	80	100		
Family history of hip fracture	Yes	15	18.8%	4	5%	7.227	**0.013***
	No	65	81.3%	76	95%		
	total	**80**	**100**	**80**	**100**		
Family history of vertebral fracture	Yes	3	3.8%	2	2.5%	0.206	0.500
	No	77	96.3%	78	97.5%		
	total	**80**	**100**	**80**	**100**		
Family history of Curve in the spine	Yes	8	10.0%	9	11.3%	0.066	0.798
	No	72	90%	71	88.8%		
	total	**80**	**100**	**80**	**100**		

The relationship is significant at 0.05 level

Table (4.7) showed that participant with family history of osteoporosis constitutes a proportion of(38.8%) cases while (15%) of controls with (chi-square = 11.481 and P value = 0.001)which means significantstatistical difference between having family history of osteoporosis anddevelopment of osteoporosis. This result indicates that the proportion difference between case and control groups is significant at 0.05 level.

In addition participant with family history of hip fracture contribute to 15 (18.8%) from case group while 4 (5%) of control group (x^2= 7.227, p value = 0.013) means that there is significant association between family history of hip fracture and osteoporosis.

In contrast, family history of vertebral fracture 3 (3.8%) of cases and 2 (2.5%) of control with (x^2 = 0.206 and p value = 0.5) indicate that there is no significant difference between family history of vertebral fracture and osteoporosis.

Furthermore, there is no significant difference between family history of curve in the spine and osteoporosis (x^2 = 0.066 and p value = 0.798).Our study results is consistent with Soroko et al.(1994) study, which concluded that men and women with a family history of osteoporosis had lower BMD than those with a negative family history. In men, a positive family history was associated with lower BMD at the hip (P= 0.01), whereas in women a significant association was observed for the spine (P = 0.02).

Table (4.8): Personal history of hip and vertebral fracture, rheumatoid arthritis (RA), eating disorder, hyperthyroidism and cancer with development of osteoporosis

Variable		case		Control		Chi square	P value
		N	%	N	%		
Personal vertebral fracture	Yes	6	7.5%	0	0%	6.234	**0.014***
	No	74	92.5%	80	100%		
	total	**80**	**100**	**80**	**100**		
Personal hip fracture	Yes	9	11.2%	2	2.5%	4.783	**0.029***
	No	71	88.8%	78	97.5%		
	total	**80**	**100**	**80**	**100**		
Rheumatoid Arthritis (RA)	Yes	23	28.8%	9	11.2%	7.656	**0.009***
	No	57	71.2%	71	88.8%		
	Total	**80**	**100**	**80**	**100**		
Eating disorder	Yes	5	6.2%	1	1.2%	2.771	0.210
	No	75	93.8%	79	98.8%		
	total	**80**	**100**	**80**	**100**		
Hyperthyroidism	Yes	5	6.2%	0	0%	5.161	**0.029*-**
	No	75	93.8%	80	100%		
	total	80	100	80	100		
Cancer	Yes	9	11.2%	5	6.2%	1.252	0.402
	No	71	88.8%	75	93.8%		
	total	**80**	**100**	**80**	**100**		

*The relation is significant at 0.05

** Fisher-Exact test is used for 2*2 tables

Table (4.8) showed that there is a significant relationship between personal vertebral fracture and hip fracture with having osteoporosis (x^2 = 6.234, p value = 0.014);(x2 = 4.783, p value = 0.029) respectively. The result indicates that the proportion difference between case and control groups is **significant** at 0.05 level. These results were agreed with Kanis et al, (2004) study that explore in meta-analysis of 11 prospective cohort studies of fracture risk in men or women with prior fracture. They reported increased risks of any fracture (relative risk [RR] 1.8, 95% CI 1.6-1.9), osteoporotic fracture (RR 1.8, 95% CI 1.6-1.9), and hip fracture (RR 1.6, 95% CI 1.3-2.0) in both men and women, even after adjustment for BMD.

In addition, the table showed that participant with Rheumatoid Arthritis (RA) constitutes of 23 (28.8%) of cases and 9 (11.2%) of control with (x^2 = 7.656, P value = 0.009). This result means there is a significant relationship between RA and osteoporosis. This result is congruent with Kanis et al. (2008) study, which recognized that patients with RA have a 30

percent increased risk of major osteoporotic fracture and 40 percent increased risk of hip fracture.

In contrast, there is no significantdifference between eating disorder (x^2 = 2.771, p value = 0.210) and osteoporosis. The researcher attributed that to few number of cases 5(6.2%) and 1(1.2%) from control group that had eating disorder.

Concerning hyperthyroidism, there is a significantdifference between hyperthyroidism and osteoporosis as evidence by the (Pearson chi-square value was 5.161 with P value 0.029). This result is consistent with Aspray et al.(2014) study,which mentioned that hyperthyroidism could be associated with muscle weakness and loss of lean body mass, which can be quite severe in some cases. This can then lead to an increased risk of falling and subsequent broken bone.

Also participant with cancer disease showed that there is no significant differencewith osteoporosis (x^2 = 1.252, P value = 0.402). This result is inconsistent with Reuss-Borst et al., 2012which assumed that cancer is a major risk for both generalized and local bone loss, with bone loss as assessed by bone mineral density (BMD) testing substantially higher in cancer patients than in the general population, independent of cancer type (Reuss-Borst et al., 2012). The researcher attributed that to few numbers of cases with cancer in our research sample.

Table (4.9): Menstrual history for female medical condition and development of osteoporosis

Variable		**Case**		**control**		**Chi square**	**P value**
		N	%	N	%		
Menopause before age 45	Yes	12	18.5	14	21.5	0.192	0.827
	No	53	81.5	51	78.5		
	total	**65**	**100**	**65**	**100**		
Removal of ovary	Yes	9	13.8	0	0	9.669	**0.001***
	No	56	86.2	65	100		
	total	**65**	**100**	**65**	**100**		
Irregular period	Yes	10	15.4	12	18.5	0.219	0.816
	No	55	84.6	53	81.5		
	total	**65**	**100**	**65**	**100**		

*The relation is significant at 0.05

** Fisher-Exact test is used for 2*2 tables

Table (4.9) showed that there isinsignificant difference between early menopause and osteoporosis (x^2 = 0.192, P value = 0.827). Our result is inconsistent with Sadat-Ali et al.

(2004) study which illustrate that menopause is a major risk factor for osteoporosis where the incidence of fractures increases by about 40% with menopause in developing countries.

While removal of ovary showed significantdifference with osteoporosis (x^2= 9.669, P value = 0.001). This result was agreed with the study of Johns Hopkins oncologist and epidemiologist, (2011) which explore that having both ovaries removed before age 45 is strongly associated with low-bone mineral density and arthritis in later years.

Regarding to female suffer from irregular period 15.4% from cases and 18.5% from control group. The chi square value of 0.219 with P value 0.816 indicateinsignificantdifference between disturbance of period and osteoporosis. The researcher estimate our research results due to high percentage 53(81.5%) of female in our study hadnot menopauseyet as opposed to 12(18.5%) who had menopause.

