2 INTRODUCTION

Osteoporosis is a disease characterized by low bone mass, micro-architectural deterioration of bone tissue leading to enhanced bone fragility, and a consequent increase in fracture risk. It is a major cause of morbidity and mortality and medical expense worldwide. In India, it has been found that 29.9% of women and 24.3% of men aged between 20 and 79 years, have low bone mass. Furthermore, about 50% women and 36% of men over 50 years of age are noted to have low bone mass. Osteoporosis affects an estimated 75 million people in the United States, Europe, and Japan combined, including one in three postmenopausal women and majority of the elderly. Osteoporosis causes more than 1,300,000 fractures annually in the United States alone. The disease will be a greater problem in the future, because the world population is aging and the incidence of osteoporotic fractures is increasing in many geographic area. (1, 2)

The primary osteoporosis includes two entities: one related to menopause, estrogen loss and the other to aging. The primary osteoporosis represents two fundamentally different conditions. Type I characterized by loss of trabecular bone owing to estrogen deficiency at menopause and type II osteoporosis characterized by loss of cortical and trabecular bone in men and women owing to long-term remodeling, inefficiency, dietary inadequacy, and activation of the parathyroid axis with age. (3)

The goals of management of osteoporosis are to prevent fractures, to decrease the pain when present and to restore function. Pharmaceutical agents are used to minimize further bone loss (4). In premenopausal conditions, calcium and vitamin D supplementation and estrogen are given for prophylaxis (5). Hormone replacement therapy (5, 6), bafilomycin A1 (7), Tibolone (8), Phytoestrogens (9), Strontium (10), HMG-CoA reductase inhibitors (10), and selective estrogen receptor modulators (5) are used in the treatment of osteoporosis. However, most commonly
calcium and Vitamin D supplementation, estrogen treatment, bisphosphonates and calcitonin administration are widely used for management of osteoporosis (5).

The efficacy of currently used anti-osteoporotic drugs is compromised in several ways. Vitamin D supplementation at higher dose causes hypocalcaemia, hypercalciuria and kidney stone formation. Most commonly estrogen is used for a long term in hormone replacement therapy, but this causes severe adverse effects like breast cancer, endometrial cancer, vaginal bleeding, blood pressure, thromboembolism and blood clot. Therapy with bisphosphonates is associated with irritation of esophagus, abdominal or musculoskeletal pain, nausea and heart burn. Parenteral calcitonin can lead to potential adverse effects including, nausea, vomiting, diarrhoea, anorexia, facial flashing, tingling, skin rash, edema of the feet and pain at the site of injection. The adverse effects of current therapeutic options of osteoporosis, along with their inability to restore lost bone mass and bone remodeling on the other, has raised interest in the study of alternative and complementary medicines for management of osteoporosis. (5)

WHO has approved the use of traditional medicines as a part of health programme. To pursue research in these systems of medicine, several USA agencies and institutions such as FDA and National Institute of Health have setup separate wings. According to the WHO survey, 80% of the populations living in the developing countries rely almost exclusively on traditional medicine for the primary health care needs. In almost all the traditional system of medicine, the medicinal plants play a major role and constitute the backbone of the traditional medicines.

Several bioactive compounds have been isolated from plants so far. However, The potential of plant as a source for new drugs is yet to be unexplored systematically. Among the estimated 250,000-400,000 plant species, only 6% have been studied for biological activity, and about 15% have been investigated phytochemically (11-13).

India has an ancient heritage of traditional system of medicine. Materia medica of India provide lots of information on the folklore practices and traditional
aspects of therapeutically important natural products. Indian traditional medicine is based on various system including Ayurveda, Siddha and Unani. China and UK also have got their own traditional systems of medicine. These traditional systems have their uniqueness no doubt but there is a common thread running through these systems in their fundamental principles and practices. With the emerging interest in the world to adopt and study the traditional systems of medicine and to exploit their potentials, the evaluation of the rich heritage of the traditional medicine is essential.

India has about 45,000 plant species: several medicinal properties have been assigned to several thousand. Plants are source of extremely wide range of chemical components. More than hundred chemical substance of known structure are extracted from plants and are being used as drugs throughout the world. In India, a sound knowledge of use of plants for medicinal purpose has come from Ayurveda, Siddha and Unani Systems of Medicine and these systems are still being practiced in all parts of the country. In many countries it is traditional to use medicinal plants, either a single herb or a polyherbal formulations, to control disease condition. Synthetic agents can produce serious side effects. Compared to synthetic drugs, herbal preparations are generally considered to be less toxic with fewer side effects (14). Therefore the search for more effective and safer therapeutic agents has become an area of current research.

Ayurvedic system of medicines is one of the oldest system of medicine having a history of more than 2000 years. A wide array of herbal and mineral drugs have been reported in ayurvedic texts for osteoporosis, but only few of them have been scientifically evaluated, importantly, *Cissus quadrangularis* Linn (15) *Withania somnifera* (16), *Epimedium brevicornum* Maxim and *Asparagus racemosus*. (17)

However, the crude drugs like *Acacia arabica* (Babul), *Terminalia Arjuna* (Arjun), *Commiphora mukul* (Guggul), *Commiphora myrrha* (Hirabol), *Boswelia serrata* (Salai guggul), *Symlocos racemosa* (Lodhra), *Polygonatum cirrhifolium* (Medalakdi), lac (resin from the lac bug, *Laccifer lacca*), *Urraria picta* (Prisnaparni), *Curcuma amada* (Mango ginger), *Grewia hirsuta* (Nagbala), *Aloe vera* (Aloe) (18), which are claimed to be efficacious in bone remodelling, have still not been
evaluated scientifically for their efficacy against osteoporosis. Hence, it is proposed to undertake a project to evaluate some of these drugs for their efficacy against osteoporosis.