

# Osteoporosis and Osteopaenia in Aged People: Insight into Aetiology, Risk Factors, Clinical Symptoms, Diagnosis, Complications, Prevention, and Treatment

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## Abstract

**Background:** At around the age of 35 years, there is an increased activity of osteoblasts for bone tissue deposition but later in old ages the activity of osteoclasts in bone resorption. Therefore, osteoporosis disease affects old people. Osteoporosis is a bone disease characterised by low mineral mass in the bone leading to fragility and risk for fracture.

**Objectives:** The current review focus on that the aetiology, risk factors and causes, clinical symptoms, diagnosis, complications, prevention, and treatment of osteoporosis. Bone tissue formation and development is facilitated by the activity of osteoblast and osteoclast cells, and usually this is achieved through calcium and phosphorus deposition and resorption from the bone respectively. Osteoporosis is diagnosed when bone density has decreased to the point where fractures occur with mild stress. Usually when bone resorption occurs at a greater rate than bone build up, there is an ultimate loss of bone mineral density and this puts an individual at risk for osteoporosis. Also in women, estrogen loss after menopause is associated with hormonal imbalance that can be associated with a rapid resorption and loss of bone density. Risk factors include fracture during falling in addition to low bone mineral density, falling is the primary risk factor for fractures. This disease can be associated with the age's chronic medical problems such as heart disease, stroke, arthritis, and depression, with the risk increasing with multiple health problems. Inactivity that results in weak thigh muscles and poor balance particularly puts any older person at risk for fracture. A lot of risk factors have been associated with the development of osteoporosis includes; gender, age, hormonal changes, mineral intake especially calcium and phosphorous, genetic and body size. Too much cigarette smoking and alcohol, consumption predisposes individuals to exposure to bone loss and subsequently fractures. Less of physical activity, reduce the fitness and muscle strength which lead to increase falls and risk of fracture. Histologically this disease is characterized by low bone mineral mass and microarchitectural deterioration of bone tissue resulting to bone fragility and increased susceptibility to fractures under falling. There are two methods to diagnosis osteoporosis. Osteoporosis can have a general association with a weak bone, muscular and support system. About 50% of women and 25% of men age 50 years and above are likely to suffer an osteoporosis-related bone fractures during their lifetime. The regular exercises improve muscular performance, skeletal integrity, and dynamic balance in premenopausal women. Also, the disease can be prevented through proper nutrition, especially through the intake of foods rich in calcium and phosphorous. Food sources of high calcium content include low-fat dairy products, such as milk, cheese, yoghurt, and ice cream; dark green, leafy vegetables, such as collard greens, broccoli, and spinach; sardines and salmon with bones; almonds; tofu; and foods fortified with calcium, such as orange juice, cereals, and breads. Young people who use a specific part of the body in vigorous exercise exhibit enhanced bone density in that part of the body, but not necessarily in other regions, although older people who have been active for many years seem to exhibit generally enhanced bone mineral density.

**Conclusion:** Osteoporosis is a disease characterised by loss of the bone mineral density and this leads to fragility and a subsequent development of fractures. The disease can be prevented by good mineral intake such as calcium and phosphorous, proper exercising, change in poor lifestyle including high alcohol consumption and cigarette smoking, and using hormonal therapies. Food high in calcium should be provided to the growing populations as their needs for this mineral is high. Prospective studies have shown that most regimens used for vigorous aerobic and strength training enhanced bone mineral density, but walking is relatively ineffective for prevention of postmenopausal bone mineral loss.

**Key Words:** Osteoporosis, Osteopaenia, Aged people, Aetiology, Clinical symptoms, Risk factors, Prevention, Treatment.

