INTRODUCTION

Osteoporosis is a global problem occurring in every geographic area and affecting 150 million men and women worldwide. Osteoporosis is defined as a reduction of bone mass (or density) or the presence of a fragility fracture **(Suman et al., 2013).**

Osteoporosis is defined as a bone density that falls 2.5 standard deviation (SD) below the mean for young healthy adults of the same race and gender also referred to as T-score of -2.5 **(Suman et al., 2013).**

It is called silent disease since there are few associated symptoms; osteoporotic fracture is chief clinical feature with an enormous burden on the health related quality of life and mortality **(Caliri et al., 2007).**

Osteoporosis is a condition characterized by decreased bone strength. Women are four times likely to develop osteoporosis than men. It is prevalent in post-menopausal women but also occurs in men and women with underlying conditions or major risk factors associated with bone demineralization **(Suman et al., 2013).**

The incidence of menopause-associated symptoms in Egyptian women is higher than in the West, probably because of the different 'sociocultural attitudes' towards the menopause in different communities. Bone mineral density charts of

Egyptian women showed lower bone mineral density compared to their Western counterparts. After the menopause, they suffer from osteoporosis, particularly at the femoral neck (**Sallam et al., 2006).**

In Egypt in 40 to 50 years age group, 42 % of females had low BMD. At the age of 60 years, about half of the females had osteopenia, while a third of the elderly populations (65 to over 80 years of age) are osteoporotic **(Hassan et al., 2001).**

In healthy post-menopausal Egyptian women osteoporosis of the lumbar spine was found in 52.0% (T-score ≤ –2.5) and 25.7% had osteoporosis of the neck of the left femur **(Abd-Al-Atty, 2011).**

Both genetic and behavioral risk factors contribute to the development of osteoporosis. Genetic risk factors include race, gender, diminished estrogen levels after menopause, thinness, small frame, and hereditary. Behavioral risk factors include alcohol and caffeine consumption, calcium deficient diet, and sedentary lifestyle **(Freeman & Turner, 2004).**

Nutrition has long been established as a key factor in building and maintaining bone strength. While calcium and vitamin D are crucial nutrients for bone health, energy, protein and other vitamins and minerals all play a role. Risk of osteoporosis is influenced not only by current dietary intake, but by life-long dietary habits **(Irish Osteoporosis Society, 2012).**

In free living elderly people in Spain according to Mini Nutritional Assessment (MNA) screening 12.5% subjects were classified as under nutrition (MNA<17) and 57.5% were at risk for malnutrition (17≤ MNA ≤23.5) **(Montana & Miguez, 2011).**

In most European countries, the prevalence of malnutrition among the elderly living at home is between 5-20%, percentages that increase among the institutionalized elderly and hospitalized **(Sieber, 2006).**

Among the elderly people living at nursing home at Urmia, Iran, 12.26% were well nourished, 49.06% malnourished and 38.68% at risk of malnutrition .The prevalence of malnutrition in female subjects was more than male ones (65.4% vs. 34.6%) **(Saeidlous et al., 2011).** However, appropriate screening and intervention have been shown to result in remarkably improved outcomes.

Nutrition screening is a process used to quickly identify those who may be at risk of malnutrition so that a full nutrition assessment and appropriate nutrition intervention can be provided. While many nutrition screening tools have been developed, few have been evaluated for use in older adults in the community setting (**Phillips et al., 2010).**

The Mini Nutritional Assessment (MNA) method has been designed to provide a single rapid assessment of nutritional risk in old people. The MNA is composed of four

parts: (I) anthropometric measurements, (II) global assessments, (III) dietary questionnaire, and (IV) subjective assessment. The total obtainable score is 30 points. If person scores <17 points he is classified as undernourished. If he scores between 17 - 23.5 points he is at risk of under nutrition. Finally, if he obtains >23.5 points, he is classified as well-nourished **(Guigoz et al., 1994).**