4.3.1.1.4 Medication Use Variables

The researcher supposed that using certain type of drug might play a role as predisposing risk factors for osteoporosis. This type of osteoporosis known as secondary osteoporosis. These drugs are Corticosteroid, Proton pump inhibitors (PPIs), Loop diuretic (Lazix), Anticoagulant, Antihypertensive and Ant diabetic drug

Table (4.10): Certain type of medication and development of osteoporosis

variable		case		Control		Chi square	P value
		N	%	N	%		
Corticosteroid (prednisolone 5mg)	Yes	30	37.5%	18	22.5%	4.286	**0.029***
	No	50	62.5%	62	77.5%		
	total	**80**	**100**	**80**	**100**		
Proton pump inhibitors (PPIs)	Yes	20	25%	12	15%	2.5	0.166
	No	60	75%	68	85%		
	total	**80**	**100**	**80**	**100**		
Loop diuretics (Lasix)	Yes	15	18.8%	3	3.8%	9.014	**0.003***
	No	65	81.2%	77	96.2%		
	total	**80**	**100**	**80**	**100**		
Anti-coagulant (heparin)	Yes	18	22.5%	6	7.5%	7.059	**0.008***
	No	62	77.5%	74	92.5%		
	total	**80**	**100**	**80**	**100**		
Anti-diabetic drug	Yes	14	17.5%	11	13.8%	0.427	0.664
	No	66	82.5%	69	86.2%		
	total	**80**	**100**	**80**	**100**		
Anti-hypertensive drug	Yes	32	40%	12	15%	12.539	**0.001***
	No	48	60%	68	85%		
	total	**80**	**100**	**80**	**100**		

Table (4.10) showed that participants used corticosteroid (prednisolone 5mg), 30 (37.5%) from the case group while 18 (22.5%) from the control group. The Pearson chi square value 4.286 with P value 0.029 indicate significant difference between using prednisolone and osteoporosis. This result indicate that the proportion difference between case and control group issignificant at 0.05 level. Our study result is consistent with Van Staa et al.(2000) retrospective cohort study in 244,235 oral glucocorticoid users database showed

a dose-dependent relationship between chronic glucocorticoid use and fracture risk, with high doses (prednisolone 7.5 mg/day or greater) having the highest risk . Low doses of glucocorticoids (prednisolone less than 2.5 mg/day) were also associated with increased fracture risk.

While there is insignificantdifference between using proton pump inhibitors such as (pepticum)^{R}and osteoporosis (x^2 = 2.5, P value =0.166). There were a debate in the literature about the relation between using PPI and osteoporosis. 0ur study result is consistent with Targownik et al. (2010)study result that failed to find an association between PPI use and a reduction of BMD in a Manitoba population consisting primarily of women aged >65 years. While our result is inconsistent with Eom et al. (2011)study on large meta-analysis, found that PPI but not H_2-receptor antagonist use was associated with an increased risk of fracture.

For participant used loop diuretic(Lasix) the table showed that 15 (18.8%) from cases and 3 (3.8%) from control group with (x^2= 9.014, P value = 0.003) indicate that there is significantdifference with developing osteoporosis. Our result is agreed with pharmacological action of drug (Lasix) that cause increase in the renal excretion of calcium, which can result in a hypocalcaemia state. Compensatory processes are thought to be responsible for the loss of bone. In addition, our study result is congruent with Rejnmark et al, (2006) study that Study concluded that ever use of LD was associated with a crude 51% (OR 1.51; 95% CI 1.48–1.55) increased risk of any fracture and a 72% (OR 1.72; 95% CI 1.64–1.81) increased risk of hip fracture.While use of furosemide was associated with higher risk estimates than use of bumetanide.

Furthermore patient used anticoagulant heparin form a proportion of(22.5%)from cases and (7.5%) from controls with (x^2= 7.059, P value = 0.008) also indicate **a** significantdifference with osteoporosis. This result agreed withRajgopal et al. (2008) study which mentioned that long-term unfractionated heparin (UH) use is associated with an increased risk of osteoporosis, up to one-third of patients on long-term UH therapy have a subclinical reduction of BMD.

Regarding participant whom taken diabetes mellitus drug, (17.5%) from cases and (13.8%) from controls. The Pearson chi square value is 0.427 and P value 0.664 means there is **insignificant**difference between taken DM drugs and osteoporosis.

In contrast, participant used hypertension drugs account for (40%) from the cases group and (15%) from the controls group with (x^2 = 12.539, P value = 0.001). This result indicatesignificantdifference between taken hypertensive drug and osteoporosis. There were a debate in the literature about the effect of hypertension drug on osteoporosis as the two disease are often coexisting among the aging population.However, our result is consistent with Ilić etal. (2013) study mentioned that treatment ofhypertension affects bone mineral density and, therefore, can worsen osteoporosis.

4.4 Logistic Regression Analysis

Logistic regression is the appropriate regression analysis to conduct when the dependent variable is dichotomous (binary). It was employed to predict the probability that participants to have osteoporosis. Logistic regression used to describe data and to explain the relationship between one dependent binary variable and one, more nominal, ordinal, interval, or ratio-level independent variables.

Table (4.11):logistic regression for socio-demographic risk factors and osteoporosis

Variable		P value	Adjusted odds ratio	95% C.I.for EXP(B)	
				Lower	Upper
Marital status	Single	0.160	9.577	0.411	223.399
	Married	0.999	2.94E+09	0.000	
	Divorce and widow ®				
Abortion history	> 4 times	0.646	1.674	0.185	15.118
	3times	0.861	0.814	0.081	8.196
	2 times	0.800	0.745	0.077	7.228
	One time ®				
Feeding method	Breast	0.079	8.790	0.780	99.035
	Bottle ®				
Occupation	Employed	0.292	2.913	0.398	21.308
	Unemployed ®	0.292	2.913	0.398	21.308
Level of income	< 1000 NIS	0.917	0.865	0.057	13.082
	1000- 2000 NIS	0.549	0.486	0.046	5.158
	2001-4000 NIS	0.382	2.801	0.279	28.150
	>4000 ®				

Table (4.11) represent the logistic regression for socio-demographic risk factor after adjusting age, gender and place of treatment conclude that,there is no significant risk factors between socio-demographic factors such as marital status, abortion history, feeding

method, occupation and level of income and development of osteoporosis as evidence by P value more than 0.05.The result of the study is consistent with Brennan et al. (2009)study which concluded that conflicting evidence exists regarding the relationship between osteoporotic fractures and levels of income and education.In addition,Smith et al. (1995) mention that Pregnancy- and lactation-associated osteoporosis is a rare condition affecting pregnant or breastfeeding women.

While our study results were inconsistent with Ozdemir et al.(2005) mention that women who had five or more abortions were found to have significantly lower spine BMD values compared to women who had no abortions or women who had one or two abortions. In addition, inconsistent result showed withKarlsson et al. (2005) study that revealed that lactation has more consistent and profound effects on bone density that bone loss of 3 to 10 percent at the spine and hip are seen over three to six months of lactation.The differences with our study results might be due to spread of maternity health centers among all cities in Gaza strip that delivered primary health care for pregnant and lactating women also the increased number of educated people in Gaza strip lead to increase knowledge about healthy nutrition.

Table (4.12):logistic regression for life style risk factors and osteoporosis

Variables		**P value**	**Adjusted odds ratio**	**95% C.I. for EXP(B)**	
				Lower	Upper
BMI	≥29.9	0.066	0.937	0.874	1.004
	<29.9 ®				
Drinking tea	Yes	0.424	1.081	0.893	1.307
	No®				
Drinking coffee	Yes	0.161	1.189	0.933	1.515
	No®				
How much milk do you drink?	1 cup per month	0.202	2.172	0.661	7.140
	1 cup per week	0.584	1.448	0.386	5.435
	Non	**0.027***	**5.775**	**1.215**	**27.458**
	1 cup per day ®				
Exercise activity	Non	0.284	4.124	0.308	55.222
	Weekly	0.547	2.278	0.157	33.139
	Monthly	0.846	1.318	0.081	21.483
	Daily®				
Sun exposure	Yes	0.822	1.107	0.455	2.692
	No®				
Using Aluminum cookware for cooking	Yes	0.061	2.181	0.964	4.933
	No®				

Table (4.12) showed that there is significant risk factors between not drinking of milk and development of osteoporosis (OR 5.775, 95%C.I. 1.215-27.458, P value 0.027). This study results is consistent with Matthews et al. (2011) which showed that women whose dairy intake was once a day or more had a 62% reduction in the likelihood of having osteoporosis (OR 0.38, 95%C.I. 0.17–0.86) (Pvalue0.02) compared to women whose dairy intake was less than twice a week.

