



(REVIEW ARTICLE)



Osteoporosis and lifestyle medicine

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GSC Biological and Pharmaceutical Sciences, 2021, 14(02), 155–164

Publication history: Received on 18 January 2021; revised on 21 February 2021; accepted on 23 February 2021

Article DOI: <https://doi.org/10.30574/gscbps.2021.14.2.0054>

Abstract

Osteoporosis is a major public health threat in this 21st century. It has high prevalence among postmenopausal women & elder patients (age > 60 years). It is a skeletal disorder characterized by compromised bone strength and suffer having greater chances of fractures. Osteoporosis is a condition where bones became weak & brittle that may increase chances of fracture in the patients. According to the WHO criteria, osteoporosis is defined as a bone mineral density (BMD) that lies 2.5 standard deviations or more below the average value for young healthy women (a T-score of <-2.5 SD).

Osteoporosis is occurs due to too much bone mineral density is decreased that results into the changes in the structure of bone. Etiological factors includes advanced age, sex (women > male), sedentary lifestyle, minimal/ absence of sun exposure, smoking, alcohol consumption, hormonal imbalance and disease conditions such as diabetes, malignancies (multiple myeloma, lymphoma, leukemia).

The diagnosis of condition must be confirmed by using spine dual energy X- ray absorptiometry (DXA) with WHO T-score thresholds. Osteopenia or low bone mass is having T-score of -1 to -2.4 & on the basis of T score, it will be classified in to two types that is primary and secondary osteoporosis. Primary osteoporosis more common in disease such as postmenopausal osteoporosis (type1) and senile osteoporosis (type2).

It has severe morbid consequences, the prevention and management of this condition and associated fractures is considered to the essential to the maintenance of health status or quality of life (QoL) of patient. Patient can prevent to suffer from this condition by applying various tools of lifestyle medicines i.e. staying physically active or doing weight bearing exercises. Smoking cessation, moderate alcohol consumption are also became major approaches to manage or prevent occurrence of condition. Nutritious diet rich in calcium, vitamin D, Vitamin A, Vitamin C and other nutrition also play a key role in the management or prevention of disease.

Keywords: Osteoporosis; Lifestyle medicine; Calcium; Vitamin D

1. Introduction

In 21th century Osteoporosis became a major issue in menopausal women & elder patients (age > 60 Years). Osteoporosis is a condition where bones became weak & brittle that may increase chances of fracture in the patients. It effects all the peoples from all races ethnic groups across globe. In this condition quality or anatomical-physiological changes occurs in bone; so decreases strength & flexibility of bone. Due to decreased strength & flexibility of bone can develop chances of fractures. Fractures that usually involves wrist, spine, hip, pelvis, the ribs and humerus(1).

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Sometimes osteoporosis condition referred as, “silent disease”. Silent disease means which doesn’t have any symptoms until any bone fracture event(2). It affects more than 75 million peoples in United States, Europe, and Japan. Annually 8.9 million peoples with osteoporosis had fractures across globe(3).

Osteoporosis is defined as a systemic skeletal disease characterized by low bone mass and micro architectural deterioration of bone tissue, with consequent increase in bone fragility and susceptibility to fractures(4). World Health Organization (WHO) defines osteoporosis on the basis of bone mineral density (BMD). According to the WHO criteria, osteoporosis is defined as a BMD that lies 2.5 standard deviations or more below the average value for young healthy women (a T-score of <-2.5 SD)(5).

Osteoporosis is occurs due to too much bone mineral density is decreased that results into the changes in the structure of bone. Etiological factors includes advanced age, sex (women > male), sedentary lifestyle, minimal/ absence of sun exposure, smoking, alcohol consumption, hormonal imbalance and disease conditions such as diabetes, malignancies (multiple myeloma, lymphoma, leukemia). Different drugs contributes to develop disease condition viz. Chronic systemic glucocorticoids, Excessive thyroxin, Anticonvulsant therapy (e.g., phenytoin, carbamazepine, phenobarbital, valproic acid) Depot medroxyprogesterone acetate, Cytotoxic chemotherapy, Cyclosporine, Gonadotropin-releasing hormone (GnRH) agonists or analogs (e.g., leuprolide), Highly-active antiretroviral therapy for human immunodeficiency virus (e.g., zidovudine, nucleoside reverse transcriptase inhibitors)(4,6,7).