## Introduction

Osteoporosis is a musculoskeletal system disease which affects the bone tissue rendering them brittle and prone to fracture, in other words, the bone loses its mineral density. Osteoporosis is diagnosed when bone density has decreased to the point where fractures occur with mild stress. The human skeleton grows significantly in strength and size between birth and maturity; therefore, the first two decades of human life are a crucial period of the final bone mass and probably of subsequent fracture risk (Heinonen & Sievanen 2000). Osteoporosis, or porous bone, is a disease development when the mechanism of bone creation and destruction gets out of balance, so that new bone is not being created fast enough to maintain normal bone density. This process leads to bone fragility and an increased risk of fractures of the hip, spine, and wrist. The elderly people in our society are usually at risk or affected by osteoporosis, a disease that can be prevented and managed therapeutically (Greenspan, 2007). Osteoporosis is a major health problem in the general population facing the society's older generation in an even distribution along all sexes.

Adults until they reach around the age 40, the process of breaking down and building up bone mineral tissue by osteoclasts and osteoblasts cells continues in a nearly perfectly coupled system, and the two phases balance each other. As a person's age go beyond 40 or in the presence of certain conditions, this balanced homeostatic system of bone formation breaks down and the two processes become out of synchronization leading to bone tissue weary. The reasons why this risk to osteoporosis occurs during aging have not been fully understood, but declining levels of sex hormone and hormonal imbalance may be one of the attributes. Eventually individual body homeostasis leads to breakdown mechanism overtaking the build-up mechanism leading to osteopaenia and exposure to osteoporosis. Women are under high risks of development of this disease and for instance about 80% osteoporosis occurs in women and 20% in men. For example, in Australia two in three women, and one in three men over the age of 60 will suffer an osteoporotic fracture in their remaining lifetime. Osteoporosis might be classified into two types, primary type 1 or postmenopausal osteoporosis which most occur in women after menopause and secondary type 2 which occur in men and women after age 75 at a ratio of 2F:1M. The large proportion of diseased women occurs most commonly at the age of post-menopause, and this has been related to the deficiency of estrogens (Marshall et al., 1996). Clinically the affected patients demonstrate signs of back pain, loss of height and stooped posture before the actual fracture occurs. The purpose of this review is to point out the reasons, symptoms, evaluation, complication, and prevention of osteoporosis.

### Objectives:

The current review focus on that the aetiology, risk factors and causes, clinical symptoms, diagnosis, complications, prevention, and treatment of osteoporosis.

### Osteoporosis and Osteopaenia in old people

#### Aetiology

Bone has a similar degree of the breakdown and growth balance to allow for the organ to undergo its establishment through bone tissue resorption and deposition. This results to proper remodelling and this can also be seen in other organs of the body, as there is a homeostatic balance through bone tissue is constantly being broken down and reformed again. This turnover is necessary especially for growth, for repair of minor damage that occurs from frequent stress, and also for the maintenance of a properly functioning body skeletal system. This is achievable by the function of two essential cells involved in this process, which are osteoblasts and osteoclasts. Osteoclast cells which are formed from certain blood cells and are responsible for the mineral breakdown, or resorption, of the bone tissue from the skeleton. These cells develop holes into the bone in the event of releasing the small amounts of calcium into the blood circulation that are necessary for other vital functions of the body. However the osteoblast cells are produced by bone stem cells and are the bone tissue deposition as well as formation. They rebuild the skeleton by forming the bone tissue, first by filling in the holes with collagen, followed by laying down of crystals of calcium and phosphorus. The balance of bone build-up (formation by the osteoblast cells) and break down (resorption by osteoclast cells) is controlled by a complex mix of hormones and chemical factors. Usually when bone resorption occurs at a greater rate than bone build up, there is an ultimate loss of bone mineral density and this puts an individual at risk for osteoporosis. Also in women, estrogen loss after menopause is associated with hormonal imbalance that can be associated with a rapid resorption and loss of bone density (Riggis and Melton, 1995). This then results in the predisposing factor for these group of people to be exposed to highest risk for osteoporosis disease development and therefore for fracture risks.

