Patient education: Osteoporosis prevention and treatment (Beyond the Basics)

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Literature review current through: Feb 2021. | **This topic last updated:** Feb 04, 2021.

OSTEOPOROSIS OVERVIEW

Osteoporosis is a common problem that causes your bones to become abnormally thin, weakened, and easily broken (fractured). Women are at a higher risk for osteoporosis after menopause due to lower levels of estrogen, a female hormone that helps to maintain bone mass.

Fortunately, preventive treatments are available that can help to maintain or increase your bone density. If you have already been diagnosed with osteoporosis, therapies are available that can slow further loss of bone or increase bone density.

This topic review discusses the therapies available for the prevention and treatment of osteoporosis. A separate topic discusses bone density testing. (See "Patient education: Bone density testing (Beyond the Basics)".)

OSTEOPOROSIS PREVENTION

Some of the most important aspects of preventing osteoporosis include eating a healthy diet, getting regular exercise, and avoiding smoking. These recommendations apply to men and women.

Diet — An optimal diet for bone health involves making sure you get enough protein and calories as well as plenty of calcium and vitamin D, which are essential in helping to maintain proper bone formation and density.

Calcium intake — Experts recommend that premenopausal women and men consume at least 1000 mg of calcium per day; this includes calcium in foods and beverages plus supplements (eg, pills), which you might need if you don't get enough calcium from your diet. Postmenopausal women should consume 1200 mg of calcium per day (total of diet plus supplements). However, you should not take more than 2000 mg calcium per day, due to the possibility of side effects. (See "Patient education: Calcium and vitamin D for bone health (Beyond the Basics)".)

The main dietary sources of calcium include milk and other dairy products, such as cottage cheese, yogurt, and hard cheese, and green vegetables, such as kale and broccoli (table 1). A rough method of estimating your dietary calcium intake is to multiply the number of dairy servings you consume each day by 300 mg. Examples of a serving include 8 oz of milk (236 mL) or yogurt (224 g), 1 oz (28 g) of hard cheese, or 16 oz (448 g) of cottage cheese.

If you don't get enough calcium through your diet, your health care provider might suggest supplements. Supplements come in the form of calcium carbonate or calcium citrate. Calcium carbonate works best when taken with food, while calcium citrate can be taken on an empty stomach. Your provider can help you decide which supplement to take if you're not sure (table 2). Supplements are often recommended for women since they are at higher risk of developing osteoporosis and they often don't consume enough through foods and beverages. If you need to take more than 500 to 600 mg/day of calcium in supplement form, you should take it in separate doses (eg, once in the morning and again in the evening).

Vitamin D intake — Experts recommend that men over 70 years and postmenopausal women (ie, women who no longer have monthly periods) consume 800 international units (20 micrograms) of vitamin D each day. This dose appears to reduce bone loss and fracture rate in older women and men who have adequate calcium intake (see 'Calcium intake' above). Although the optimal intake has not been clearly established in premenopausal women or in younger men with osteoporosis, 600 international units (15 micrograms) of vitamin D daily is generally suggested.

Milk supplemented with vitamin D is a primary dietary source of vitamin D; it contains approximately 100 international units (2.5 micrograms) per 8 oz (236 mL). Another good source is salmon, with approximately 800 international units (20 micrograms) per 3 oz (98 g) serving. Other foods, such as orange juice, yogurt, and cereal, are also available with added vitamin D (table 3). Many people do not get enough vitamin D from their diet; your health care provider might suggest a supplement to help reduce your risk of osteoporosis.

Alcohol — Drinking a lot of alcohol (more than two drinks a day) can increase your risk of fracture.

Exercise — Exercise may decrease fracture risk by improving bone mass in premenopausal women and helping to maintain bone density in women who have been through menopause. Furthermore, exercise can strengthen your muscles, improve your balance, and make you less likely to have a fall that could lead to fracture or other injury. Most experts recommend exercising for at least 30 minutes three times per week. Many different types of exercise, including resistance training (eg, using free weights or resistance bands), jogging, jumping, and walking, are effective.

The benefits of exercise are quickly lost if you stop exercising. Finding a regular exercise regimen that you enjoy doing improves your chances of keeping up the habit over the long term. (See "Patient education: Exercise (Beyond the Basics)".)