This study is inconsistent witha 2005 review published in Pediatrics showed that milk consumption does not improve bone integrity in children (Lanou et al., 2005). Similarly, the Harvard Nurses' Health Study, which followed more than 72,000 women for 18 years, showed no protective effect of increased milk consumption on fracture risk(Feskanichet al., 2003).

Whereas, BMI, drinking tea and coffee, exercise activity, using aluminum cookware and sun exposure were not associated with osteoporosis in our study.

Study showed that any weight-bearing exercise and activities that promote balance and good posture are beneficial for bones. Furthermore, walking, running, jumping, dancing and weightlifting seem particularly helpful (Heyward & Gibson., 2014). However, our study result observed that exercise activity had no association with development of osteoporosis.

Coffee, tea and soft drinks (sodas) contain caffeine, which may decrease calcium absorption and contribute to bone lossthatinterfere with calcium absorption and cause bone loss. A study showed that a daily intake of 330 mg of caffeine, equivalent to 4 cups (600 ml) of coffee, or more may be associated with a modestly increased risk of osteoporotic fractures(Hallström et al., 2006) and National Osteoporosis Foundation recommend that Colas may have other chemicals, besides phosphoric acid and caffeine that can affect the bones. People with osteoporosis should not drink more than five cola drinks a week (NOF, 2002).This study however revealed no significant difference between coffee, tea and soft drink intake and osteoporosis.

Aluminum cookware is cheap and widely available and it has a negative consequence for health. A study published in the International Journal of Electrochemical Science has discovered that cooking with aluminum increases the risk of developing Osteoporosis and alzehaimers disease (Bassioni, et al., 2012). Our study revealed that no significant difference between using Aluminum cookware and develop of osteoporosis.

Table (4.13):logistic regression of family history risk factors and osteoporosis

Variables		P value	Adjusted odds ratio	95% C.I.for EXP(B)	
				Lower	Upper
Family history of osteoporosis	yes	**0.002***	**3.522**	**1.589**	**7.809**
	No®				
Family history of hip fracture	Yes	**0.019***	**4.209**	**1.273**	**13.918**
	No®				
Family history of vertebral fracture	Yes	0.616	0.584	0.071	4.780
	No®				
Family history with curve in the spine	Yes	0.580	0.731	0.240	2.222
	No®				

As shown in table (4.13), there is significant risk factors between family history of osteoporosis and development of osteoporosis (OR 3.522, 95%CI 1.589-7.809, p value 0.002). This result is consistent withRobitaille et al., (2008) study which concluded that women with a family history of osteoporosis were2.4 times more likely to have osteoporosis than women without such history(Robitaille et al., 2008).

In addition, there is significant risk factors between family history of hip fracture and development of osteoporosis (OR 4.209, CI 1.273-13.918, and p value 0.019). This study consistent withCummings et al. (1995) study which reveal thatin a first-degree relative parental, history of hip fracture is associated with a twofold increased risk of hip fracture in women, regardless of BMD (Cummings et al., 1995).

In contrast, There is no significant risk factor between family history of vertebral fracture and family history of with curve in the spine and development of osteoporosis (OR 0.584, CI 0.071-4.780, p value 0.616; OR 0.731 CI 0.240-2.222, p value 0.580) respectively.

Table (4.14):logistic regression of menstrual history for female and osteoporosis

Variables		P value	Adjusted odds ratio	95% C.I.for EXP(B)	
				Lower	Upper
Early menopause before age 45	Yes	0.207	0.504	0.174	1.462
	No®				
Suffer from amenorrhea (no period and not pregnant)	Yes	0.239	2.496	0.544	11.452
	No®				
Irregular period	Yes	0.219	0.505	0.169	1.502
	No®				

Table (4.14) showed that there is no significant risk factors between menstrual history of female and development of osteoporosis as evidence by P value more than 0.005. Our study result is inconsistent with Sadat-Ali et al. (2004) study, which concluded that menopause is a major risk factor for osteoporosis where the incidence of fractures increases by about 40% with menopause in developing countries. The researcher attributed that the lowest percentage of female 12 (18.5%) in our study had menopause before the age of 45 years while 53(81.5%) had not menopause before age 45 years. Therefore,the few number of cases may affect our result.

Table (4.15):logistic regression of medication used and osteoporosis

Variables		P value	Adjusted odds ratio	95% C.I.for EXP(B)	
				Lower	Upper
Corticosteroid tablets (prednisolone) for over three months	Yes	0.090	2.063	0.894	4.761
	No®				
Breast cancer treatment	yes	0.413	0.473	0.079	2.838
	No®				
proton pump inhibitors PPIs	Yes	0.457	1.468	0.533	4.045
	No®				
Any type of contraceptive	Yes	0.354	0.679	0.299	1.540
	No®				
Loop diuretics (Lasix)	Yes	**0.046***	**4.636**	**1.027**	**20.929**
	No®				
Anticoagulant drug (heparin)	Yes	0.063	2.897	0.944	8.890
	No®				
Anti-diabetic drug	Yes	0.295	0.522	0.154	1.762
	No®				
Anti-hypertension drug	**Yes**	**0.049***	**2.702**	**1.003**	**7.280**
	No®				

The table (4.15) showed that there is significant risk factor between using loop diuretics (lazix) and development of osteoporosis (OR = 4.636, 95% CI 1.027-20.929, P value = 0.046). This result is consistent withRejnmark et al. (2010) study which showed that use of loop diuretics(LD) was associated with 51% (OR 1.51; 95% CI 1.48–1.55) increased risk of any fracture and a 72% (OR 1.72; 95% CI 1.64–1.81) increased risk of hip fracture. Moreover, using of furosemide was associated with higher risk estimates than use of bumetanide.

In addition , the same table represent that there is significant risk factor between using Anti-hypertensive drug and development of osteoporosis with evidence of (OR= 2.702,

95% CI 1.003-7.280, P value = 0.049). Our result is consistent withChen et al., (2016) study which showed that the risk of osteoporosis after adjusting age, sex, comorbidities, and concurrent medications was higher among the users of angiotensin-converting enzyme (ACE) inhibitors (OR 1.64, 95% CI 1.01–2.66) than among nonusers. Patients who took calcium channel blockers (OR 0.70, 95% CI 0.49–0.99) were at a lower risk of developing osteoporosis than nonusers. Also, statistically significant differences (P value = 0.008) were observed between the beta-blocker and calcium channel blocker groups (Ağaçayak et al., 2014).

Corticosteroids have several adverse effects on bone metabolism. Direct inhibition of osteoblast function, direct enhancement of bone resorption, inhibition of gastrointestinal calcium absorption, increase in urinary calcium loss, and inhibition of gonadal hormones mainly affect the trabecular bone. (Walsh et al., 2002; Sinigaglia et al., 2000; IP et al., 1994).In our study, corticosteroid intake did not show a significant association, this could be because of the problem of reporting the exact type of medication

While our study found no association between Breast cancer treatment, proton pump inhibitors PPIs, any type of contraceptive,Anticoagulant drug (heparin) and Anti-diabetic drug and development of osteoporosis.