The patient assessment should be done to diagnose fractures related to osteoporosis in high risk group of peoples. Simple useful physical examination includes bone pain assessment, postural changes and loss of height. A spine radiograph may confirm the vertebral fractures. The assessment of condition must be confirmed by using spine dual energy X- ray absorptiometry (DXA) with WHO T-score thresholds. Osteopenia or low bone mass is having T-score of -1 to -2.4 & on the basis of T score, it will be classified in to two types that is primary and secondary osteoporosis. Primary osteoporosis more common in disease such as postmenopausal osteoporosis (type1) and senile osteoporosis (type2)(5,8).

Bone strength is equal to bone mass. Hence bone mass measurement is the main aspect in the diagnosis of osteoporosis. Bone mass is measured by bone mineral density (BMD) or Bone Mineral Content (BMC).BMD of lumbar spine, femur and femoral neck using central (axial) dual energy X-ray absorptiometry (DXA)(4,5). WHO described the criteria for classification of osteoporosis on the basis of bone mineral density as shown in table 1.

Table 1 World Health Organization criteria for diagnosis of osteoporosis on the basis of bone mineral density(5).

Sr. No.	Classification	T Score
1	Normal	-1.0 or greater
2	Osteopenia (Low bone mass)	Between -1.0 and -2.5
3	Osteoporosis	-2.5 and below
4	Severe Osteoporosis	-2.5 and below + fragility fracture.

It has severe morbid consequences, the prevention and management of this condition and associated fractures is considered to the essential to the maintenance of health status or quality of life (QoL) of patient. Patient can prevent to suffer from this condition by staying physically active by doing weight bearing exercises. Smoking cessation, moderate alcohol consumption & nutritious diet rich in calcium, vitamin D also play a key role in the prevention of disease(1,9–13).

1.1. Assessment of risk factors

The various risk factors may contributes to progress disease. Some of the risk factors that cannot be changed but others may be changed. However by understanding these factors, patient/sufferer may be able to prevent disease(8,14,15).

Following are the factors which may often play a key role in the development of condition.

- Age: Risk is increased with increased age. As bones became thinner in later stage of life.
- After 60 years of age male or female are having greater risk to develop osteoporosis symptoms. Sometimes patient may having hospitalization due to fracture/s(14).
- Gender: Women over the age of 50 i.e. postmenopausal phase are the most likely to get osteoporosis. The women having 4 times greater risk to getting osteoporosis than male.
- Family History: If you have family history of osteoporosis then it has greater risk to get symptoms of osteoporosis in late stage of life. If your siblings has history of bone fractures due to osteoporosis then you are more likely to develop condition in later stage of life.
- Body Size: Slim women or men are having risk to get osteoporosis in later stage of life (>60 years). Obesity in female or men in elder age is the greater risk factor to contribute development of condition because overweight have fat inside bone that is responsible to make bone weak and susceptible to get fracture at any stage.
- Race: Ethnicity and race are the important factors which may often to develop condition. The white and Asian women are having greater risk than others. Rate of risk in black women is about 50% lower than white women. While African, American and Mexican have lower risk than others(16).
- Hormone imbalance: Certain hormones can increase chances of development of osteoporosis. It has proven that estrogen level will decreased after menopause. While low level of estrogen in case of abnormal or absence of menstrual periods in premenopausal women due to hormone disturbances(17,18). In case of male patients, low level of testosterone having risk to get symptoms of condition.
- Diet: Junk food intake in daily life is hazardous to the health status of the body. As junk food contains high level of salt or sodium, can causes body to lose calcium. Decreased calcium level is the main aspect to progress pathogenesis of osteoporosis(14,19).
- Disease condition: The various type of disease conditions may contributes to progress disease viz. primary or secondary ovarian failure, Cushing syndrome, disorder of calcium imbalance, chronic liver disease, inflammatory bowel disorders, crohns disesase,rheumatoid arthritis, cystic fibrosis, multiple sclerosis, turner syndrome ,malaborsive states, organ transplantation ,down syndrome, stroke, chronic kidney disease,marfans syndrome, chronic pulmonary obstructive disease(COPD),leukemia, lymphoma.
- Medication use: Certain medication contributes to develop condition viz. cyclosporine, long term proton pumps inhibitors, selective serotonin reuptake inhibitors, aromatase inhibitors, cytotoxic therapy, chronic systemic glucocorticoid, and long term unfractionated heparin, excessive thyroxine, phenytoin, carbamazepine, zidovudine, nucleoside reverse transcriptase inhibitors, and phenobarbital(6).
- Sedentary lifestyle: Physical activity or weight bearing exercise is the main aspect of osteogenesis and ossification. Along with calcium rich diet and vitamin D, maintenance of physical activity is the important aspect to live free from osteoporosis. Peoples who spend lot of time in sitting position have greater risk than others who is engaged in daily physical activities. Now we are living in pandemic era in the form of COVID19, so it is necessary to maintain our daily physical activities to keep health status of body(20).