Smoking — Avoiding or quitting smoking is strongly recommended for bone health because smoking cigarettes is known to speed bone loss. One study suggested that women who smoke one pack per day throughout adulthood have a 5 to 10 percent reduction in bone density by menopause, resulting in an increased risk of fracture. (See "Patient education: Quitting smoking (Beyond the Basics)".)

Avoiding falls — Falling significantly increases the risk of osteoporotic fractures in older adults. Taking measures to prevent falls can decrease the risk of fractures. Such measures may include the following:

- Removing loose rugs and electrical cords or any other loose items in the home that could lead to tripping, slipping, and falling.
- Providing adequate lighting in all areas inside and around the home, including stairwells and entrance ways.
- Avoiding walking on slippery surfaces, such as ice or wet or polished floors.
- Avoiding walking in unfamiliar areas outside.

- Reviewing drug regimens to replace medications that may increase the risk of falls with those that are less likely to do so.

- Visiting an ophthalmologist or optometrist regularly to check your vision.

Medications that increase risk — Certain medications can increase bone loss, especially if used at high doses or over a long time. In some cases, you can reduce your risk of osteoporosis by stopping the medication, reducing the dose, or switching to a different medication. Medications that may increase bone loss include the following:

- Glucocorticoid medications (eg, prednisone)
- Heparin, an "anticoagulant" medication used to prevent and treat abnormal blood clotting
- Certain antiepileptic drugs (eg, phenytoin, carbamazepine, primidone, and phenobarbital)
- Aromatase inhibitors for the treatment of breast cancer (eg, letrozole, anastrozole)

OSTEOPOROSIS SCREENING

Experts suggest screening for osteoporosis for women 65 years and older and for women under 65 who have gone through menopause and have risk factors (such as past fracture, certain medical conditions or medications, or cigarette or alcohol use). Screening involves physical examination, discussion of the person's history, and measurement of bone density through imaging tests. Bone density testing is discussed in more detail separately. (See "Patient education: Bone density testing (Beyond the Basics)".)

OSTEOPOROSIS TREATMENT

The measures discussed above can help to prevent osteoporosis or reduce your risk of fracture if you already have osteoporosis. Depending on your situation, your health care provider may also recommend medication or hormonal therapy. Most people at high risk for fracture are treated with drugs that slow the breakdown and removal of bone (antiresorptive drugs). For people with severe osteoporosis at very high risk for fracture, a drug that stimulates new bone formation (anabolic drug) is sometimes prescribed.

Who needs treatment with medication? — People with the highest risk of fracture are the ones most likely to benefit from drug therapy.

- **Postmenopausal women and older men** – In the United States, the National Osteoporosis Foundation (NOF) recommends use of a medication to treat postmenopausal women (and

men ≥50 years) with a history of hip or vertebral (spine) fracture or with osteoporosis on bone density testing (T-score ≤-2.5). T-scores are numbers that doctors use to measure bone density based on the way your bones look on imaging (table 4).

In addition, the NOF recommends treatment with medication for low bone density (T-score between -1.0 and -2.5) and an estimated 10-year risk of hip or major osteoporosis-related fracture ≥3 or ≥20 percent, respectively. You can estimate your risk of fracture using the Fracture Risk Assessment Tool (FRAX) calculator; click on Calculation Tool, and select your region and country to begin.

However, some people who do not meet the above criteria may benefit from a medication to prevent fractures. Your health care provider can talk to you about the risks and benefits and help you make a decision about treatment.

- **Premenopausal women** – The relationship between bone density and fracture risk in **premenopausal** women (ie, those who have not yet gone through menopause) is not well defined. A premenopausal woman with low bone density may have little increased risk of fracture. Thus, bone density alone should not be used to diagnose osteoporosis in a premenopausal woman; further evaluation for other potential causes of bone loss is generally recommended.

Antiresorptive drugs

Bisphosphonates — Bisphosphonates are medications that slow the breakdown and removal of bone (ie, resorption). They are widely used for the prevention and treatment of osteoporosis in postmenopausal women. Some of the commonly prescribed bisphosphonates include:

- Alendronate – Alendronate (brand names: Binosto, Fosamax) reduces the risk of vertebral and hip fractures, and it decreases the loss of height associated with vertebral fractures. It is available as a pill that is taken once per day or once per week.