Table (4.16): The final model of logistic regression for all variables

Variables		P value.	Adjusted odds ratio	95% C.I.for EXP(B)	
				Lower	Upper
Feeding method	Breast	**0.008***	**8.742**	**1.774**	**43.066**
	Bottle®				
BMI	≥29.9	**0.002***	**0.838**	**0.750**	**0.936**
	<29.9®				
How much milk do you drink?	1 cup monthly	0.927	0.942	0.258	3.430
	1 cup weekly	0.337	1.882	0.517	6.849
	None	**0.014***	**11.225**	**1.639**	**76.898**
	1 cup daily ®				
using aluminum pots for cooking	Yes	0.361	1.590	0.588	4.300
	No ®				
Family history with osteoporosis	Yes	**0.010***	**5.424**	**1.497**	**19.651**
	No ®				
Family history of a hip fracture	Yes	0.087	4.717	0.799	27.841
	No ®				
Rheumatoid arthritis	Yes	0.179	2.613	0.645	10.592
	No ®				
Corticosteroid tablets (prednisolone) for over three months	Yes	0.518	1.491	0.444	4.999
	No ®				
Loop diuretics (Lasix)	Yes	**0.046***	**6.621**	**1.030**	**42.551**
	No ®				
Anticoagulant drug (heparin)	Yes	0.104	3.061	0.793	11.811
	No ®				
Anti-hypertension drug	Yes	**0.029***	**4.168**	**1.157**	**15.013**
	No ®				

The variable is significant at 0.05 level

Table (4.16) showed the logistic regression for all risk factors in our study it represents that there is significant risk factors between breast feeding and developing of osteoporosis (**OR 8.742, 95%CI 1.774-43.066, P value = 0.008**). This result is consistent with Karlsson et al. (2005) study that revealed that lactation has more consistent and profound effects on bone density that bone loss of 3 to 10 percent at the spine and hip are seen over three to six months of lactation.

Concerning Body Mass Index (BMI) represent significant protective factor with osteoporosis **(OR 0.838, 95% CI 0.750- 0.936, P value =0.002)** whileodds ratio less than one means participant with high BMI (obese and over obesity) protected from developing osteoporosis in contrast to participant with low BMI<29.9. Our study result is consistent with Green et al. (2004) study, which showed, that low body weight (less than 58 kg) is associated with increased risk of osteoporosis and fractures, possibly related to small bone size.

In addition, there issignificant risk factors between drinking one cup of milk monthly and development of osteoporosis**(OR 11.225, 95%CI 1.639-76.898, P value = 0.014).** This indicates that drinking at least one cup of milk daily or weekly protected body from osteoporosis. Our study result is congruent with Matthews et al. (2011) which showed that women whose dairy intake was once a day or more had a 62% reduction in the likelihood of having osteoporosis (OR=0.38, 95%CI: 0.17–0.86) (p value =0.02) compared to women whose dairy intake was less than twice a week.

While our study result is inconsistent withLanou et al., 2005 who showed that milk consumption does not improve bone integrity in children. Similarly, the Harvard Nurses' Health Study, which followed more than 72,000 women for 18 years, showed no protective effect of increased milk consumption on fracture risk(Feskanichet al., 2003).

Furthermore, the table showed that participants with family history of osteoporosis is at a significant risk factor with developing osteoporosis **(OR 5.424, 95%CI 1.497-19.651, P value = 0.010).**This result is consistent withRobitaille et al. (2008) study concluded that women with a family history of osteoporosis were 2.4 times more likely to have osteoporosis than women without such history.

Moreover, there is a significant risk factor between using loop diuretics (Lazix) and developing of osteoporosis**(OR 6.621, 95%CI 1.030- 42.551, P value = 0.046).** our study result is congruent with Rejnmark et al. (2010) study which showed that use of loop diuretics(LD) was associated with 51% (OR 1.51; 95% CI 1.48–1.55) increased risk of any fracture and a 72% (OR 1.72; 95% CI 1.64–1.81) increased risk of hip fracture. Moreover, using of furosemide (Lazix) was associated with higher risk estimates than use of bumetanide.

Finally, the same table showed that there is significant risk factor between using Anti-hypertensive drugs and developing of osteoporosis **(OR 4.168, 95% CI 1.157-15.013, P value = 0.029).** This result is consistent with Chen et al., (2016) study which showed that the risk of osteoporosis after adjusting age, sex, comorbidities, and concurrent medications was higher among the users of angiotensin-converting enzyme (ACE) inhibitors (OR 1.64, 95% CI 1.01–2.66) than among nonusers. Patients who took calcium channel blockers (OR 0.70, 95% CI 0.49–0.99) were at a lower risk of developing osteoporosis than nonusers. Also, statistically significant differences (P value = 0.008) were observed between the beta-blocker and calcium channel blocker groups (Ağaçayak et al., 2014).

Chapter Five

Conclusion and Recommendations

5.1 Conclusion

This study aimed to identify the main risk factors, which are associated to osteoporosis among male and female in Gaza Governorates. A case-control study was undertaken to patient attending to Palestinian German Diagnostic Center. The target population consisted of two groups, the first group were cases (all participants whom diagnosed confirmed by doing DEXA scan T score <-2.5 during the study period and having osteoporosis confirmed by doctor), the second group were controls who include (all participants whom diagnosis confirmed by doing DEXA scan that they were osteoporosis free T score >-1 confirmed by doctor). A convenience sample was consisted of 160 participants (80 cases and 80 controls) matched with gender, age and place of treatment. Validated questionnaire was distributed to all 160 participants during collected data time.

The study population consisted of 160 participants, 80(50%) were cases and 80(50%) were controls for each group 65(81.2%) were females and 15(18.8) were males. Also 11(13.8%) aged 20-30years, 18 (22.5%) aged 31-40 years, 18(22.5%) aged 41-50 years, 20 (25%) aged 51-60 years and finally 13 (16.2%) aged more than 60 years.

Among socio-demographic risk factors, bivariate test was used by chi-square, the result showed that there was a significant difference between osteoporosis and mother breast-feeding (x^2 = 5.35, P value = 0.021). Other factors were statistically insignificant including marital status, having and number of children and history of abortion.

For life style risk factors the results of bivariate test represent that there were significant association with drinking soft drink (cola) were (x^2 = 10.027, P value = 0.007) and development of osteoporosis. While other factors such as BMI, smoking, exercise activity, sun exposure, cooking in aluminum cookware, drinking coffee, tea milk and avoiding dairy products revealed statistical insignificant risk factors for developing osteoporosis.

Concerning medical condition risk factors, bivariate test using chi square showed that there were asignificant association between family history of osteoporosis and family history of hip fracture (x^2= 11.481, P value = 0.001), (x^2= 7.227, P value = 0.013) respectively. In addition, significant difference showed with personal vertebral fracture

(x^2= 6.234, P value = 0.028), personal hip fracture (x^2 = 4.783, P value = 0.029), Rheumatoid Arthritis (x^2= 7.656, P value = 0.009), Hyperthyroidism (x^2 = 5.161, P value = 0.029) and removal of ovary (x^2= 9.669, P value = 0.003). Other factors were statistically insignificant risk factors with osteoporosis including, family history of vertebral fracture and curve of spine, eating disorder, cancer, menopause before age 45(female), and irregular period (female).

Regarding medication (drugs) used, bivariate test using chi square revealed that there were statistical difference between using corticosteroid prednisolone 5 mg, Loop diuretics (Lasix), Anticoagulant (heparin), anti-hypertensive drug and development of osteoporosis (x^2 = 4.286, P value = 0.029), (x^2= 9.014, P value = 0.005), (x^2= 7.059, P value = 0.014), and (x^2= 12.539, P value= 0.001) respectively. Other factors were statistically insignificant including Proton Pump Inhibitors and Antidiabetic drugs.