For the assessment of risk of fractures, world health organization (WHO) released, a fracture risk assessment tool (FRAX) tool. This tool is freely available online (www.shef.ac.uk/FRAX)(7). It evaluate risk of fractures on the basis of clinical risk factors viz. age, gender, BMI, prior history of fracture, long term exposure (more than 3 months) to glucocorticoids, high alcohol intake and smoking.

Table 2 Risk factors for osteoporosis.

Nonmodifiable risk factors	Modifiable risk factors
Advanced age	Smoking & alcohol intake
Gender - Female	Inadequate calcium intake & Vit. D
White- Asian Race	Low BMI (<18 kg/m ²)
Family history of osteoporosis	Hormone deficiency (Estrogen/ testosterone)
Personal history of fracture	Drug abuse e.g. Corticosteroids

Risk factors may often categorized into two categories viz. modifiable means can change or modify to maintain body free from symptoms of osteoporosis. While some are Nonmodifiable are those who doesn't change in spite of lot of efforts to be taken. Following are the examples of Nonmodifiable as well as modifiable risk factors(3,6,14). (Table 2)

1.2. Complications

It is essential to confirm the diagnosis of osteoporosis, identify underlying disease that if osteoporosis not treated within time, will convert into various forms of complications(21). Development of complication is a slow process while it may often develop a chronic condition. The possible complications include fractures and deformities, bone cancer and other bone related conditions. The most common complication is patient suffering from low trauma fractures. Fractures possibly related to vertebral columns, proximal femur, and distal radius. Osteoporosis fractures can lead to increased mortality or morbidity and it may often decrease quality of life (QoL) of typical patient. It can also limit to the patient's physical activity. Sometimes it may causes vertebral compression then results into neurological complications(4,15).

It's related to immobility of bones; sometimes it may results into bone cancer i.e. osteosarcoma. It may often occurs in long bones of the arms and legs. Finally bone metastasis can cause severe osteopenia and fractures(3,22).

1.3. General approaches in the management of Osteoporosis

It is necessary to maintain healthy lifestyle for good health status throughout the life. Bone related healthy lifestyle practices include adequate intake of vitamin D, calcium, and other essential nutritional items(9,22).

First step in the management of this condition in adult patient is to assess and diagnose disease on the basis of laboratory investigations. Along with laboratory investigations, it is necessary to assess physical examinations, history (family history, social history, medical history, medication history) and special investigations can cause osteoporosis. Along with these parameters, to assess the role of medical history, medication history, social history to contribute to progress disease(9,16,22).

While to treat osteoporosis symptoms, initially patient receives medications. Bisphosphonates are the drug of choice to manage symptoms of osteoporosis (T-score less than -2.0

Or less than -1.5). Management of this condition include both pharmacological as well as nonpharmacological strategies(6).

Primary goal is to prevent condition if possible. Since birth child and their parents should engage in skeletal development and maintenance of bone mineral density by ensuring vitamin D and calcium intake. If patient diagnosed with disease condition & felt symptoms such as osteopenia then patient should receive medication therapy as well as nutritional supplement along with counselling regarding exercise very soon(23).

1.4. Lifestyle interventions in the prevention & management of Osteoporosis

It is necessary to do certain modifications for the management or prevention of osteoporosis. Various lifestyle key factors are key elements in the prevention and management of osteoporosis. Healthy lifestyle changes include diet, smoking cessation, exercise, fall prevention, and hip protectors(8).

1.5. Dietary modifications

It is an important aspect for osteogenesis or bone development. Adequate nutrition is required for maintenance of bone mass. In order to keep bone healthy, limit to the intake of caffeine, alcohol, sodium, and other carbonated beverages. Because of excessive consumption of caffeine can cause increased calcium excretion thereby decreases bone mineral density(8,12,21). Ideally moderate caffeine consumption (2- 4 servings/day) is somewhat extent good. Excessive alcohol intake can decrease level of calcium & vitamin D(3,5,8,12,14,17,21). People who consumed 0.5 to 1 drink per day had 1.38 times the risk to get osteoporosis. People who consumed 1 to 2 drinks per day had 1.34 times the risk of developing osteoporosis(24). People who consumed 2 drinks or more per day had 1.63 times the risk of developing osteoporosis. As per 2005 dietary guidelines, alcohol intake should not more than one drink for women and for men it will be within two drinks per day. However increased intake of sodium will increases excretion of calcium thereby reduces BMD. For correction of calcium level inside the body, it is necessary to increase intake of calcium and potassium and slow down to the intake of sodium (<2.4 g/day)(12,21,25).