#### Risk Factors and causes for osteoporosis

Risk factors include fracture during falling in addition to low bone mineral density, falling is the primary risk factor for fractures. This disease can also be associated with the age's chronic medical problems such as heart disease, stroke, arthritis, and depression, with the risk increasing with multiple health problems. Taking multiple medications especially tranquilizers and antidepressants poor physical function, importantly slow gait and reduced muscle strength (Gerend et al., 2006). Inactivity that results in weak thigh muscles and poor balance particularly puts any older person at risk for fracture and particularly those with low bone density. A lot of risk factors have been associated with the development of osteoporosis and the contribution to an individual's likelihood of developing the disease. These includes; gender, age, hormonal changes, mineral intake especially calcium and phosphorous, genetic and body size.

Gender, generally women are highly exposed to developing osteoporosis as compared to their male counterparts due to less bone tissue proportion to the muscle cover as well as changes of menopause (Siris et al., 2001). Also, for normal women, the regression of BMD on age was negative and linear at each site; overall decrease during life was 58% in the femoral neck, 53% in the intertrochanteric region of the femur, and 42% in the lumbar spine. For

normal men, the age regression was linear also; the rate of decrease in BMD was two-thirds of that in women for femoral neck and intertrochanteric femur but was only one-fourth of that in women for lumbar spine. (Riggs et al., 1982).

Age, the ageing population show greater risk of developing osteoporosis, since with age the activity of osteoclast cells increases and the activity of osteoblast decreases rendering bones thinner and weaker (Taranta et al., 2002). Due to the sex hormone secretion goes down (oestrogen and testosterone) in the body. Further, the physical activity is decrease when the human reach ageing.

Body size, persons with a small body and thin-boned size may be at a high risk as compared to large body sized individuals especially in the women. Body size associate with BMD in both sexes, and it markers of BMD in the weight-bearing sites than in the non-weight-bearing sites (Edelstein et al., 1993). This means a mechanical effect of weight on BMD. Also there is a genetic predisposition to development of that disease, and usually African Americans and Hispaniards are at low risk as compared to Asians counterparts. People who their parents have osteoporosis have more opportunity exposure to osteoporosis.

Hormonal imbalances, as seen in the absence of menstrual periods (amenorrhea), low estrogen level (during menopause), and low testosterone (T4) levels in men can act as a predisposing factor to osteoporosis. Menopause whither produce of surgical or natural which lead to ovary inactivity and reduce estrogen levels, generate an imbalance in favor of bone resorption, with an increase in the latter and a decrease in bone mass (Taranta et al., 2002). Conditions such as anorexia nervosa which can be characterized by an irrational fear for weight gain, and this eating disorder increases risk for osteoporosis (Benito M., 2005).

Low calcium intakes as well as vitamin D, in the diets are another predisposing factor for loss of BMD. Calcium is the mean component in bone tissue, it has important role to make the bone strength. Therefore, inadequate calcium dramatically contributes to the development of osteoporosis. The high prevalence of vitamin D deficiency in healthy elderly people living mainly in southern European countries increase the risk of osteoporotic fractures in these populations above those anticipated for the general elderly population of the European community (Rodriguez et al., 2002 ).

A long period exposure to certain medications, such as glucocorticoids and some anticonvulsants can result into loss of bone density and fracture risks. Some lifestyle which allows for body exercise inactivity may result into the weakening of the bone tissue strength and thus expose these individuals to osteoporosis.

Too much cigarette smoking and alcohol, consumption predisposes individuals to exposure to bone loss and subsequently fractures. The smoking may more impact in menopause on women. Woman who stops smoking before the menopause would, on average, reduce her risk of eventual hip fracture by about a quarter (Law et al., 1991). Human and animal studies reveal that chronic heavy drinking, particularly during adolescence and the young adult years, can significantly compromise bone quality and may increase osteoporosis risk. Additional, study indicates that the effects of heavy alcohol use on bone cannot be reversed, even if alcohol consumption is terminated (Sampson and Wayne, 2002).

Less of physical activity, reduce the fitness and muscle strength which lead to increase falls and risk of fracture.

### Clinical symptoms

Widow's hump, is the first symptom that patient can be observable before the doctor measure bone density for patient. A loss of height and change in posture or sudden back pain, are also another symptom particularly in men.