Multivariate analysis of risk factors for osteoporosis among adults was done using multiple regression to show the important and independent risk factors. Resultsshowed that there were significant risk factors between drinking no cup of milk and development of osteoporosis [(OR: 5.775, 95% CI: 1.215-27.458), P value = 0.027], family history of osteoporosis[(OR: 3.522, 95% C.I.: 1.589- 7.809), P value= 0.002], family history of hip fracture [(OR: 4.209, 95% C.I.: 1.273- 13.918), P value= 0.019] and development of osteoporosis. Furthermore, significant risk factor showed with using Loop diuretics (Lasix) [(OR: 4.636, 95% C.I.: 1.027-20.929), P value= 0.046], and Antihypertensive drug [(OR: 2.702, 95% C.I.: 1.003- 7.28), P value= 0.049] and development of osteoporosis.

Finally, logistic regression was done to all significant risk factors to identify the most significant variable in our study and the results showed that there was significant risk factor between breast feeding and development of osteoporosis [(OR: 1.436, 95%C.I.: 1.436-26.842), P value = 0.015], while BMI > 29.9 showed a protective factor for osteoporosis[(OR: 0.871, 95%C.I.: 0.796-0.954), P value= 0.003].

In addition, significant risk factor was shown between family history and development of osteoporosis [(OR: 3.845, 95%C.I: 1.283-11.520), P value= 0.016]with no (reference group).

Furthermore, there was a significantrisk factor between using loop diuretics (Lasix) and development of osteoporosis [(OR: 6.967, 95%C.I.: 1.362-35.649), P value = 0.020]. at last, significant risk factor between using antihypertensive drug and development of osteoporosis [(OR: 3.004, 95%C.I.: 0.978-9.228), P value= 0.05].

5.2 Recommendations

The researcher suggests the following recommendations

1. Frequent pregnancies and lactation may predispose women in our society to lower BMDs. Thus, proper nutritional and family planning advices are wanted for this group**.**
2. Optimal nutrition in the youth to achieve high peak bone mass, including adequate intake of calcium and vitamin D.
3. Increase drinking of milk daily to achieve the instant amount of calcium that required by the body to build the bone.
4. Assessment of every postmenopausal woman for risk of osteoporosis to determine the need for diagnostic tests and prevention or treatment.
5. Early prevention of secondary causes of osteoporosis [for example, loop diuretics (Lasix), Antihypertensive drugs, and hyperparathyroidism].
6. Work with leadership of health organizations to develop and implement behavior change strategies within primary care, emergency departments, and orthopedic practices.
7. Continue screening test to identify people at risk in order to offer treatment and prevent complications of disease.
8. Health education program at primary and secondary level should be started to reduce the incidence of osteoporosis.
9. Other research with increasing of sample size and using matching between one case and two controls.
10. Improve awareness for different risk factors of osteoporosis among people live in Gaza Strip and how they can overcome these risks of osteoporosis.

Additional Recommendations from National Osteoporosis Foundation:

1. Advise on a diet that includes adequate amounts of total calcium intake (1000 mg/day for men 50–70; 1200 mg/day for women 51 and older and men 71 and older), incorporating dietary supplements if diet is insufficient.
2. Advise on vitamin D intake (800–1000 IU/day), including supplements if necessary for individuals age 50 and older.
3. Recommend regular weight-bearing and muscle-strengthening exercise to improve agility, strength, posture, and balance; maintain or improve bone strength; and reduce the risk of falls and fractures.
4. Assess risk factors for falls and offer appropriate modifications (e.g., home safety assessment, balance training exercises, correction of vitamin D insufficiency, avoidance of central nervous system depressant medications, careful monitoring of antihypertensive medication, and visual correction when needed).
5. Advise on cessation of tobacco smoking and avoidance of excessive soft drink (cola) intake.

5.3 Suggestion for Further Studies

- To conduct cost effectiveness studies on ongoing screening for women and men aged 50 years old and more to decrease the prevalence of osteoporosis.
- Research is needed to define the mechanisms by which adaptation to a low calcium intake occurs, and to examine the interaction of genetic make-up, dietcomposition and other environmental exposures with calcium regulation and bone health.

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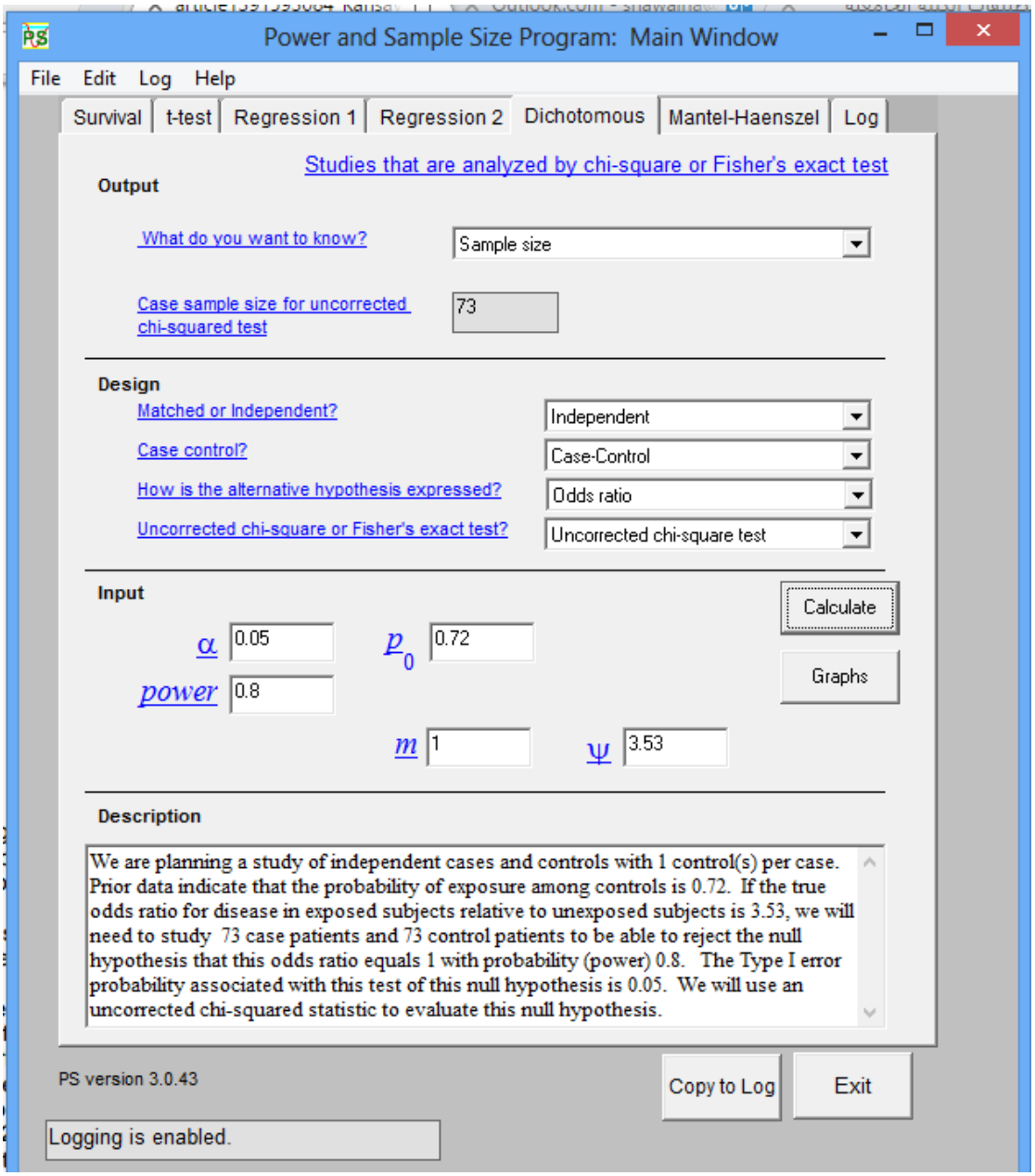
Annexes

Annex (1): Map of Palestine

PCBS, 2013

Annex (2): Sample size calculation



Annex (3): Study Activity Timetable

Activity	duration	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5
Proposal writing	2 month	■	■													
Proposal defense and approval	1 month			■												
Expert committee check for validity	2 months				■	■										
Pilot study	1 month						■									
Modification								■								
Data collection	4 months								■	■	■	■				
Data entry	1 month												■			
Data analysis	1 month													■		
Research writing	2 months														■	■

Annex (4): Interviews Questionnaire (English copy)

Cover letter

Risk Factors for Osteoporosis among Adults in Gaza Governorate:

Case – Control Study

Our participant:

The researcher carries out this study as a part of the requirements for master degree of public health at Al-Quds University, School of public health –Palestine. The study is self-funded.

