



Diet and Osteoporosis

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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.

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 density reduces bone fracture risk. Diet, exercise and other lifestyle factors play important roles in maximizing bone 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.

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 a majority 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.

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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. Vitamin D is needed to absorb and deposit calcium in the bones. 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.

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.

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.

Vitamin D: Vitamin D helps with the absorption and deposit of calcium in the bones. 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 of osteoporosis 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.

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, B₁₂, 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.

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

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 harmful if used in reasonable amounts. However, individuals who have kidney stones should check with their health care provider before taking calcium supplements.

References

- Whitney, E.N. & Rolfes, S.R. (2015). *Understanding Nutrition*, 14th ed., Wadsworth, Cengage Learning, Belmont, CA.
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Dietary Reference Intakes For Calcium and Vitamin D

Age	Calcium (mg/day)	Vitamin D (IU/day)
Youth 9-13 years	1,300	600
Youth 14-18 years	1,300	600
Males 19-50 years	1,000	600
Males 51-70 years	1,000	600
Males 71+ years	1,200	800
Females 19-50 years	1,000	600
Females 51-70 years	1,200	600
Females 71+ years	1,200	800
Pregnant females 14-18 years	1,300	600
Pregnant females 19-50 years	1,000	600

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