- Risedronate – Risedronate (brand names: Actonel, Atelvia) reduces the risk of both vertebral and hip fractures. Risedronate is approved for both prevention and treatment of osteoporosis. It can be taken once per day, once per week, or once per month.

- Ibandronate – Although ibandronate (brand name: Boniva) reduces the risk of bone loss and vertebral fractures, there is no proof that it reduces the risk of hip fractures, so it is not recommended as often as alendronate and risedronate. Ibandronate (brand name: Boniva) can be used for prevention and treatment of osteoporosis. It is available as a pill that is

taken once per day or once per month. It is also available as an injection that is given into a vein once every three months.

- Zoledronic acid – A once-yearly, intravenous dose of zoledronic acid (sample brand name: Reclast) is also available for the treatment of osteoporosis. This medication is given into a vein (by "IV") over 15 minutes and is usually well tolerated. Zoledronic acid can improve bone density and decrease the risk of vertebral and hip fractures.

  Intravenous zoledronic acid is an appealing alternative for people who cannot tolerate oral bisphosphonates or who prefer a once yearly to a monthly, weekly, or daily regimen. Zoledronic acid is usually given for three years and then discontinued. Your doctor will monitor your bone density to see if it needs to be restarted.

Instructions for oral bisphosphonates — Oral bisphosphonates need to be taken first thing in the morning on an empty stomach with a full 8 oz glass of plain (not sparkling) water. You then need to wait for a half hour or an hour, depending on which one you take, before eating or taking any other medications:

- Alendronate or risedronate – If you take either of these drugs, wait at least **half an hour**.
- Ibandronate – If you take this drug, wait at least **one hour**.

These instructions help ensure that the drugs will be absorbed and also reduce the risk of side effects and potential complications.

A "delayed-release" formulation of risedronate is also available. Unlike immediate-release risedronate and other oral bisphosphonates, delayed-release risedronate is taken immediately after breakfast and with at least 4 ounces of water.

After taking any oral bisphosphonate, remain upright (sitting or standing) for at least 30 minutes to minimize the risk of acid reflux and other gastrointestinal side effects. (See 'Side effects of bisphosphonates' below.)

If you are at high risk for breaking a bone, you can safely take osteoporosis medicines for many years. However, most people can stop taking alendronate, risedronate, or ibandronate after five years. This is because these drugs have residual benefit, even after you stop them. This approach also minimizes side effects from long-term use. Your doctor will continue to monitor your bone density to determine if you need to start medication again.

Side effects of bisphosphonates — Most people who take bisphosphonates do not have any serious side effects related to the medication. However, it is important to closely follow the

instructions if taking the medication by mouth; lying down or eating sooner than the recommended time after a dose increases the risk of stomach upset.

Side effects of intravenous zoledronic acid can include flu-like symptoms within 24 to 72 hours of the first dose. This may include a low-grade fever and muscle and joint pain. Treatment with a fever-reducing medication (acetaminophen) generally improves the symptoms. Subsequent doses typically cause milder symptoms.

There has been concern about use of bisphosphonates in people who require invasive dental work. A problem known as osteonecrosis of the jaw has developed in people who used bisphosphonates. The risk of this problem is very small in people who take bisphosphonates for osteoporosis prevention and treatment. However, there is a slightly higher risk of this problem when higher doses of bisphosphonates are given into a vein during cancer treatment.

For people who take bisphosphonates to treat osteoporosis, experts do not think that it is necessary to stop the medication before invasive dental work (eg, tooth extraction or implant). However, people who take a bisphosphonate as part of a treatment for cancer should consult their doctor before having invasive dental work.

Taking bisphosphonates for a long time (eg, seven years or longer) can rarely increase the risk of an unusual type of femur (thigh bone) fracture. Taking bisphosphonates for up to five years for osteoporosis (the usual duration of treatment) is usually not associated with these "atypical" fractures, and the benefits outweigh the risk of this rare side effect.