1.6. Calcium intake and its role in the management of osteoporosis

It is necessary to take adequate calcium intake to maintain BMD. As per age group, the level of calcium should be maintained. Calcium rich foods such as milk, yogurt, and other essential nutrients are play a key role to manage calcium level. The following table 3 describes recommended adequate calcium based on age(10,26).

Recommended dietary intake of calcium in milligram (mg) per day:

Table 3 Recommended dietary intake of calcium in milligram (mg) per day(26)

Age	Male	Female	Pregnant	Lactating
0 – 6 months	200	200		
7 – 12 months	260	260		
1 – 3 years	700	700		
4 – 8 years	1000	1000		
9 – 13 years	1300	1300		
14 – 18 years	1300	1300	1300	1300
19 – 50 years	1000	1000	1000	1000
51 – 70 years	1000	1200		
>71 years	1200	1200		

Some food items have rapid absorption but have low elemental calcium e.g. broccoli. Additionally such foods contains oxalic acid or phytic acid that binds calcium within the food thereby decreases calcium absorption e.g. spinach, wheat bran. The calcium absorption from calcium- fortified soy milk is lower than that absorbed from cow's milk. Various evidence suggests that a positive role for no-digestible oligosaccharides (Insulin- type fructans) in enhancing calcium absorption. Dairy products such as milk, yogurt, and cheese are having higher calcium level. Nondairy sources includes vegetables, broccoli and spinach. Some of the food sources and amount of calcium enlisted in table 4(7,11,21,22,25,27).

Table 4 Food sources of calcium with percentage daily value(10,28).

Food	Milligram per serving (mg)	Percentage Daily value (DV)
Yogurt, plain, low fat, 8 ounces	415	32
Orange juice, calcium fortified, 1 cup	349	27
Mozzarella, part skim, 1.5 ounces	333	26
Sardines, canned in oil, with bones, 3 ounces	325	25
Cheddar cheese, 1.5 ounces	307	24
Milk, nonfat, 1 cup	299	23
Soy milk, calcium fortified, 1 cup	299	23
Milk, reduced fat (2% milk fat), 1 cup	293	23
Milk, buttermilk, low-fat, 1 cup	284	22
Milk, whole (3.25% milk fat), 1 cup	276	21
Yogurt, fruit, low fat, 6 ounces	258	20
Tofu, firm, made with calcium sulfate	253	19
Salmon, pink, canned, solids with bone, 3 ounces	181	14
Cottage cheese, 1% milk fat, 1 cup	138	11
Tofu, soft, made with calcium sulfate, ½ cup	138	11
Breakfast cereals, fortified with 10% of the DV for calcium, 1 serving	130	10

Frozen yogurt, vanilla, soft serve, ½ cup	103	8
Turnip greens, fresh, boiled, ½ cup	99	8
Kale, fresh, cooked, 1 cup	94	7
Ice cream, vanilla, ½ cup	84	6
Chia seeds, 1 tablespoon	76	6
Chinese cabbage (broccoli), raw, shredded, 1 cup	74	6
Bread, white, 1 slice	73	6
Tortilla, corn, one, 6" diameter	46	4
Tortilla, flour, one, 6" diameter	32	2
Sour cream, reduced fat, 2 tablespoons	31	2
Bread, whole-wheat, 1 slice	30	2
Kale, raw, chopped, 1 cup	24	2
Broccoli, raw, ½ cup	21	2
Cream cheese, regular, 1 tablespoon	14	1

1.7. Vitamin D (Ergocalciferol) intake and its role in the management of osteoporosis

Vitamin D is also main aspect of prevention of the condition. Vitamin D is synthesized inside the body by sun exposure or from the diet. Dietary sources of vitamin D includes fortified milk, fishes (salmon, herring and sardines), liver and egg yolk. Vitamin D has direct effect on bone muscle strength. The mode of action shown by vitamin D by modulating specific vitamin D receptors present in human muscle tissue. Osteopenia or other related symptoms of osteoporosis can be reversible in early age patient with the intake of vitamin D supplementation. High doses of calcium supplementation will increase risk of soft tissue calcification. While along with supplementation, natural sources of vitamin D is having greater value in the management of condition(7,18,22).