Recommended intervals for screening with the MNA are annually in the community, every three months in institutional settings or in persons who have been identified as malnourished or at risk for malnutrition, and whenever a change in clinical condition occurs **(Tur et al., 2005).**

It was determined that the nutritional status of elderly women, assessed by the Mini Nutritional Assessment questionnaire, reflects bone mineral density **(Ožeraitienė & Būtėnaitė, 2006).**

Malnutrition Universal Screening Tool 'MUST' is a screening tool that has been devised for application to all adult patients across all health care Settings. In the absence of a definitive method to diagnose malnutrition, 'MUST' has been developed to detect protein–energy malnutrition and the risk of developing malnutrition using evidence-based criteria **(Elia, 2003).**

Although Osteoporosis has been present in humans for millennia, affecting Egyptian women over 4,000 years ago, it is only in the last three centuries that the disease has been recognized and quantified. Investigation of nutritional status as a risk factor among Egyptian postmenopausal women representing new challenge.

GOAL & AIM OF THE WORK

Goal :

To aid health planning authority in their efforts in prevention and management of malnutrition in postmenopausal female and its role in developing osteoporosis.

Aim of the Work:

To investigate the relationship between osteoporosis and nutritional status as determined by the Mini-Nutritional Assessment questionnaire (MNA).

To assess the agreement of malnutrition risk between Malnutrition Universal Screening Tool (MUST) and Mini-Nutritional Assessment questionnaire (MNA) in the same patients and compare their relationship with osteoporosis.

OSTEOPOROSIS

Osteoporosis is a systemic disease characterized by low bone mass and micro architectural, deterioration of bone tissue, resulting in an increased risk of fracture **(Garnerio, 2008).**

It is called silent disease since there are few associated symptoms; osteoporotic fracture is chief clinical feature with an enormous burden on the health related quality of life and mortality **(Caliri et al., 2007).**

Osteoporosis is emerging as a major public health problem in developing countries because of an increase in the elderly population .The increase of the elderly population is a global phenomenon reflecting the increase in life expectancy **(Morais et al., 2008).**

The World Health Organization (WHO) has defined osteoporosis as a spinal or hip bone mineral density (BMD) that is 2.5 standard deviations or more below the mean BMD for healthy, young women, measured by Dual Energy X-ray Absorptiometry (DEXA). The WHO defines osteopenia as a spinal or hip BMD between 1 and 2.5 standard deviations below the mean for healthy, young women (**Sweet, 2009).**

Normal bone turnover involves a balance between the processes of bone resorption and bone formation in which osteoclasts remove (resorb) bone by acidification and

proteolytic digestion and osteoblasts secrete osteoid (organic matrix of bone) into the resorption cavity **(Manolagas, 2000).**

In postmenopausal women, the rate of bone turnover increases dramatically and remains elevated for up to 40 years after cessation of ovarian function, leading to continuous, progressive bone loss (**Garnero et al., 1996).**

Pathogenesis of osteoporosis:

The mechanisms leading to increased bone loss & skeletal fragility in women with postmenopausal osteoporosis are still poorly understood **(Garnero et al., 2000).**

During childhood and adolescence, bone formation exceeds bone resorption, leading to a net gain of bone mass. However, with the onset of menopause in women and normal aging in both sexes, this balance is disrupted and BMD, bone structure, and bone quality all begin to deteriorate. The rate at which this occurs and the pattern and type of bone loss are most likely genetically determined **(Pantsulaia et al., 2005).**

The normal functioning of 3 key bone cells: osteoclasts, osteoblasts, and osteocytes. Osteoclasts and osteoblasts compose the bone multicellular unit (BMU), where bone remodeling and reconstruction occur **(Seeman& Delmas, 2006).**

At the BMU, a small packet of old or damaged bone tissue is removed by the osteoclast in a process known as bone resorption. Osteoblasts are then recruited to the excavated site to fill it in with new, young, healthy bone tissue (bone

formation).This occurs continuously Osteoclast and osteoblast functions are well coordinated or coupled **(Seeman& Delmas, 2006).**