"Estrogen-like" medications — Certain medications, known as selective estrogen receptor modulators (SERMs), produce some estrogen-like effects in the bone. These medications, which include raloxifene (brand name: Evista) and tamoxifen, provide protection against postmenopausal bone loss. In addition, SERMs decrease the risk of breast cancer in women who are at high risk. Raloxifene can be used for the prevention and treatment of osteoporosis in postmenopausal women, although it may be less effective in preventing bone loss than bisphosphonates or estrogen (see 'Hormone therapy' below). Tamoxifen is usually given to women with breast cancer to reduce the risk of recurrence, or to women who have never had breast cancer but are at high risk of developing it. (See "Patient education: Medications for the prevention of breast cancer (Beyond the Basics)".)

SERMs are not recommended for premenopausal women.

Hormone therapy — In the past, hormone therapy with estrogen or estrogen-progestin was considered the best way to prevent postmenopausal osteoporosis, and it was often used for treatment. Data from the Women's Health Initiative (WHI), a large study designed to find out if

hormone therapy would reduce the risk of coronary heart disease and osteoporosis after menopause, found that combined estrogen-progestin treatment reduced hip and vertebral fracture risk by 34 percent. A similar reduction in fracture risk was seen in women who took estrogen alone. Estrogen had the additional advantage of helping to control menopausal symptoms. However, the WHI found that estrogen plus progestin does not reduce the risk of coronary artery disease, and it slightly increases the risk of breast cancer, stroke, and blood clots in postmenopausal women. More information about the WHI is available elsewhere. (See "Patient education: Menopausal hormone therapy (Beyond the Basics)".)

Thus, estrogen is **not** recommended for the treatment or prevention of osteoporosis in postmenopausal women. However, some postmenopausal women continue to use estrogen, including women with persistent menopausal symptoms and those who cannot tolerate other types of osteoporosis treatment. Women who take estrogen do not need additional drugs to prevent bone loss.

Estrogen may be an appropriate treatment for prevention of osteoporosis in young women whose ovaries do not make estrogen. This treatment may be given as a skin patch or orally, such as a birth control pill. (See "Patient education: Absent or irregular periods (Beyond the Basics)".)

Denosumab — Denosumab (brand name: Prolia) is an antibody directed against a specific protein involved in the formation of cells that break down bone. Denosumab improves bone mineral density and reduces fracture in postmenopausal women with osteoporosis. It is given as an injection under the skin once every six months. Although denosumab is generally well tolerated, side effects can include skin infections (cellulitis) and eczema. A mild transient lowering of blood calcium levels has also been reported, but this is not usually a problem in patients with good kidney function, who are taking enough calcium and vitamin D.

Denosumab is usually reserved for people who are intolerant of or unresponsive to oral and/or intravenous bisphosphonates.

Stopping denosumab results in bone loss within a relatively short time. An increased risk for vertebral fracture has been reported after stopping denosumab. If you need to stop taking denosumab, your doctor will prescribe an alternative medication to prevent rapid bone loss.

Calcitonin — Calcitonin is a hormone produced by the thyroid gland that, together with parathyroid hormone (PTH), helps to regulate calcium concentrations in the body. Calcitonin is no longer used to treat osteoporosis, because other available options (eg, bisphosphonates) are more effective for the prevention of bone loss and reduction of fracture risk. In addition, there is concern about the long-term use of calcitonin for osteoporosis and an increase in cancer

rates. However, due to its pain-relieving effects, calcitonin may be suggested as short-term therapy for people who have acute pain due to vertebral fractures. The treatment regimen is typically changed once the acute pain subsides or if the pain fails to improve over a prolonged period (eg, four weeks).

Calcitonin may be administered as a nasal spray or injection. Most people prefer the nasal spray due to ease of use and because the injections tend to cause more nausea and flushing. (See "Calcitonin in the prevention and treatment of osteoporosis".)

Anabolic agents — Anabolic agents are usually only recommended for people with severe osteoporosis. Anabolic agents are unique osteoporosis drugs in that they work by stimulating bone formation. The other medications described above (anti-resorptives) work by reducing bone resorption.

Anabolic agents used in the treatment of osteoporosis are discussed below.

Parathyroid hormone/parathyroid hormone-related protein — Clinical trials suggest that PTH and parathyroid hormone-related protein (PTHrP) are effective in the treatment of osteoporosis in postmenopausal women and in men, and that these drugs are more effective than anti-resorptives. These drugs reduce the risk of vertebral and nonvertebral fractures.

