1. INTRODUCTION

Non communicable diseases (NCD) are growing in developing countries including India. India is experiencing the transition mainly reflecting on the growing burden of the non communicable diseases due to life style changes [1]. The latter part of the 20th century has shown a steady rise in the prevalence of NCD and other degenerative diseases. Heredity, lifestyle and environment can cause non-communicable diseases, such as diabetes, lung disorders, hypertension, cancer and osteoporosis. The increased life-span of population, falling fertility rates and increasing child survival are determinants of non-communicable diseases [2]. In 1998, World Health Organization’s (WHO) Division of Non Communicable Diseases announced that osteoporosis must be considered as a priority public health issue [3].

Osteoporosis is defined as a progressive systemic skeletal disease, characterized by low bone mass and micro-architectural deterioration of bone tissue, with a consequent increase in bone fragility and susceptibility to fracture, which typically involves wrist, spine and hip [4]. Clinically, osteoporosis is recognized by the characteristic low trauma fractures, so that any meaningful definition of osteoporosis must account for the risk of fracture. This reasoning has led to the use of ‘Bone Mineral Densitometry’ for defining osteoporosis. This is a noninvasive, method to predict fracture in the bone

A BMD (Bone Mineral Density) test is the best way to determine the bone health which helps in diagnosing low bone density or osteoporosis from which the risk for fractures can be predicted. The commonly used BMD tests like Qualitative Ultrasound (QUS) and Quantitative Computed Tomography (QCT) are used to screen the population for osteoporosis. However, the widely recognized BMD test is the Dual-Energy X-ray Absorptiometry (DEXA) test. It can measure bone density at fore arm, hip and spine.

Several screening studies for BMD revealed that osteoporosis is three times more common in women than in men, because women have a lower peak bone mass and partly because of the hormonal changes that occur after menopause. Estrogens
have an important function in preserving bone mass during adulthood, and bone loss occurs as levels decline, usually around the age of 50 years [3]. With ageing this difference becomes more pronounced. This is a universal phenomenon, occurring in both sexes and in all races.

The problem of osteoporosis is that it can be present in a patient for many years without any apparent consequences either as symptoms or as a medical condition that would prompt the patient to seek medical advice. The one event that does indicate the possible presence of osteoporosis is the occurrence of a fracture, which, if investigated, will in certain circumstances reveal the presence of osteoporosis.

The prevalence of osteoporosis and low bone mass is expected to increase worldwide with increased life-span. Across the globe, the number of individuals with age 65 years and above is expected to increase fivefold from 1990 to 2050, from 323 million to 1.55 billion. This trend alone could result in a 3.7 fold increase in the number of osteoporotic hip fractures worldwide from an estimated 1.7 million in 1999 to a projected 6.3 million in 2050 [5].

Approximately 10 million individuals over the age of 50 in USA, have osteoporosis of the hip. An additional 33.6 million individuals over the age of 50 have low bone mass or osteopenia of the hip and thus are at risk of developing osteoporosis at any site in the skeleton [6].

Population based studies in India show prevalence of osteoporosis in male as 3% and female as 8% (ICMR), [7]. Some studies conducted in India showed the prevalence of osteoporosis as 29% in low socioeconomic women [8]; 28% males and 44% females in rural areas in South India have osteoporosis [9]. When compared to the West, Indians have a lower average peak bone mass which is attributable to poor awareness levels of the importance and intake of calcium and vitamin D, particularly during childhood where the maximum bone mass formation happens.

Common osteoporotic fractures in later life are vertebral, proximal femur, distal forearm, and pelvis particularly in women in their late forties. In women in their fifties, the incidence of vertebral fracture increases rapidly, with a significant
number contributing to crush fractures. The fracture of the proximal femur becomes the most frequent fracture after people are over 70. Roughly 4 in 10 white women experiences fracture of hip, spine or wrist after age 50 till their end of life. Life time risk of getting hip fracture for Caucasian women is 17.5% [10] whereas for Swedish women alone, because of their higher life expectancy, the hip fracture is 14 -23% [11]. Japanese data estimates the fracture of spine in Japanese women to be as high as or more than the Caucasians and reports the fracture of hip to be low (12%) [12].

Based on 2001 census, approximately 163 million Indians are above the age of 50; this number is expected to increase to 230 million by the year 2015. Even conservative estimates suggest that, of these, 20% of women and 10-15% of men would be osteoporotic. The total affected population would therefore, be around 25 million. The lower bone density is shown to confer a greater risk of fracture, as is expected, and touched 50 million in India in the year 2008 [13]. This is expected to rise significantly with increase in the aging population and continued improvement in the life expectancy. As a person ages, the change in the site of fracture is probably related to the loss of bone mass at these specific locations. Fractures that occur in elderly patients have consequences on their quality of life, resulting in morbidity and even mortality.

Addressing to a group of people on world osteoporosis day 20th October 2010 in Bengaluru city, Dr. Mahesh Bijjawara, Spine Surgeon, Member of Association of Spine Surgeons of India (ASSI) said that there are two interesting features about the Osteoporosis in India - the high incidence among men and the lower age of peak incidence as compared to Western countries.

In Western countries, while the peak incidence of Osteoporosis occurs at 70-80 years of age, in India it afflicts those at age 50-60. Osteoporosis not only causes fractures, it makes people confine to bed because of severe back pain, loss of height due to kyphosis, pneumonia and pulmonary thromboembolism.

The factors that are linked to the development of osteoporosis or contribute to an individual's likelihood of developing the disease are called risk factors. Majority of the population have several risk factors for osteoporosis. There are some
risk factors that cannot be changed (non modifiable), and others that can be changed (modifiable).