Osteocytes act as the mechanosensors for the skeleton and are actually derived from senescent osteoblasts. They form an intricate communication network with each other and with the outer bone surface, and, in response to mechanical and structural demands, they direct where and when bone remodeling will occur (**Seeman & Delmas, 2006).**

Normal bone turnover involves a balance between the processes of bone resorption and bone formation in which osteoclasts remove (resorb) bone by acidification and proteolytic digestion and osteoblasts secrete osteoid (organic matrix of bone) into the resorption cavity **(Manolagas, 2000).**

With aging, for unknown reasons, the osteoblastic response to bone resorption is inadequate and resorption outstrips formation. This osteoblastic failure is a major factor in the pathogenesis of osteoporosis **(Raisz, 2005).**

The basis for the increased bone turnover is thought to be due in part to a shortening of the lifespan of osteoblasts and a prolongation of the lifespan of osteoclasts **(Manolagas, 2000).**

Through a complex interaction between the immune system and bone cells, estrogen deficiency causes T cells to release a variety of inflammatory cytokins which promote osteoclast recruitment, differentiation, and prolonged survival,

whereas others inhibit osteoblast differentiation and activity and cause premature death of osteoblasts(a process known as apoptosis) **(Weitzmann & Pacific, 2005).**

This has led some to refer to postmenopausal osteoporosis as an inflammatory autoimmune disease triggered by estrogen deficiency **(Weitzmann & Pacific, 2006).**

Peak BMD in the lumbar spine, femoral neck, and total hip occurred at 15-19 years. Peak BMD at the distal forearm occurred at 40-44 years **(Wu et al., 2008).**

Epidemiology of osteoporosis:

Understanding the epidemiology of osteoporosis is an essential step in developing strategies to reduce the burden of osteoporotic fracture in the population **(Dennison et al., 2005).**

Osteoporosis is a major public health problem, especially in postmenopausal Caucasian women. Osteoporotic fractures are claimed to affect 50% of women and 30% of men aged over 50 years **(Prince, 1997).**

Osteoporosis currently affecting more than 10 million people in the United States, osteoporosis is projected to impact approximately 14 million adults over the age of 50 by the year 2020 **(National Osteoporosis Foundation, 2002).**

Worldwide, approximately 200 million women have osteoporosis **(International Osteoporosis Foundation, 2005).**

In Saudi Arabia the Prevalence of osteoporosis among postmenopausal women was 46.7% in Lumbar spine and 44.1% in hip bone **(Sadat-Ali et al, 2004).**

In Egypt in 40 to 50 years age group, 42 % of females had low BMD. At the age of 60 years, about half of the females had osteopenia, while a third of the elderly populations (65 to over 80 years of age) are osteoporotic **(Hassan et al., 2001).**

The incidence of osteoporosis is lower in Japan and other Asian countries than in Europe and the USA. However, the incidence of osteoporosis is rising in all these regions in association with increasing longevity **(Draper, 1994).**

Particularly among the elderly, insufficient calcium intake, impaired intestinal absorption of calcium due to aging or disease, and deficiency of vitamin D can result in secondary hyperparathyroidism and bone loss **(Lips, 2001).**

Factors such as urbanization, parity, lactation, nutrition, occupational activities may influence bone density in developing countries **(Gu et al., 2007).**

Advanced age is the best predictor of osteoporosis, but early menopause, a maternal history of hip fracture, a fracture after 40 years of age, low body weight, or specific diseases and treatments increase susceptibility to fractures. All fractures (wrist, ribs, vertebrae, and hip) are associated with considerable morbidity, a decline in quality of life, and increased mortality **(NIH Consensus Development Panel, 2001).**

Risk Factors for Osteoporosis:

A-NON-MODIFIABLE RISK FACTORS:

1-AGE:

BMD decreases and consequently the risk of osteoporosis increases with age. A significant increase in prevalence with each decade after age 60 has been demonstrated. The United States National Health and Nutrition Survey (NHANES) III survey of postmenopausal women showed that the prevalence of osteoporosis in non-Hispanic white American women was 27% (50-59 years), 32% (60-69 years) and 41% for those 70 years **(Snelling et al., 2001).**

Aging may cause an increase in parathormone (PTH) secretion and subsequently increased bone resorption and osteoporosis **(Franek et al., 2008).**

2-SEX:

Women are at greater risk of osteoporosis as they have smaller bones and hence lower total bone mass. Additionally, women lose bone more quickly following the menopause, and typically live longer. The rate of bone loss in men is less than that in women. In the Framingham Osteoporosis Study annualized percent bone loss for women was 0.86% to 1.21% at different sites and for men, 0.04% to 0.90% **(Hannan et al., 2000).**

Secondary causes of osteoporosis are, however, more common in men, affecting approximately 40% of cases **(Baillie et al., 1992).**

Excepting reproductive factors and taking into account the increased influence of secondary factors in men, the risk factors in women also apply to men **(Baillie et al., 1992).**

Sex hormone deficiency is associated with unrestrained osteoclast activity and bone loss. Even though estrogen deficiency is more pronounced in women, it appears to be a major factor in the pathogenesis of osteoporosis in both genders **(Pietschmann et al., 2008).**

3- ETHNICITY:

Afro-Caribbean women have a higher BMD than white women at all ages due to a higher peak bone mass and slower rate of loss **(Snelling et al., 2001)**.

White women have a 2.5-fold greater risk of getting osteoporosis **(Snelling et al., 2001).**

4 -REPRODUCTIVE FACTORS:

A late menopause or short time from menopause to BMD measurement is associated with higher BMD. There is consistent evidence that low BMD is associated with early menopause **(Melton et al., 1993).**

Consequently, women with an early menopause should be considered at higher risk of osteoporosis than others at a similar age. BMD decreases most rapidly in the early postmenopausal years **(Ravn et al., 1999).**

There is no consistent evidence that tubal ligation, parity, number of previous miscarriages, or breast feeding affects BMD. Current use of estrogen replacement therapy is associated with a higher BMD **(Hannan et al., 2000).**

Those currently taking estrogen therapies should therefore be considered as being at lower risk than others at a similar age, unless the therapy was prescribed for osteoporosis (**Hannan et al., 2000).**

5 -FAMILY HISTORY OF OSTEOPOROSIS:

Lower BMD is found in women and men with a family history of osteoporosis, a family history being defined as a history of osteoporosis or brittle bones, kyphosis (.dowager's hump.), or low trauma fracture after age 50 years as reported by the offspring. Individual BMD decreases as the number of family members with osteoporosis increases **(Soroko et al., 1994).**

Overall family history is a more sensitive predictor of osteoporosis risk than maternal or paternal history alone (**Soroko et al., 1994).**

Prevalence of a positive history in sisters is similar to prevalence reported for mothers **(Snelling et al., 2001).**

6-MODIFIABLE RISK FACTORS

1-WEIGHT:

Weight loss or low body mass index (BMI) is an indicator of lower BMD **(Omland et al., 2000).**

In addition, those in the lowest tertile of BMI have a two-fold greater bone loss than those in the highest tertile over two years. Post menopausal women with below average BMI should be considered as being at increased risk of osteoporosis **(Ravn et al., 1999).**

Women with low BMI are at increased risk of osteoporosis. The change in risk associated with a 1 unit change in BMI (~5–8 lb) is of greater magnitude than most other modifiable risk factors **(Asomaning et al., 2006).**

2- DIET:

Important nutritional factors include dietary calcium intake, Vitamin D status, protein intake, Phosphorus, magnesium and zinc.

a-Calcium:

Calcium is one of the main bone-forming minerals and an appropriate supply to bone is essential at all stages of life (**Prentice, 2004).**

Bone is largely calcium in nature, but it is only now becoming more obvious that calcium intake is but one of many