Histologically this disease condition is defined as bone disease characterized by low bone mineral mass and microarchitectural deterioration of bone tissue resulting to bone fragility and increased susceptibility to fractures under falling. Clinically the most frequently sites of bone fracture are hip, spine and wrist, hence these osteoporotic fractures have a considerable economic impact due to levels of mortality, morbidity and medical costs.

### Clinical Diagnosis and Evaluation using BMD

There are two methods to diagnosis osteoporosis which are occurrence of an osteoporotic fracture and the World Health Organization's (WHO) bone density criteria (Ebeling, 2008). The preferable method of diagnosis is measurement of bone mineral density (BMD). Low BMD is the single best predictor of the occurrence of fracture especially as seen in the asymptomatic postmenopausal women. This can be determined by T-Score evaluation and therefore this can be used to determine the BMD level and the presence or risk of osteoporosis (Khan and Syed, 2004). A T- Score is the standard deviation variance of patient's BMD compared to a standard healthy young individual reference in a given population. According to WHO, individuals with a T-Score below -2.5 have osteoporosis and those with a T-Score between -1 and -2.5 have a low bone density and are at risk for fractures and are thought to be involved with osteoporosis as well as osteopaenia.

### Complications

Osteoporosis can have a general association with a weak bone, muscular and support system, and this may result to a variety of skeletal health conditions. Current research studies have indicated that this disease causes more than 1.5 million fractures annually in the world and the large proportion is attributed to the young individuals, aged as well as women especially those beyond the phase of menopause (Guadalupe et al., 2009). For instance experiments show that about 50% of women and 25% of men age 50 years and above are likely to suffer an osteoporosis-related bone fractures during their lifetime. Most of these fractures associated with bone mineral loss usually occurs after relatively minor falls or accidents attributed by fragility of the skeletal system and the bone.

### Prevention and treatment

The most essential way of prevention of bone mineral through osteopaenia or osteoporosis loss is exposure to appropriate exercises. Most studies using specific bone-loading exercise have shown substantial increases in bone density at the specific sites loaded. Many studies have shown that regular exercises improve muscular performance, skeletal integrity, and dynamic balance in premenopausal women (Kemmler et al., 2011). Exercise rise peak BMD in youth, so regular exercise is good way to prevent osteoporosis in aged people (Law et al., 1991). Cross sectional studies have shown that the highest BMD best and greater cortical bone mass exists in sportswomen and sportsmen. Also, aged people who had physical activities work such as farmers when they were youth are less likely to have osteoporosis (Heinonen et al., 2000). Due to they have strong muscle and high BMD. However, elderly people seem incapable of responding favourably to vigorous exercise (Guadalupe et al, 2009). Extremely high volumes of vigorous exercise may overwhelm a person's adaptive capacity especially the aged, leading to stress fractures. For instance, young women athletes may be at a risk of suffering from menstrual dysfunction exhibit reduced BMD and musculoskeletal disorders (Kanis, 1994). Clinical implication although the evidence is far from conclusive, an exercise regimen should probably include vigorous total body exercise, including strength and aerobic training.

Exercise, especially the weight bearing ones, has a wide variety of beneficial bone and musculoskeletal health effects. Although exercise does not bring about substantial increases in BMD, its importance is subjected to the body stability and thus resulting into decreased risk of falls, as the balance is improved and/or muscle strength is increased. People with osteoporosis should not involve themselves in strenuous exercises, since their bone tissue is weak and likely to undergo fractures (Grampp et al., 1999). Elderly patients with heart disease, diabetes mellitus, obesity and high blood pressure, have to be exposed only to exercise prescribed and monitored by physicians. Smoking of cigarettes daily throughout adult life can itself lead to loss bone mass, and is involved to decreased estrogen levels and thus bone loss in women before menopause.