The most important risk factors for osteoporosis that are categorized as non modifiable are advanced age (in both men and women) and feminine gender; estrogen deficiency following menopause, while in men a decrease in testosterone levels has a comparable (but less pronounced) effect. While osteoporosis occurs in people from all ethnic groups, European or Asian ancestry predisposes for osteoporosis. Those with a family history of fracture or osteoporosis are at an increased risk; the heritability of the fracture as well as low BMD are relatively high, ranging from 25 to 80 percent. Those who have already had a fracture are at least twice vulnerable to have another fracture. A small stature is also a non-modifiable risk factor associated with the development of osteoporosis.

The modifiable risk factors that include are: consumption of excess alcohol, calcium and vitamin D deficiency, tobacco smoking, malnutrition, anorexia nervosa, bulimia, insufficient and excess physical activity, amenorrhea, heavy metals and soft drinks (excess caffeine and phosphoric acid).

International Osteoporosis Foundation (IOF) in 1999[14] stated that “recognizing the global problem posed by osteoporosis, WHO sees the need for a global strategy for prevention and control of osteoporosis, focusing on three major functions: prevention, management and surveillance”.

The goal of treatment and management of osteoporosis is the prevention of bone fractures by stopping bone loss and by increasing bone density and strength. Although early detection and timely treatment of osteoporosis can substantially decrease the risk of future fracture, 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 and management of osteoporosis is more important than treatment which is possible by adapting changes in the lifestyle. This includes controlling body weight, quitting cigarette smoking, controlling alcohol intake, regular exercising, and consuming a balanced diet with required amount of calcium and vitamin D.
Calcium and vitamin D are important for bone health. Bone stores 99% of body’s calcium. Calcium balance is dependent on the absorption rate of calcium consumed as well as the rate of calcium excretion. Calcium that is lost from the body is normally replaced by calcium in the diet. This depends on the food we eat and also the presence of vitamin D which helps in absorption of calcium. When the diet does not contain enough calcium, the body, in order to offset the losses, starts utilizing the calcium from the bone.

Conditions that alter nutritional status as well as other nutrients should also be considered in treating osteopenia and osteoporosis. This consideration also includes nutrients such as vitamin B-12 and vitamin K that may reduce fracture risk by increasing bone mineral density as well as the improvement of bone micro architecture.

Diets high in fruits and vegetables contribute nutrients such as magnesium and potassium that are associated with bone health and may also produce an alkaline environment, reducing calcium excretion and thus improving bone density.

Weight-bearing exercise offers the greatest benefit for the bones, and is an ideal way to help prevent and treat osteoporosis. Adults should engage in at least 30 minutes of moderate physical activity on most (preferably all) days of the week. Exercise helps reduce the risk of osteoporosis and helps to improve the bone mineral density and bone strength [7].

Exercise in the form of Yoga is an ancient practice originated during vedic times in India. It provides integral and holistic health benefits to its practitioners. Yoga is a "step by step" physical exercise. It is also considered as a complete exercise for the physical, mental and psychological well-being [15].

Prevention of osteoporosis should start during adolescence and progress throughout a woman's lifetime. Assessing modifiable risk factors should be an important part of the whole picture of osteoporosis prevention and management. Young women should be counseled to maintain a well-balanced diet, and lead an active lifestyle with weight-bearing exercises [16].
Preventing osteoporosis requires integrated health promotion behaviour. This requires increased awareness about osteoporosis. Adequate ingestion of calcium throughout the lifespan is essential, as is weight-bearing exercise. Once the osteopenia or osteoporosis has set in, management is inevitable. The older woman should be encouraged to continue exercising, maintain an adequate diet, and modify her lifestyle to improve her quality of life and prevent osteoporotic fractures.

**Need for the study**

Osteoporosis is a ‘silent thief’ that robs the mineral calcium from the microskeletal architecture leading to the low BMD. The peak bone mineral density is achieved at the age of 20 years for women and thereafter from 35 years it depletes and accelerates as soon as menopause sets in either naturally or surgically. Osteoporosis is not a fatal disease but the morbidity is high suppressing the quality of life.

Given the health implications of osteoporotic fractures, the primary goal of osteoporosis management is to prevent fractures, which is accomplished by slowing or stopping bone loss, maintaining bone mineral density, and minimizing or eliminating factors that may contribute to fractures. Management should first focus on non pharmacologic measures, such as a balanced diet, adequate calcium and vitamin D intake, adequate exercise and exposure to sunlight. In addition to these factors smoking and excessive alcohol intake should be avoided [4].

A need was felt to study the prevalence of the osteoporosis in women, the age of onset of the disease and related factors leading to the same. As revealed above the modifiable risk factors could be managed with education, diet and exercise. This process is expected to delay the onset of the disease and mange to stop further deterioration by improving the quality of life. In severe conditions medical intervention is inevitable. From the discussions above, it was felt that there is an urgent need for investigations related to low bone mineral density in Indian population. Therefore the present study was framed with the following objectives.
Objectives

The Major objective of the study is

- To find out the Impact of education, dietary supplement and yoga in the management of osteoporosis.

The specific objectives of the study are

- To assess the prevalence of osteopenia and osteoporosis in adult women (41 to 60 years of age)
- To assess the risk factors associated with low bone mineral density leading to osteopenia and osteoporosis.
- To investigate the effect of intervention program with reference to education, dietary supplement and yoga in the management of osteoporosis.

Hypothesis

- Education as such will not improve BMD status and manage osteoporosis.
- Diet supplement as such will not improve BMD status and manage osteoporosis.
- Yoga as such will not improve BMD status and manage osteoporosis.