



INTRODUCTION

“Health is wealth” is an old proverb, but its significance reverberates even today. Healthiness is natural wellbeing of body and mind. The importance of food and its effect on body was premeditated in detail by our ancestors who devised foods that were excellent medicines and these foods made us healthy. In today’s scenario, nutritive value of foods should be reviewed and we need to work out foods that fight against the diseases.

Good health is a major reserve and an important dimension of the quality of life. But in present times, changes in lifestyle and dietary pattern stemming from rapid modernization have favoured an increase in the occurrence of non communicable yet chronic and degenerative diet related diseases (Parvathi *et al.*, 2008). World Health Organization has identified India as one of the nations with most of the lifestyle disorders in the near future gaining another dubious distinction of becoming the lifestyle related disease capital (Sharma, 2010).

Changing demographic profile and technological progress have lead to many health problems, coupled with sedentary life style and unsuitable diets, which have contributed to chronic degenerative diseases like cardiovascular diseases, diabetes mellitus, low bone mass disorder, arthritis, hypertension and other disorders (Semple *et al.*, 2004).

Low bone mass disorder is a major public health threat worldwide and many studies have reported that Asian women have higher predisposition for low bone mass disorder than their Caucasian counterparts (Anuradha and Neha, 2013).

Osteoporosis means “porous bone”. If a normal healthy bone is observed in a microscope, a honeycomb structure is seen. In the case of osteoporotic bone, the holes and spaces in honeycomb structure is bigger compared to normal healthy bone. Low bone mass disorder has become one of the most prevalent and costly health problems in Asia. Asia is the region expecting the most dramatic

increase in hip fractures during coming decades. By 2050 one out of every two hip fractures worldwide will occur in Asia (Lau *et al.*, 2006).

The prevalence of low bone mass disorder is expected to increase worldwide with increased ageing of the population. Bones are rigid organs that constitute the endoskeleton system of the body. Bones perform key roles in the body like supporting and shielding organs, producing white blood and red blood cells and storing minerals especially calcium and phosphorus. Bones are considered as hard and lifeless, but in reality they are living and growing tissue. World Health Organization has declared the first decade of 21st century as “Decade for bone and joint disorders” (Gabrielle, 2002). A low bone mass fracture is the sixth most disability cause of disease in world.

Low bone mass disorder is characterized by micro architectural worsening of bone tissue leading to better bone fragility, thus escalating the vulnerability to fracture. One out of 8 males and 1 out of 3 females in India experience Low bone mass disorder, making India one of the largest affected countries in the world (International Osteoporosis Foundation, 2004). Every year, there are a predictable 500,000 spinal fractures, 300,000 hip fractures, 200,000 broken wrists and 300,000 fractures of other bones. Regarding fractures 80 per cent of these occur from relatively minor falls or accidents (www.asianhealthsecrets.com).

Expert groups peg the number of low bone mass disorder patients at approximately 26 million (2003 figures) with the numbers projected to increase to 36 million by 2013. Two points worth mentioning about low bone mass disorder in India is the towering incidence among men and the less age of peak occurrence in contrast to Western countries. The incidence of hip fracture is 1 woman to 1 man in India. In most Western countries, while the highest peak incidence of low bone mass disorder occurs at about 70 to 80 years of age, in India it may distress those of 10 to 20 years younger, at age 50 to 60 years (www.medicalnewstoday.com). Bone resorption means some bone cells break down bone tissue and release minerals into the fluid tissue to be made available for other uses in the body. They are activated by hormones that are released when the blood calcium levels or

mineral levels are too low. The osteoblasts form collagen fibers that become coated with minerals, especially calcium salts, which then begin to harden (Glimcher, 2004).

