



# Diet and Osteoporosis

Janice R. Hermann, PhD, RD/LD

Nutrition Education Specialist

## What is Osteoporosis?

Osteoporosis is a gradual loss in bone mineral density. Over time, loss of bone mineral density causes bones to become thin and porous. Fragile bones fracture easily. They can fracture or break from a minor fall or with normal everyday use.

Bone fractures are a common sign of osteoporosis. The spine, hip, and wrist are the most common places for fractures. Unfortunately, because osteoporosis progresses slowly, many people do not realize they have osteoporosis until they fracture a bone.

Osteoporosis affects millions of people in the United States. The effects of osteoporosis go beyond the fracture itself. Fractures, especially hip fractures, can have serious side effects. Up to 20 percent of people with hip fractures die from complications within a year of having a hip fracture. Many people who survive never return to their earlier abilities. Many may not be able to walk, get dressed, use the bathroom, shop for groceries, or cook meals, resulting in a loss of independence.

Bone loss naturally occurs with age; however, osteoporosis does not have to. Building maximum bone mass and bone density reduces bone fracture risk. Diet, exercise, and other lifestyle factors play important roles in maximizing bone mineral density and lowering the risk of osteoporosis and bone fractures.

## Understanding Bone

There are two basic types of bone, cortical and trabecular bone. Cortical bone is the outer shell and is mainly found in the shafts of long bones. Cortical bone has a slow turnover rate. Trabecular bone is the inside part of bone and has a rapid turnover rate. Trabecular bone is found in the vertebrae and pelvis and the ends of the long bones. In osteoporosis, loss of both types of bone occurs, but the majority of loss is trabecular bone.

## Types Of Osteoporosis

There are two main types of osteoporosis Type I (postmenopausal) and Type II (senile).

**Type I:** Type I osteoporosis is characterized by an increased bone breakdown, mainly affecting trabecular bone. Fractures associated with Type I osteoporosis usually occur in the vertebrae, distal radius, and other areas high in trabecular bone.

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Type I osteoporosis primarily occurs among women, and directly relates to decreased estrogen production resulting from menopause. Decreased production of estrogen results in increased bone breakdown and decreased calcium absorption. Type I osteoporosis usually occurs within 10 to 15 years after menopause

**Type II:** Type II osteoporosis results from a gradual loss of both trabecular and cortical bone. Many factors related to aging are felt to contribute to Type II osteoporosis including inadequate calcium intake, decreased calcium absorption, decreased synthesis of vitamin D, and decreased physical activity. These factors lead to a situation in which bone breaks down but never fully reforms. Fractures associated with Type II osteoporosis usually occur in the hip. Type II osteoporosis occurs in both males and females after 70 years of age.

## Factors Affecting Bone Mineral Density

There are many dietary, exercise, and lifestyle factors that affect bone mineral density.

**Genetics and Family History:** Genetics accounts for up to 80 percent of the variation in bone mineral density. A family history of osteoporosis influences the risk for osteoporosis.

**Gender:** Females are more likely than males to develop osteoporosis. At any adult age, females have a lower bone mass and bone density than males. In addition, females tend to have a lower calcium intake during critical years when peak bone mass and density are being formed than males. Females lose bone density due to increased bone breakdown, whereas males lose bone due to decreased bone formation. Females also tend to lose trabecular bone at a greater rate than males. During menopause, females lose the hormone estrogen that helps deposit calcium in bones. As a result, for the first six to eight years after menopause females lose bone mass faster than do males.

**Age:** Many age-related factors contribute to bone loss. The cells that build bone gradually become less active, while those that breakdown bone continue working, resulting in loss of bone strength and density. Calcium intake of older adults are typically low, and calcium absorption decreases after age 65. The kidneys do not activate vitamin D as well

with increasing age. Also, sunlight is needed to form vitamin D, and many older people spend little or no time outdoors in the sunshine. Some of the hormones that regulate bone and calcium metabolism also change with age and accelerate bone mineral withdrawal.

**Calcium:** Calcium is the most abundant mineral in the body. About 99 percent of the calcium in the body is found in the bones and teeth. The remaining one percent is in the blood. Blood calcium functions to regulate the heartbeat, relax muscles, and transmit nerve impulses. In addition, blood calcium has important roles in blood coagulation, acid-base balance and maintaining normal blood pressure.

Although the amount of calcium in the blood is small, it is very important. If enough calcium is not consumed in the diet to maintain the one-percent blood calcium level, calcium will be pulled from the bones. Maintaining blood calcium level is one reason calcium is needed in the diet every day.