Recommended Dietary allowances for vitamin D:

Table 5 Daily recommended dietary allowances for vitamin D(4).

Age	Male	Female	Pregnancy	Lactation
0 – 12 months	10 µg (400 IU)	10 µg (400 IU)		
1 – 13 years	15 µg (600 IU)	15 µg (600 IU)		
14 – 18 years	15 µg (600 IU)	15 µg (600 IU)	15 µg (600IU)	15 µg (600IU)
19 – 50 years	15 µg (600 IU)	15 µg (600 IU)	15 µg (600IU)	15 µg (600IU)
51 – 70 years	15 µg (600IU)	15 µg (600IU)		
>70 years	20 µg (800IU)	20 µg (800IU)		

Natural sources of vitamins D are certain foods such as cod liver oil, trout (rainbow), salmon (sockeye) mushrooms, milk fat. Also the foods as like soya, almond, and oat milks, vitamin D fortified, ready-to-eat cereal. We can sourced vitamin D from the fishes such as Sardines (Atlantic, Liver, beef, egg, Tuna fish (light). And other foods which contains vitamins are cheese, mushrooms, portabella, raw, Broccoli, carrots, almonds, apple, banana, brown rice, whole wheat, sunflower seeds(22,29).

2. Other nutritional aspects in the prevention & management of osteoporosis

Along with essential nutritional parameters for the development of bone, other nutritional aspects also plays a key role. As Vitamin K is needed to complete carboxylation of proteins such as osteocalcin. In this process of carboxylation, vitamin K is acts as cofactor. Several studies stated that vitamin K deficiency would be the one possible reason for bone loss or increased risk to the fractures. So it is mandatory to fulfill daily needs of other nutritional substances such as vitamin K, Phosphorous/ phosphate intake, Magnesium, sodium, potassium, vitamin A, vitamin C, and other trace elements such as fluoride, boron, copper, zinc. Iron, and manganese(21).

Vitamin K has major role in the carboxylation process. It may also reduce the calcium excretion. The fat soluble vitamin D has major contribution in the development and maintenance of bone mineral density and overall health of bone. Dietary sources of vitamin K are dark green leafy vegetables such as spinach, broccoli and in somewhat extent in fruits(22,24).

In early age the intake of phosphorous/ phosphate is an essential aspect of bone development. It is must to maintain optimal level of phosphorous level. Recommended daily allowances of phosphate intake should be 700 mg/day. Certain foods high in phosphorous include nuts, beans, meat, fishes and other dairy products(30).

Along with other components such as calcium, phosphorous, magnesium has role in the bone development. Bone tissues contains 50 % of the magnesium of total body. It helps to improve BMD(31,32). Magnesium rich foods are vegetables, fruits, legumes, grains, nuts, seeds, dairy and animal products(21).

Sodium intake is also having role with calcium. As high sodium intake and low calcium intake can contribute to the risk of osteoporosis. Moderate consumption of sodium salt is the best option to reduce chances of getting osteoporosis. Recommended daily sodium salt intake is 2300 mg/day(31,33).

Low potassium intake is became one the etiological factor for increased calcium loss. So it is essential to maintain potassium level for bone development. Potassium containing foods include fruits, legumes, milk etc.(34–36).

Vitamin A has key role in bone remodeling. The daily recommended intake of vitamin A is 900 micrograms (μg) for adult men and 700 μg for adult women(8).

As like vitamin A, vitamin C also has main role in the collagen formation. In this process vitamin C acts as cofactor. Daily recommended intake of vitamin C is 75 – 90 mg/ day. Certain foods contains vitamin c viz. citrus fruits such as oranges and oranges juices, blackcurrants, broccoli, strawberries, peppers, potatoes, Brussels sprouts(15).

Protein intake should be balanced to develop healthy bone. The main controversial thing regarding protein intake is that high protein having dual effects i.e. it acts as protective against risk of bone fractures while it may often causes increased urinary calcium excretion(17,18,25).