Every individual lose old bones and new bones get formed during their lifetime. Young people prolong to make new bones even after they stop growing tall. Bones continue to become denser until peak bone mass stage is reached. This happens usually in the range of 18 to 25 years of age. The higher the peak bone mass, the less likely is the chance to get low bone mass disorder. Once the peak bone mass stage is reached, the balance between bone formation and bone loss reverses which means one may lose more bone than its formation. The condition when the bone mass becomes less dense is categorized as low bone mass disorder. The Bone Mineral Density (BMD) can be measured by using BMD test that determines the richness of minerals such as calcium and phosphorus in the bones. If the BMD value is high, it means the bones are denser and stronger and accordingly they are less prone to breakage (www.ncbi.nlm.nih.gov).

Earlier, X-ray methods were employed to measure the bone mineral density factor that is an accurate, but costly and time consuming method. Patients need to visit the laboratories and wait for X-ray measurements. With advancement in technology, ultrasonic methods were successfully employed to measure bone mass density that is easy to use, cost less and much faster. The Ultrasonic technicians can reach the major population through medical camps and render the service at door steps that turned-out to be useful and convenient. Moreover, doctors and nutritional experts can improve the awareness through direct counseling (Giampiero and Chiara, 2008).

T-Score is a comparative factor or the standard deviation of bone density of patient compared to bone density of young healthy adult of same sex, age and race. In case, T score is negative, bones are thinner and are prone for easy breakage. A T score between -2 and +2 indicates tolerable bone density, a score below -2 (e.g. -2.5) may specify, that the bone loss is high, which can be due to reasons unrelated to age (www.osteopenia3.com).

Low bone mass disorder is a silent disease and there are no symptoms of this disease condition. Osteopenia is defined as bone mineral density that is lesser than normal but not low to be classified as osteoporosis, though it places at risk for osteoporosis. Osteoporosis exactly means porous bone in Latin and is measured as a disease with extremely porous bones subjecting to fracture and slow healing (The Wellness Express, 2014).

The patient may recognize the osteoporotic state only after breaking of a bone. Hence it is advisable to consult the doctor, after the age of 45 years and check the bone condition. A person having osteoporotic bones, will fracture his bones even after a minor injury, such as a fall. Spine, wrist and hip are common fracture zones and among these, spine and hip are critical zones and they may lead to chronic and long term pain. If prolonged, it can cause disability and even death. Low bone mass disorder makes people to be bed ridden. This cause secondary complications which can be life threatening in the elderly. The main goal of treating low bone mass disorder is to prevent such fractures in the first place (www.niams.nih.gov).

According to International Osteoporosis Foundation (2013), 50 million people in India are estimated to be prone to osteopenia and osteoporotic condition. Indian Council for Medical Research (ICMR) conducted large multi-center studies and found that Indians have lower BMD compared to North American people owing to possible genetic differences, nutritional deficiency and smaller skeletal size. Also, urbanization has caused a lot of lifestyle changes e.g., reduced physical activity, more indoor living, and lower sun exposure.

Malhotra and Mithal (2008), reported that a recently published data has clearly demonstrated widespread vitamin D deficiency across India, at all ages and in both sexes, particularly in the urban areas. Poor sunlight exposure, skin pigmentation and a vitamin D deficient diet are some obvious causes for this finding.

Physical inactivity due to reduced energy expenditure and over fatness is a key cause for worsening health status (Patel, 2013). Unhealthy food consumption behaviour and inadequate physical activity can likely to boost the threat for low bone mass disorder, obesity, hyperlipidemia, diabetes and cancer later in life (Franko *et al.*, 2008).

According to 2011 census, women constitute 48.46 per cent of the total population in India (Meenakshisundaram, 2013). Often women, because of their household responsibilities and ignorance of health and hygiene practices tend to neglect their illness till their health problems get aggravated and they become too sick to move around and attend to their normal household chores (Muthiah and Krishnaveni, 2012).

Women play a significant role in assuring the health, nutrition and overall well being of the intact family and intergenerational control on the health of the future generation. Unfortunately in India the nutritional status of women is meager due to speckled reasons. Women have unique medical problems and health care requirements and women's health has been a global concern for many decades (WHO, 2009).