Kindly, I would like to inform you that you have been selected to be part of my study research" Risk Factors for Osteoporosis among Adults in Gaza Governorate: Case – Control Study". You are selected because you have met the selection criteria for participation and your facility has been thoroughly selected as a source of data by filling a well and comprehensive questionnaire.

The purpose of this study is to determine the main risk factors that contribute to incidence of osteoporosis among adults in Gaza Governorates.

The researcher thankfully appreciate your effective participation in this study through answering the interviewer's questions that do not take more than 15 minutes. The researcher would like to emphasize that all data given from your side is top confidential and only for the purpose of scientific research. Accordingly, we will not need to mention names. Although t welcome your participation, participation is optional and no information given would be used against you whatever.

Thanking you in advance for your cooperation

Researcher

ShimaShagfa

Mobile: 0599309818

Questionnaire English Copy

1- Socio-demographic Risk Factors	
1.1 Patient name:	**Serial NO:**
1.2 Telephone/mobile:	**1.3 Age**
1.4 Place of treatment: ☐ Palestinian German Diagnostic Center	
1.5 Do you have osteoporosis? ☐ yes ☐ NO	
1.6 Living Area: ☐ North ☐ Gaza ☐ middle zone ☐ south area	
1.7 marital status: ☐ single ☐ married ☐ widow ☐ Divorced	
1.8 If you are married, do you have children? ☐ Yes ☐No **1.9 If yes, how many? .....**	
1.10 Do you have a history of abortion? ☐ Yes ☐ No **1.11 If yes, how many times?**	
1.12 Did you use breast or bottle-feeding? **1.13 If you are breast-feeding for how long?**	
1.14 Do you work? ☐ Yes ☐ No **1.15 If yes, what type of work?** **1.16 If you not work now, what was the previous work?**	
1.17 Level of income: **☐<1000 shekel ☐ 1000- 2000 shekel ☐ 2000- 4000 shekel ☐>4000 shekel**	
1.18 What is the highest education level you achieved? **☐ illiterate ☐ primary ☐ preparatory ☐ secondary ☐ diploma ☐ university** **☐ more**	

2- Life Style Risk Factors
2.1 Height: … 2.2 Weight: … 2.3 BMI: …
2.4 Smoking status: ☐ non ☐ previous ☐ current, How many per day? ….
2.5 How much tea do you drink? Per collated … cups per day.
2.6 How much milk do you drink? ……cups **☐ daily ☐ weekly ☐ monthly ☐ non**
2.7 Do you avoid dairy products? ☐ Yes ☐No

2.8 Exercise activity (walking, running, …) **☐ don't do ☐daily ☐ weekly ☐ monthly**
2.9 Do you take calcium supplement? ☐ Yes ☐ No
2.10 Do you take supplement of vitamin D? ☐Yes ☐No
2.11 What is type of your house? ☐ flat ☐independent house **2.12 Are your house sunny? ☐ Yes ☐No**
2.13 Do you use aluminum pots for cooking? ☐ Yes ☐ No

3- medical condition risk factors **3.1 family history**		
3.1 Has anyone in your family had any of the following?		
a- Been diagnose with osteoporosis?	☐Yes	☐No
b- Had a hip fracture?	☐Yes	☐No
c- Had a vertebral fracture?	☐ Yes	☐No
d- Had a noticeable "dowagers hump" or curve in the spine? ☐Yes ☐No		

3.2 Menstrual history for (female)		
3.2 Have you had		
a- Early menopause before age 45	☐ Yes	☐ No
b- Hysterectomy with removal of ovary before age 45	☐ Yes	☐ No
c- Suffer from amenorrhea (no period and not pregnant)	☐ Yes	☐ No
d- Irregular period	☐ Yes	☐ No

3.3 Personal Medical condition risk factor	
3.3 Have you had any of the following conditions?	
a- Vertebral fracture	☐ Yes ☐ No
b- Hip fracture	☐ Yes ☐ No
c- Rheumatoid arthritis	☐ Yes ☐ No
d- Eating disorder causing sever weight loss	☐ Yes ☐ No
e- A condition which affect the absorption of food such as Crohns or celiac disease	☐ Yes ☐ No
f- Gastric bypass or any other weight loss surgery	☐ Yes ☐ No
g- Long period of immobility (stroke)	☐ Yes ☐ No
h- Hyperthyroidism which level of thyroid hormone is abnormally high	☐ Yes ☐ No
i- Parathyroid disease which level of parathyroid hormone is abnormally high	☐ Yes ☐ No
j- Diabetes mellitus? If yes, which type? ☐type 1 ☐type2	☐ Yes ☐ No
k- Liver disease? If yes? Which type	☐ Yes ☐ No
l- Kidney disease / kidney stone	☐ Yes ☐ No
m- Chronic asthma	☐ Yes ☐ No
n- Epilepsy	☐ Yes ☐ No
o- Depression	☐ Yes ☐ No
p- Chronic constipation	☐ Yes ☐ No
q- Chronic diarrhea	☐ Yes ☐ No
r- Cancer If yes which type? ……	☐ Yes ☐ No

4-Medication use risk factor	
4.1 Have you taken any of the following	
a- Corticosteroid tablets for over three months If yes, which type? ..... For how long?	☐ Yes ☐ No
b- Antiepileptic drug If yes, for how long?	☐ Yes ☐ No
c- Breast cancer treatment (female)	☐ Yes ☐ No
d- Prostate cancer drug (male)	☐ Yes ☐ No
e- Drug that reduce acid of stomach called proton pump inhibitors PPIs (ex: pepticu m)	☐ Yes ☐ No
f- Any type of contraceptive? If yes which type? ..... For how long? …….	☐ Yes ☐ No
g- Loop diuretics (Lasix)	☐ Yes ☐ No

	If yes, for how long?	
h-	Anticoagulant drug (heparin) If yes for how long?	☐ Yes ☐ No
i-	Anti-diabetic drug If yes, which type? For how long?	☐ Yes ☐ No
j-	Anti-hypertension drug If yes, which type? And how long?	☐ Yes ☐ No

Annex (5): Suggested interviews questionnaire (Arabic copy)

استبيان المقابلة

عزيز/تي المواطن/ة، مرحبا

انا طالبة دراسات عليا بجامعة القدس "أبو ديس" أقوم بدراسة حول :

عوامل الخطر التي تؤدي للإصابة بهشاشة العظام لدى الكبار في محافظات قطاع غزة

يسعدني موافقتك على المشاركة بالاستبيان، وأرجو التكرم بالإجابة على جميع أسئلة الاستبانة، مع العلم ان مشاركتك في هده الدراسة طوعية، كما ان البيانات التي سيتم جمعها سيتم استخدامها لغرض البحث العلمي فقط، يرجى الإجابة على الأسئلة بكل امانه وصدق ولا داعي لكتابة الاسم.