Another reason for taking calcium daily is that bones are constantly being reformed. Calcium is constantly being removed from bone while new calcium is constantly being deposited. At any one time, 10 percent of bone is being reformed. The body deposits 600 to 700 milligrams of calcium each day in newly forming adult bones.

The body deposits great amounts of calcium during growth years. This calcium adds length and diameter to the growing bones. After age 20, the body deposits calcium to increase bone density rather than increase the length or diameter. After the age of 30, all people, especially women, lose bone mass at a faster rate than it is reformed. Building a peak bone mass and bone density during adolescent years is critical for lower risk of osteoporosis later in life.

Many Americans do not consume enough calcium. Women and teenage girls fall short of an adequate calcium intake. Teenage girls who do not get enough calcium, do not maximize their peak bone density and may be more prone to bone mineral loss and osteoporosis later in life.

The body cannot make calcium; calcium comes from the diet. The recommended intake for calcium depends on age and stage of life.

#### Dietary Reference Intakes For Calcium and Vitamin D

Age	Calcium (mg/day)	Vitamin D (mcg/day)
Infants (0 to 0.5 year)	210	5
Infants (0.5 to 1 year)	270	5
Children (1 to 3 years)	500	5
Children (4 to 8 years)	800	5
Teenagers (9 to 18 years)	1,300	5
Adults (19 to 50 years)	1,000	5
Adults (51 to 70 years)	1,200	10
Adults (70+ years)	1,200	15
Pregnant or Nursing Teenagers	1,300	5
Pregnant or Nursing Women	1,000	5

Dairy foods are the major dietary source of calcium. These foods also contain other nutrients, such as vitamin D and lactose, which help the body absorb calcium. If milk and dairy products are omitted from the diet, it is very difficult to consume adequate amounts of calcium. This is especially true when milk is not used as a beverage.

Supplementing calcium intake from other food groups requires careful planning because most foods in the other food groups contain only small amounts of calcium. Canned salmon and sardines, when processed with their bones, supply calcium. However, one has to eat the bones to obtain the calcium from these foods. Tofu (soybean curd), provides calcium if it is processed with calcium sulfate. Some dark-green leafy vegetables, such as broccoli, collards, kale, mustard and turnip greens provide calcium. Grains are poor sources of calcium; however, when milk is used to make baked goods these foods provide moderate amounts of calcium. Many processed foods, such as orange juice and breakfast cereals, may be fortified with calcium.

The Dietary Reference Intake (DRI) for calcium is 1,300 milligrams per day for 9- to 18-year-olds, 1,000 milligrams per day for 19- to 50-year-olds and 1,200 milligrams per day for adults over 50 years of age. The tolerable upper intake level (UL) for calcium is 2,500 milligrams per day.

**Vitamin D:** Vitamin D helps with the absorption and deposit of calcium and phosphorous in the bones. Vitamin D is called the “sunshine” vitamin because the body can make vitamin D when the skin is exposed to sunlight. For most people, exposing the hands, face, and arms on a clear summer day for 10 to 15 minutes a few times a week maintains adequate vitamin D synthesis. However, exposure to the sun can also increase the risk of skin cancer. Sunscreens help reduce the risk of skin cancer, but sunscreens with sun protection factors of 8 and above also prevent vitamin D synthesis. To avoid this problem, apply sunscreen after enough time has elapsed to provide sufficient vitamin D synthesis.

Milk is an excellent source of vitamin D because fluid milk is fortified with vitamin D. Cheese, eggs, some fish (sardines and salmon), fortified cereals, and margarine also contain small amounts of vitamin D.

Older adults are at greater risk when they have a low intake of vitamin D. With age, the skin is less efficient at making vitamin D, and older adults may not be outside as much. Older adults may also limit their intake of dairy foods if they have a problem with lactose intolerance.

The Dietary Reference Intake (DRI) for vitamin D is 5 micrograms per day up to 50 years of age. Older adults may be susceptible to low vitamin D levels as a result of being homebound, use of sunblocks, and decreased capacity to synthesize cholecalciferol, the precursor to vitamin D in the skin. As a result, the DRI for vitamin D for adults 51 to 70 years of age is 10 micrograms per day. For adults over 70 years of age, the DRI is 15 micrograms per day. It is possible, through food, calcium, and multivitamin supplements, to get more than the DRI for vitamin D a day. Too much vitamin D is undesirable because the body stores vitamin D, and it can be toxic. As a result, the tolerable upper intake level (UL) for vitamin D is set at 50 micrograms per day.