Consumption of refined and fast foods along with the lifestyle modification and stress has compounded to the problem of premenstrual syndrome in a majority of women. Various studies have pointed out that there are alterations in iron, calcium and magnesium levels among women with and without premenstrual syndrome (Suba and Devi, 2013)

The divergence in the type of lifestyle in urban and semi urban region play an important role for the health status of adult women (Patel, 2013). Ramesh and Vinod (2013), state that quality nutrition is a clause in retaining good health. Opting a variety of food groups in sufficient amounts collective with the precise quantity of physical activity is the key to wellbeing.

Women are at a greater risk of developing low bone mass disorder than men, because of the hormonal change that can affect bone density leading to low bone mass disorder (Cummings and Melton, 2002). Many research studies in

India have revealed the hard fact that the prevalence of bone related disorders has increased rapidly in women of different ages due to inadequate nutrition and lifestyle changes.

Loss of bone mineral content due to age related cause is greater among women (Esmat, 2012). In a study by Shatrugna, *et al.*, (2005), Indian women aged 30 to 60 years from low income groups, the BMD at all the skeletal sites were much worse than values reported from urbanized countries, with an elevated incidence of osteopenia (52%) and osteoporosis (29%) a reflection of inadequate nutrition.

Health status of women is a theme of immense concern in the modern day world, since numerous roles occupied by women give rise to severe health and nutritional problems. The health of Indian women is essentially associated to their lifestyles. Healthy lifestyle i.e., diet, exercise and other factors can have a major positive impact on the bone metabolism and bone health of Indians. These public health measures are recommended for the population at large as they are efficacious, safe and cost-effective. Nutritional supplements play a major role to keep the body metabolism especially antioxidants in dietary sources help as major elements to keep the body and bone healthy. Nutritional supplements can help to strengthen the cartilage and joints which may decrease the onset of the disease (www.christianet.com).

Nutrition is an important factor in the prevention and treatment of low bone mass disorder (Ilich *et al.*, 2003). Adequate calcium intake, vitamin D synthesis and exercise are the three crucial elements in determining peak bone mass. Thus there is an urgent need for greater public awareness about low bone mass disorder. For middle aged and elderly women early detection and treatment of low bone mass disorder can significantly reduce the risk of fractures and associated morbidity and mortality.

Young middle age is the suitable period to improve healthy intake and life style activities. Diet and lifestyle choice among adults have long term as well as undeviating effect on their health (Dorothy and Priyadharshini, 2007). In young

adults the rates of bone deposition and resorption are about the same. As the level of sex steroids diminishes during middle age, especially in women after menopause, a decrease in bone mass occurs, because, bone resorption outpaces bone deposition (Kaunitz, 2007).

Assessment of nutritional status of the community is one of the first steps in the formation of any public health strategy to combat malnutrition (Sridevi and Veena, 2011). Improvement in the standard of living and health status of the population has remained one of the important objectives of Indian planning (Gandhimathi, 2011). Food Supplementation is one of the most effective ways of combating malnutrition especially deficiency diseases to reach some or all population. Nutritional quality of diet can be improved through judicious selection of inexpensive nutritious foods (Thirumanidevi and Revathy, 2011). Nutrition counseling to women helps to improve their nutritional knowledge which will eventually have a positive impact not only on their nutritional status but also on their infants (Lalitha and Sathya, 2011).

Madhukar (2007) reported that calcium supplementation has a beneficial effect on bone density and may reduce vertebral fractures. Burckhardt, (2007) found that calcium from dairy products, mineral waters and supplements is almost equally well absorbed. But the former contain other nutrients with positive effects on bone, such as proteins, phosphorus and bicarbonates. The choice goes for the nutrient or supplement with the best acceptance by a given individual. Calcium seems to be the most important determinant of peak bone mass in young adult and has received most of the media attention (Bedani and Rossi, 2005).