3. Exercise and its significance in the management of osteoporosis

Several studies concluded that most of fractures in osteoporosis patient is due to sudden falls. The chances of falls can be reduced by regular exercising. Regular exercise helps to increase muscle strength and improve balance of body. Bone mineral density of physically active peoples are higher than those living sedentary lifestyle. The chances of getting osteoporosis is reduced by doing regular exercise. Running, jogging, walking, and functional movements helps to maintain BMD. But in case of elder patients, they must prefer exercises like walking, jogging with the advice of physiotherapist. Weight bearing exercises are having major contribution to develop bone mass and maintaining bone mineral density. The stress is given to the joints and muscles that leads to stimulation of osteoblast activity. Several studies concluded that bone mass gain is done by doing weight bearing exercises regularly(9,14,22,25,37).

Strength training is also one of the best option to maintain BMD because the forces produced by the muscle contraction during exercise has direct effect as loading to the skeletal system. It has dual effects viz. increase bone mineral density and also improves balance thus may often prevent falls. So regular exercise at least 30 min helps to maintain coordination, balance and posture thereby reduces chances of fractures(27,37).

Aerobic exercise can improve or maintain bone mass hence it is helpful to prevent and manage condition. Moderate to vigorous aerobic exercise can improve bone mass of the hip and spine. It also has additional benefits on cardiovascular,

muscular system to maintain healthy status of these system. Rowing is one of the aerobic exercise that has benefit to the spine health. It also include fast walking with speed 8 km/hr. at least for 30 min per day(1,38).

Jumping is also having good effect on bone specially to improve BMD of hip bones. Various studies concluded that middle aged or older women who regularly engaged in resistance exercise with 50 – 100 jumps, three times per week helps to maintain hip bone mass(1,8,27).

In this pandemic situation, we should maintain regular physical activities that has good impact on various system such as cardiovascular system, skeletal system, and muscular system. It improves bone mass and muscle strength.

Regular exercise can helps to maintain bone mass so it is necessary to stay physically active instead of adaptation of sedentary lifestyle(11,20,27,37).

The following table 6 describes exercise recommendations for prevention and management of osteoporosis.

Table 6 Exercise recommendations for prevention and management of osteoporosis as per American College of Sport Medicine, 2018(38,39).

	Aerobic	Resistance	Flexibility
Frequency	4 to 5 days per week	Start with 1 to 2 nonconsecutive days/weeks .may progress to 2 to 3 days/weeks.	5 to 7 days/weeks.
Intensity	Moderate Intensity	Adjust resistance so that the last two rapes are challenging to perform high intensity to training is beneficial in those who can tolerate it.	Stretch to the point of tightness or slight discomfort.
Time	Begin with 20 min. Gradually progress to a minimum of 30 min (with a maximum of 45 to 60 min)	Begins with one set 8 to 12 reps, increase to two sets after 2 weeks no more than 8 to 10 exercises per person.	Hold static stretch for 10 to 30 sec; 2 to 4 reps of each exercise.
Type	Walking, Cycling, jumping, & other type of weight bearing exercises	Standard equipment can be used with adequate instruction and safety consideration.	Static stretching of all major joints.

4. Conclusion

Osteoporosis is became more prevalent in this 21st century because of adaptation of sedentary lifestyle, increased intake of junk foods, smoking and other factors such as hormonal imbalance in postmenopausal women. To prevent this condition, it is mandatory to follow various aspects of lifestyle medicine. It comprises integration of body awareness practices with physical activity programmers in the special population viz. postmenopausal women & elder peoples who having major risk to getting osteoporosis.

Adequate nutrition is required for maintenance of bone mass. In order to keep bone healthy, limit to the intake of caffeine, alcohol, sodium, and other carbonated beverages. Because of excessive consumption of caffeine can cause increased calcium excretion thereby decreases bone mineral density. Regular exercise helps to increase muscle strength and improve balance of body. The chances of getting osteoporosis is reduced by doing regular exercise. Running, jogging, walking, and functional movements helps to maintain BMD. But in case of elder patients, they must prefer exercises like walking, jogging with the advice of physiotherapist. Weight bearing exercises are having major contribution to develop bone mass and maintaining bone mineral density. The stress is given to the joints and muscles that leads to stimulation of osteoblast activity. Several studies concluded that bone mass gain is done by doing weight bearing exercises regularly.

Compliance with ethical standards

Acknowledgments

The Author gratefully acknowledges the continuous support and guidance from Mr. Vishweshwar Dharashive Sir (Principal at Shivlingeshwar College of pharmacy, Latur, India), Mr. Malpani Sir, Dr. Chavan P.R., Mr. Dinesh Gujrathi Sir, Mr. Sameer Shafi Sir, Mr. Ladde Sir, and Mr. Katu Sir.

Disclosure of conflict of interest

All Authors contributed equally and declared that they have no conflict of interest.

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