هده الاستبانة سوف تستغرق جوالي 15 دقيقة لاستكمالها، مهما كانت المعلومات التي تعطيها سوف تبقى سرية وطي الكتمان ولن يطلع عليها أحد باستثناء الباحث.

اشكر حسن تعاونك

الباحثة: شيماء شقفة

رقم المحمول: 0599309818

الاستبيان

1 - المعلومات الاجتماعية والديموغرافية
1.1 -اسم المريض : الرقم المتسلسل:
1.2 -رقم الجوال : 1.3 - العمر:
1.4 -مكان تلقي العلاج: المركز الألماني☐
1.5 -هل انت/ي مريض بهشاشة العظام: ☐ نعم ☐ لا
1.6-مكان السكن: ☐ الشمال ☐ غزة ☐ المنطقة الوسطى ☐ المنطقة الجنوبية
1.7-الحالة الاجتماعية: ☐ أعزب ☐ متزوج ☐ مطلق/ ة ☐ أرمل/ ة
1.8-لو كنتي متزوجة، هل لديكي أطفال؟ ☐ نعم ☐ لا 1.9كم عدد الأطفال؟
1.10 - هل تعرضت للإجهاض؟ ☐ نعم ☐ لا 1.11 -لو الإجابة بنعم، كم عدد مرات الإجهاض؟ .....
1.12 -هل كنتي تستخدمين الرضاعة الطبيعية ام الصناعية؟ 1.13 -ادا استعملت/ي الرضاعة الطبيعية كم المدة التي أرضعتها؟
1.14 -هل تعمل/ي: ☐ نعم ☐ لا 1.15 -لو كانت الإجابة بنعم، ما طبيعة العمل؟ 1.16 -لو كنتي لا تعمل/ين الان ما هو عملك السابق؟
1.17 -مستوى دخل الاسرة: ☐ اقل من 1000 شيكل ☐ 1000- 2000 شيكل ☐ 2000- 4000شيكل ☐ أكثر من 4000 شيكل
1.18 -أعلى مستوى تعليمي حصلت عليه: ☐ غير متعلم ☐ ابتدائي ☐اعدادي☐ ثانوي ☐ دبلوم ☐ جامعة ☐ أكثر من
2-نمط العيش
2.1- الطول: 2.2 -الوزن: 2.3- مؤشر كتلة الجسم:
2.4-هل انت مدخن: ☐ نعم ☐ لا ☐ سابقا لو كنت مدخن، كم عدد السجائر في اليوم .....
2.5-كم عدد اكواب الشاي المتناولة في اليوم؟ .....كوب
2.6-كم عدد فناجين القهوة المتناولة في اليوم؟ .....كوب
2.7-كم كوبا من المشروبات الغازية تتناولين في اليوم؟..... كوب
2.8-هل تشرب /ي الحليب؟ ☐ نعم ☐ لا لو كانت الاجابة بنعم ، كم كوبا .....في☐ اليوم ☐ الأسبوع ☐ الشهر
2.9-هل تتجنبين منتجات او مشتقات الالبان ؟ ☐ نعم ☐ لا
2.10-هل تمارسين الرياضة مثل المشي او الجري؟ ☐ نعم ☐ لا لو كانت الإجابة بنعم، تمارسين الرياضة ☐ يوميا ☐ أسبوعيا ☐ شهريا
2.11-هل تتناولين مكملات تحتوي على الكالسيوم؟ ☐ نعم ☐ لا
2.11-هل تتناولين مكملات تحتوي على فيتامين د؟ ☐ نعم ☐ لا

2.12-ما طبيعة السكن : ☐ شقة ☐ بيت مستقل
هل يعتبر المنزل مشمس؟ ☐ نعم ☐ لا

2.13-هل تعدين الطعام في اواني مصنوعة من الالمونيوم؟ ☐ نعم ☐ لا

3 - العوامل الخطر الطبية

3.1 -التاريخ العائلي

3.1 - هل يوجد أي شخص في العائلة يعاني من:

أ -	يعاني من هشاشة في العظام	☐ نعم ☐ لا
ب -	أصابه كسر في عظمة الحوض	☐ نعم ☐ لا
ت -	أصابه كسر في العمود الفقري	☐ نعم ☐ لا
ث -	أصابه انحناء في العمود الفقري	☐ نعم ☐ لا

3.2-تاريخ الدورة الشهرية (للإناث فقط)

3.2- هل تعانين من

أ -	انقطاع الدورة الشهرية قبل سن 45	☐ نعم ☐ لا
ب -	عملية إزالة لمبيض قبل سن 45	☐ نعم ☐ لا
ت -	انقطاع في الدورة الشهرية لسبب غير الحمل	☐ نعم ☐ لا
ث -	دورة غير منتظمة	☐ نعم ☐ لا

3.3 -الوضع الصحي الشخصي

هل تعاني من أي واحدة من الامراضالاتية:

1 -	كسر في العمود الفقري	☐ نعم ☐ لا
2 -	كسر في عظمة الحوض	☐ نعم ☐ لا
3 -	التهاب المفاصل (الروماتيزم)	☐ نعم ☐ لا
4 -	مشاكل في التغذية تؤدي الى نقص في الوزن	☐ نعم ☐ لا
5 -	حالات تمنع امتصاص الطعام مثل مرضcrohns or celiac	☐ نعم ☐ لا
6 -	عملية تصغير معدة او أي عملية تخفيف وزن	☐ نعم ☐ لا
7 -	عدم الحركة لمدة طويلة بسبب الإصابة بجلطة	☐ نعم ☐ لا
8 -	زيادة في افراز الغدة الدرقية	☐ نعم ☐ لا
9 -	زيادة في افاز الغدة الجار درقية	☐ نعم ☐ لا
10 -	داء السكري ان كانت الإجابة بنعم؛ كم كان عمرك عند الإصابة؟	☐ نعم ☐ لا
11 -	مرض الكبد	☐ نعم ☐ لا
12 -	أمراض في الكلية / حصوات في الكلية؟	☐ نعم ☐ لا
13 -	أزمة مزمنة	☐ نعم ☐ لا
14 -	داء الصرع	☐ نعم ☐ لا
15 -	اكتئاب	☐ نعم ☐ لا
16 -	امساك مزمن	☐ نعم ☐ لا
17 -	اسهال مزمن	☐ نعم ☐ لا
18 -	أي نوع من أنواع مرض السرطان مع ذكر نوعه؟	☐ نعم ☐ لا

4 - عوامل الخطر المتعلقة باستخدام الادوية	
4.1- هل تتناول/ين أي من الادوية التالية:	
1 - أدوية كورتيزون لأكثر من ثلاثة شهور لو كانت الإجابة بنعم، ما اسم الدواء ان أمكن؟ وماهي المدة المستخدمة؟	☐ نعم ☐ لا
2 - أدوية لعلاج الصرع؟ لو كانت الإجابة بنعم، كم المدة المستخدمة؟	☐ نعم ☐ لا
3 - أدوية لعلاج سرطان الثدي؟ (للإناث فقط) كم المدة المستخدمة؟	☐ نعم ☐ لا
4 - أدوية لعلاج سرطان البروستاتا؟ (للذكور فقط) كم المدة المستخدمة؟	☐ نعم ☐ لا
5 - أدوية لعلاج حموضة المعدة مثل دواء (الببيتكمpepticum) كم المدة المستخدمة؟	☐ نعم ☐ لا
6 - موانع للحمل لو كانت الإجابة بنعم، ما نوعه؟..... ماهي المدة المستعملة؟.....	
7 - مدرات للبول مثل (اللازكس)	☐ نعم ☐ لا
8 - مضادات للتجلط (الهبارين) لو كانت الإجابة بنعم، ماهي المدة المستعملة؟	☐ نعم ☐ لا
9 - أدوية لعلاج داء السكر لو كانت الإجابة بنعم، ما اسم الدواء؟ وماهي المدة المستخدمة؟	☐ نعم ☐ لا
10 -أدوية لعلاج مرض الضغط؟ لو الإجابة بنعم، ما اسم الدواء أن أمكن وماهي المدة المستعملة؟	☐ نعم ☐ لا