According to Napoli *et al.*, (2007), calcium from dietary sources is concerned with a change in estrogen metabolism towards the active 16-hydroxyl metabolic pathway and with better BMD and thus may fabricate more favourable effects in bone health in postmenopausal women than calcium from supplements. In general, health conscious people must be advised on healthy food choices and balance their meal pattern to prevent diet related disorders (Anuradha, *et al.*, 2011).

Sirtori (2001), reported that soy isoflavones reduced the plasma cholesterol levels and low bone mass disorder and in the prevention of heart disease and cancer. The isoflavones of soy protein when substituted for animal protein improved the bone strength, supported bone growth and delayed bone loss (Messina and Messina, 2000). Sesame seeds rich in calcium, magnesium, zinc etc., help to defend colon cells from cancer causing chemicals, prevent bone loss, reduce postmenopausal symptoms among women and prevent migraine. Zinc rich in sesame helps to boost the bone mineral density particularly for post menopausal women (www.pyroenergen.com).

Nutrition education is an effective tool and when used properly on only target group for a specific condition it can bring about positive results. Nutrition education offers a great opportunity to individuals to learn about the essentials of nutrition for health and to take steps to improve the quality of their diets and thus their well-being (Robinson *et al.*, 2004). Nutrition Education on healthy diets and emphasis on increased physical activity that would help to reduce the risks for diseases.

Nutrition education is the process, which assists the public in applying knowledge from nutrition science and the relationship between diet and health to their regular day-to-day practices (Barasi, 2001). An important tool for combating the problem of malnutrition is creating awareness among the public using appropriate nutrition education package (www.whoindia.com). As stated by Iran *et al.*, (2014), inadequate knowledge of women about healthy lifestyles and their lack of timely awareness to assess the risk factors and screening tests account for developing this devastating condition. Imparting knowledge, inculcating preventative behaviour towards a healthy lifestyle could eventually support in the prevention of lifestyle diseases (www.jourlib.org).

Women are more prone to bone disorders than men because of the hormonal changes and with increase in age, bone mass start decreasing as early as 30 yrs of age. Bone formation reaches the peak in the mid 20's and continues till the age of 30 yrs after which the bone resorption gradually becomes faster than

the development of new bone. Healthy lifestyle, diet, exercise and other factors can have a major positive impact on the bone metabolism and bone health. These public health measures are recommended for the population at large as they are efficacious, safe and cost effective.

There are various medicinal intervention strategies to tackle low bone mass disorder. The medicinal pills containing calcium citrate and calcium citrate malate are clinically proven remedies for low bone mass disorder. These tablets contain additional pain-killing elements which give relief to chronic pain. However, excess calcium supplemented through tablets can affect kidney and urinary system. Hence these need to be taken as prescribed by physician (Aguilera *et al.*, 2007).

Considering such ill-effects of medicinal intervention, nutritional supplements need to be encouraged. Since they play a major role to strengthen the cartilage and joints which may decrease due to the onset of the disease. Two intervention strategies like food supplementation along with nutrition education were found to be the most effective ways in bringing about changes among populations (Vimalarani, 2008).

Few studies have indicated that women who engage in physical activities like games and household work develop high bone mass density compared to women who practice sedentary lifestyle. In today's scenario, women either work in home or engage in less strenuous work at office. Hence we need to create alternative options to improve their bone health. A practical solution to this problem is nutritional supplementation (Therasa, 2006).

Thus, there is an urgent need for all the women to concentrate on lifestyle management, dietary pattern, food supplements and weight bearing exercise to reduce the fracture risk and enhance bone health to lead a healthy life.

With this background the present study was planned with the following specific objectives

- To elicit information on socio-economic, lifestyle pattern and dietary background of selected women
- To evaluate the nutritional and health status of the selected women
- To assess the Bone Mineral Density (BMD) and find out the incidence of osteopenia and osteoporosis among the selected women
- To develop nutrient rich mixes to overcome bone related problems and study the effect of food supplementation on selected osteopenic women and
- To plan and conduct nutrition education and evaluate the impact on knowledge, attitude and practices of selected women.