The disease can also be prevented through proper nutrition, especially through the intake of foods rich in calcium and phosphorous. The adequate supply of calcium over a lifetime contributes to preventing the development of osteoporosis. Research studies show that low calcium dietary intake appears to be associated with low bone mass, rapid bone loss through osteoporosis and osteopenia, and high fracture rates (Michaelsson et al., 2003). Despite the essence of this mineral calcium, the nutrition surveys show that many people consume less than half the amount of calcium recommended to build and maintain healthy bone mineral density (Huopia et al., 2004). Food sources of high calcium content include low-fat dairy products, such as milk, cheese, yoghurt, and ice cream; dark green, leafy vegetables, such as collard greens, broccoli, and spinach; sardines and salmon with bones; almonds; tofu; and foods fortified with calcium, such as orange juice, cereals, and breads. The body's demand for calcium is greater during childhood and adolescence, and this is the phase when the skeleton is growing rapidly, as well as during pregnancy and breastfeeding. Postmenopausal women and ageing men also need to consume more calcium (Greenspan, 2007). Also the older adults are more likely to have chronic medical complications and to use medications that may impair calcium absorption.

Calcium is very important to build the bone and to keep on BMD, so calcium is significant component to prevent osteoporosis, but there is another component also very important to prevent osteoporosis which is vitamin D, because the intestine in humane body needs vitamin D to absorbed calcium (Boonen et al., 2006). Vitamin D is formed by the action of sunlight on our skin, and people can obtain on small amount of vitamin D from food. Approximately 5-9 minutes of sunlight per day will give you adequate vitamin D. In winter, approximately 9-47 minutes of sunlight per day will give you adequate vitamin D. However, you should stay out of the sun between 10am-2pm (11am-3pm in daylight savings time) due to the cancerous effects of sunlight at that time (Lips et al., 2006).

The optimal goal for the treatment of osteoporosis, especially for patients who already have advanced bone loss, is to increase bone mass and bone strength to levels seen in average young women and men so as to prevent all osteoporotic fractures (Gutin and Kasper, 1992). Indeed, with the rapid aging of the population, there is an urgent need for a cure, not merely the management of osteoporosis. The clinical pharmacotherapies currently approved by the food and drug administration for the management and treatment of osteoporosis includes; administration of raloxifene, estrogen, alendronate, risedronate and calcitonin. These are antiresorptive agents and their mechanism of action is based on slowing the rate of bone remodeling, and thereby, they reduce or stop bone loss. The disadvantage with these pharmacotherapies is that they are incapable of rebuilding bone, and the increase in bone mineral density in patients exposed to antiresorptive agents are not due to bone rebuilding (Greenspan, 2007). These bone mineral changes is however attributed to the result of contraction of the remodeling space and more complete secondary mineralization.

Although early detection and timely treatment of osteoporosis can substantially decrease the risk of future fractures, none of the available treatments for osteoporosis are complete cures. In other words, it is difficult to completely rebuild bone that has been weakened by osteoporosis. Therefore, prevention of osteoporosis is as important as treatment. The following are osteoporosis treatment and prevention measures: Lifestyle changes, including quitting cigarette smoking, curtailing excessive alcohol intake, exercising regularly, and consuming a balanced diet with adequate calcium and vitamin D, using pharmacotherapeutics that reduces bone loss and increases bone strength (Bauer et Al., 1997). These includes medications such as alendronate (Fosamax), risedronate (Actonel), calcitonin (calcimar) raloxifene (Evista), ibandronate (Boniva), zoledronate (Reclast), and denosumab (Prolia). Also, hormonal therapy is another treatment for osteoporosis such as oestrogen and testosterone. Previous studies have shown that testosterone therapy in aged men may increase BMD and decrease fracture risk (Amory, 2004).

## Conclusion

Osteoporosis is a disease characterised by loss of the bone mineral density and this leads to fragility and a subsequent development of fractures. Despite this poor prognosis to pharmacotherapeutic remedies, the disease can be prevented by good mineral intake such as calcium and phosphorous, proper exercising, change in poor lifestyle including high alcohol consumption and cigarette smoking, and using hormonal therapies. Food high in calcium should be provided to the growing populations as their needs for this mineral is high.

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