PTH (teriparatide; brand name: Forteo) or a PTHrP analog (abaloparatide; brand name; Tymlos) are given by a daily subcutaneous (under the skin) injection. These are available in multi-dose, prefilled pens so people can give themselves injections at home. They are only used for up to two years, then replaced with an antiresorptive drug.

Romosozumab — Romosozumab (brand name: Evenity) is a medicine that blocks a protein in the body. This protein usually stops new bone from being formed. Blocking the protein allows the body to make new bone. Romosozumab has been shown to decrease vertebral and nonvertebral fractures. It is given by a monthly subcutaneous injection (administered by a health care professional) and is only used for up to one year, then replaced with an antiresorptive drug.

MONITORING RESPONSE TO TREATMENT

If you take medication to prevent or treat osteoporosis, your doctor will monitor you to see how well it is working. This typically includes measurement of bone mineral density with dual-energy x-ray absorptiometry (DXA) (see "Patient education: Bone density testing (Beyond the Basics)").

Some people also get blood or urine tests; these can give information about the rate of bone turnover (ie, how quickly old bone is resorbing and new bone is forming).

WHERE TO GET MORE INFORMATION

Your health care provider is the best source of information for questions and concerns related to your medical problem.

This article will be updated as needed on our website (www.uptodate.com/patients). Related topics for patients, as well as selected articles written for health care professionals, are also available. Some of the most relevant are listed below.

Patient level information — UpToDate offers two types of patient education materials.

The Basics — The Basics patient education pieces answer the four or five key questions a patient might have about a given condition. These articles are best for patients who want a general overview and who prefer short, easy-to-read materials.

Patient education: Osteoporosis (The Basics)
Patient education: Menopause (The Basics)
Patient education: Calcium and vitamin D for bone health (The Basics)
Patient education: Vitamin D deficiency (The Basics)
Patient education: Bone density testing (The Basics)
Patient education: Exercise (The Basics)
Patient education: Primary hyperparathyroidism (The Basics)
Patient education: Paraplegia and quadriplegia (The Basics)
Patient education: Aseptic necrosis of the hip (The Basics)
Patient education: Hip fracture (The Basics)
Patient education: Vertebral compression fracture (The Basics)
Patient education: Medicines for osteoporosis (The Basics)
Patient education: Monoclonal gammopathy of undetermined significance (The Basics)

Beyond the Basics — Beyond the Basics patient education pieces are longer, more sophisticated, and more detailed. These articles are best for patients who want in-depth information and are comfortable with some medical jargon.

Patient education: Bone density testing (Beyond the Basics)
Patient education: Calcium and vitamin D for bone health (Beyond the Basics)
Patient education: Menopausal hormone therapy (Beyond the Basics)

Patient education: Non-estrogen treatments for menopausal symptoms (Beyond the Basics)
Patient education: Exercise (Beyond the Basics)
Patient education: Quitting smoking (Beyond the Basics)
Patient education: Medications for the prevention of breast cancer (Beyond the Basics)
Patient education: Absent or irregular periods (Beyond the Basics)

Professional level information — Professional level articles are designed to keep doctors and other health professionals up-to-date on the latest medical findings. These articles are thorough, long, and complex, and they contain multiple references to the research on which they are based. Professional level articles are best for people who are comfortable with a lot of medical terminology and who want to read the same materials their doctors are reading.

The use of bisphosphonates in postmenopausal women with osteoporosis
Calcitonin in the prevention and treatment of osteoporosis
Calcium and vitamin D supplementation in osteoporosis
Clinical manifestations, diagnosis, and evaluation of osteoporosis in men
Clinical manifestations, diagnosis, and evaluation of osteoporosis in postmenopausal women
Evaluation and treatment of premenopausal osteoporosis
Metabolic bone disease in inflammatory bowel disease
Evaluation and treatment of low bone mass in primary biliary cholangitis (primary biliary cirrhosis)
Overview of the management of osteoporosis in postmenopausal women
Pathogenesis of osteoporosis
Menopausal hormone therapy in the prevention and treatment of osteoporosis
Screening for osteoporosis in postmenopausal women and men
Treatment of osteoporosis in men
Use of biochemical markers of bone turnover in osteoporosis

The following organizations also provide reliable health information.