**Other Dietary Factors:** The total diet, not just calcium and vitamin D, develops and maintains healthy bones. Many nutrients play critical roles in bone development and maintenance including adequate protein, vitamins D, C, B<sub>12</sub>, K, folate; and the minerals calcium, phosphorous, zinc, copper, magnesium, iron, fluoride, and boron. These nutrients function in bone formation, maintaining blood calcium levels, and bone maintenance. The importance of these nutrients must not be ignored. Having an adequate intake of all nutrients is important for forming and maintaining healthy bones.

An adequate intake does not mean an excessive intake. High sodium intakes may increase calcium losses. Excess sodium is excreted from the body and calcium is pulled out along with the sodium. High caffeine intake has also been shown to increase calcium excretion. Excessive alcohol intake is believed to decrease bone formation, and may also result in poor dietary intake of other nutrients essential to bone.

**Physical Activity:** Weight-bearing physical activity is important in maintaining bone. Weight-bearing physical activity places mechanical stress, particularly on the ends of the long bones. Increased mechanical stress stimulates bone remodeling and bone formation, making bones stronger and denser. Decreased mechanical stress results in increased remodeling and decreased bone formation.

Weight-bearing physical activity also strengthens muscles that pull on bones. This action keeps bones strong. Weight-bearing activities also improve coordination, thus reducing the risk of falls and bone injuries.

The benefits of weight-bearing physical activities are site-specific. This means that only the bones used directly in the physical activity are strengthened. It is a good idea to participate in a variety of weight-bearing physical activities. Examples of weight-bearing physical activities include walking, jogging, running, tennis, weight lifting, aerobics, and dancing.

**Smoking:** Cigarette smoking is another risk factor because lowers bone mineral density. Smoking promotes a condition called acidosis, which stimulates bone loss. Smoking also lowers estrogen levels in women, further contributing to bone loss.

**Alcohol:** Excessive alcohol use increases the risk of osteoporosis. Alcohol increases fluid excretion leading to excessive calcium loss in the urine; and alcohol upsets the hormonal balance required for healthy bones. In addition, alcohol slows bone formation, leads to lower bone density and increases the risk of falling. However, alcohol in lesser amounts, does not appear to damage bones.

## Calcium Supplements

It is advisable to get a doctor's recommendation before taking a calcium supplement because there might be reasons that calcium supplements would be unwise or unnecessary. Calcium supplements may help maintain an adequate calcium intake. However, the main source of calcium should come from food, not pills. Foods supply other nutrients the bones need in addition to calcium. Supplements should "supplement" the diet, not "replace" the diet.

There are many types of calcium supplements. Supplements vary in the percent of calcium they provide. Most calcium supplements are well tolerated and are not toxic if used in reasonable amounts. However, they should not be given to individuals who have kidney stones or individuals who form kidney stones. Dolomite and bone meal are two calcium supplements that are NOT recommended because of possible contamination with heavy metals such as lead, mercury, arsenic, and cadmium.

Some calcium supplements contain vitamin D. The body needs vitamin D to absorb calcium; however, the body can make vitamin D with adequate sunlight exposure. For older adults who do not get much sunlight exposure, a calcium supplement containing vitamin D may be beneficial. For adults who do get sunlight exposure, a calcium supplement containing vitamin D may not be necessary.

## References

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## The Oklahoma Cooperative Extension Service

### *Bringing the University to You!*

The Cooperative Extension Service is the largest, most successful informal educational organization in the world. It is a nationwide system funded and guided by a partnership of federal, state, and local governments that delivers information to help people help themselves through the land-grant university system.

Extension carries out programs in the broad categories of agriculture, natural resources and environment; family and consumer sciences; 4-H and other youth; and community resource development. Extension staff members live and work among the people they serve to help stimulate and educate Americans to plan ahead and cope with their problems.

Some characteristics of the Cooperative Extension system are:

- The federal, state, and local governments cooperatively share in its financial support and program direction.
- It is administered by the land-grant university as designated by the state legislature through an Extension director.
- Extension programs are nonpolitical, objective, and research-based information.
- It provides practical, problem-oriented education for people of all ages. It is designated to take the knowledge of the university to those persons who do not or cannot participate in the formal classroom instruction of the university.
- It utilizes research from university, government, and other sources to help people make their own decisions.
- More than a million volunteers help multiply the impact of the Extension professional staff.
- It dispenses no funds to the public.
- It is not a regulatory agency, but it does inform people of regulations and of their options in meeting them.
- Local programs are developed and carried out in full recognition of national problems and goals.
- The Extension staff educates people through personal contacts, meetings, demonstrations, and the mass media.
- Extension has the built-in flexibility to adjust its programs and subject matter to meet new needs. Activities shift from year to year as citizen groups and Extension workers close to the problems advise changes.

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