Annex (6): Experts panel

1.	Dr. Bassam Abu Hamad	Al-Quds University
2.	Dr. Yehia Abed	Al-Quds University
3.	Dr. Khitam Abu Hamad	Al-Quds University
4.	Dr. Ashraf El-Jedi	Islamic University
5.	Dr. FadelNaeem	Islamic University
6.	Dr. Abdrabo Abu Hashish	Palestinian German Diagnostic Center manager
7.	Dr. Saied Abo Hammra	European Hospital
8.	Dr. SaadiJaber	European Hospital
9.	Mr. Ali Abu Riala	Al Wafaa Hospital
10.	Dr. Areefa Al-Bahri	Islamic University

Annex (7): Approval from Helsinki committee- Gaza governorate

المجلس الفلسطيني للبحث الصحي

Palestinian Health Research Council

تعزيز النظام الصحي الفلسطيني من خلال مأسسة استخدام المعلومات البحثية في صنع القرار

Developing the Palestinian health system through institutionalizing the use of information in decision making

Helsinki Committee

For Ethical Approval

Date: 01/09/2016 **Number:** PHRC/HC/139/16

Name: SHIMA H. SHAGFA الاسم:

We would like to inform you that the committee had discussed the proposal of your study about:

نفيدكم علماً بأن اللجنة قد ناقشت مقترح دراستكم حول:

Risk Factors for Osteoporosis among Adults in Gaza Governorate: A case Control Study

The committee has decided to approve the above mentioned research. Approval number PHRC/HC/139/16 in its meeting on 01/09/2016

و قد قررت الموافقة على البحث المذكور عاليه بالرقم والتاريخ المذكوران عاليه

Signature

Member **Member**

Chairman

Genral Conditions:-

1. Valid for 2 years from the date of approval.
2. It is necessary to notify the committee of any change in the approved study protocol.
3. The committee appreciates receiving a copy of your final research when completed.

Specific Conditions:-

E-Mail:pal.phrc@gmail.com

Gaza - Palestine غزة - فلسطين

شارع النصر - مفترق العيون

Annex(8): An official letter of request

Al-Quds University
Jerusalem
School of Public Health

جامعة القدس
القدس
كلية الصحة العامة

التاريخ: 2016/11/12

حضرة / د. عبدربه أبو حشيش المحترم
مدير المركز الفلسطيني الألماني للتشخيص
السلام عليكم ورحمة الله،،،

الموضوع:مساعدة الطالبة شيماء شيقفة

نشكر لكم دعمكم الدائم لمسيرة العلم والتعليم وخصوصاً دعم كلية الصحة العامة وطلابها، ونود أعلامكم بأن الطالبة المذكورة أعلاه تقوم بعمل بحث كمتطلب للحصول على درجة الماجستير في الصحة العامة-مسار إدارة صحية بعنوان:

Risk Factors for Osteoporosis among Adults in Gaza Governorates: A Case Control Study

وعليه نرجو من سيادتكم التكرم بالموافقة على تسهيل مهمة الطالبة في إنجاز هذا البحث حيث تشمل عينة الدراسة المرضى المشخصيين بهشاشة العظام والمترددين على المركز التابع لإدارتكم الموقرة.

شاكرين لكم حسن تعاونكم ودعمكم للمسيرة التعليمية،،،
و اقبلوا فائق التحية و الاحترام،،،

د. بسام أبو حمد
منسق عام برامج الصحة العامة
جامعة القدس-فرع غزة

نسخة: الملف

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ص.ب. 51000 القدس

ملخص الدراسة

هذه الدراسة بعنوان: "عوامل الاختطار لمرض هشاشة العظام بين البالغين في محافظات غزة: دراسة الحالات والشواهد". على الصعيد العالمي يعتبر مرض هشاشة العظام من مشاكل العظام الأكثر شيوعاً حول العالم والتي تؤثر خاصة على البالغين وكبار السن ويدعى هذا المرض بالمرض الصامت حيث لا يعلم المصاب به حتى يصاب بكسر بأحد عظامه.

تكونت عينة الدراسة من (160) حالة (80 حالة مصابة بمرض هشاشة العظام و 80 حالة سليمة)، حيث استخدم الباحث دراسة مقارنة بين الحالات المرضية والحالات السليمة ، وقد أُخذت جميع الحالات من المركز الفلسطيني الألماني التشخيصي خلال فترة جمع العينة؛ وذلك بعد إجراء فحص الدكسا (DEXA) المختص بكشف مرض هشاشة العظام لكل من الحالات والشواهد.

تكونت أداة الدراسة من استبانة تم إعدادها لقياس متغيرات الدراسة (العوامل الاجتماعية الديموغرافية، نمط العيش، الوضع الصحي الطبي، الأدوية المستخدمة)، وقد قام الباحث بإجراء اختبارات الصدق والثبات للاستبانة من خلال عينة استطلاعية تكونت من 20 حالة (10 حالات و 10 شواهد)، وقد تم تضمينهم في عينة الدراسة، وقد استخدم الباحث الحزمة الإحصائية((Statistical Package of Social Science (SPSS) لإجراء بعض الاختبارات الإحصائية مثل مربع كاي والانحدار المتعدد.

وقد أظهر اختبار الانحدار المتعدد لإيجاد عوامل الاختطار لمرض هشاشة العظام أن هناك علاقة ذات دلالة إحصائية بين الإصابة بمرض هشاشة العظام وبين (الرضاعة الطبيعية، التاريخ العائلي للإصابة بالمرض، استخدام مدرات البول اللازكس، استخدام أدوية الضغط) في حين أن زيادة الوزن اعتبرت كعامل حماية من الإصابة بمرض هشاشة العظام.

كذلك أظهرت نتائج الدراسة أن الحالات التي تستخدم الرضاعة الطبيعية تزداد معدل إصابتهم بالمرض بمعدل (OR: 1.436) أكثر من النساء اللواتي يستخدمن الرضاعة الصناعية لأطفالهن كما وأظهر الانحدار المتعدد أن الحالات التي لديها تاريخ عائلي للإصابة بمرض هشاشة العظام تزداد معدل إصابتهم بالمرض بمعدل (OR:3.845) أكثر من الذين ليس لذويهم تاريخ عائليللإصابة بمرض هشاشة العظام، كما وأظهرت النتائج أن الحالات التي تتناول أدوية مثل مدرات البول اللازكس وأدوية الضغط تزداد معدل الإصابة لديهم بمرض هشاشة العظام بمعدل(OR: 3.004 ;OR: 6.967) على التوالي أكثر من الذين لا يستخدمون مثل هذه الأدوية.

في حيث أظهرت نتائج الدراسة أن زيادة الوزن تشكل عامل حماية من الإصابة بمرض هشاشة العظام (OR: 0.871) من الأشخاص الذين يعانون من النحافة.

وتوصي هذه الدراسة بالاهتمام بعوامل الاختطار الناتجة عن استخدام بعض الأدوية المسببة لمرض هشاشة العظام.