- National Library of Medicine

  (www.nlm.nih.gov/medlineplus/healthtopics.html)

- Osteoporosis and Related Bone Diseases National Resource Center

Toll-free: (800) 624-BONE (2663)
TTY: (202) 466-4315
(www.bones.nih.gov/health-info/bone/bone-health/nutrition/calcium-and-vitamin-d-important-every-age)

- National Osteoporosis Foundation

Phone: (202) 223-2226
(www.nof.org)

- National Women's Health Resource Center (NWHRC)

Toll-free: (877) 986-9472
(www.healthywomen.org)

- Osteoporosis Society of Canada

Phone: (416) 696-2663 x 294
(www.osteoporosis.ca/)

- Hormone Health Network

(www.hormone.org, available in English and Spanish)

Topic 2160 Version 31.0

GRAPHICS

Foods and drinks with calcium

Food	Calcium in milligrams
Milk (skim, 2%, or whole; 8 oz [240 mL])	300
Yogurt (6 oz [168 g])	250
Orange juice (with calcium; 8 oz [240 mL])	300
Tofu with calcium (0.5 cup [113 g])	435
Cheese (1 oz [28 g])	195 to 335 (hard cheese = higher calcium)
Cottage cheese (0.5 cup [113 g])	130
Ice cream or frozen yogurt (0.5 cup [113 g])	100
Soy milk (8 oz [240 mL])	300
Beans (0.5 cup cooked [113 g])	60 to 80
Dark, leafy green vegetables (0.5 cup cooked [113 g])	50 to 135
Almonds (24 whole)	70
Orange (1 medium)	60

Graphic 67824 Version 6.0

Examples of calcium supplements

	Elemental calcium per tablet	Calcium compound	Vitamin D
Caltrate 600 + D3	600 mg	Carbonate	800 units (20 mcg)
Caltrate 600 + D3 Soft Chews	600 mg	Carbonate	800 units (20 mcg)
Caltrate Gummy Bites	250 mg	Tribasic calcium phosphate	400 units (10 mcg)
Caltrate 600 + D3 Plus Minerals Chewables	600 mg	Carbonate	800 units (20 mcg)
Caltrate 600 + D3 Plus Minerals Minis	300 mg	Carbonate	800 units (20 mcg)
Citracal Petites	200 mg	Citrate	250 units (6.25 mcg)
Citracal Maximum	315 mg	Citrate	250 units (6.25 mcg)
Citracal Plus Magnesium & Minerals	250 mg	Citrate	125 units (3.12 mcg)
Citracal + D Slow Release	600 mg	Citrate + carbonate blend	500 units (12.5 mcg)
Citracal Calcium Gummies	250 mg	Tricalcium phosphate	500 units (12.5 mcg)
Citracal Calcium Pearls	200 mg	Carbonate	500 units (12.5 mcg)
Os-Cal Calcium + D3	500 mg	Carbonate	200 units (5 mcg)
Os-Cal Extra + D3	500 mg	Carbonate	600 units (15 mcg)
Os-Cal Ultra	600 mg	Carbonate	500 units (12.5 mcg)
Os-Cal Chewable	500 mg	Carbonate	600 units (15 mcg)
Tums	200 mg	Carbonate	–
Tums Extra Strength	300 mg	Carbonate	–
Tums Ultra Strength	400 mg	Carbonate	–
Tums Chewy Delights	400 mg	Carbonate	–
Viactiv Calcium plus D + K	650 mg	Carbonate	500 units (12.5 mcg)

These are examples of calcium supplements. You can also find other brands, as well as generic versions, in most drug stores.

Ca: calcium.

Graphic 70454 Version 9.0

Selected food sources of vitamin D[1]

Food	Amount per serving	
	In international units (IU)	In micrograms
Cod liver oil, 1 tablespoon (15 mL)	1360	34
Salmon (sockeye), cooked, 3 ounces (85 g)	380 to 570*	9.5 to 14*
Mushrooms that have been exposed to ultraviolet light to increase vitamin D, 3 ounces (85 g) (not yet commonly available)	889	22.3
Mackerel, cooked, 3 ounces (85 g)	388	9.7
Tuna fish, canned in water, drained, 3 ounces (85 g)	40 to 68	1 to 2
Milk, nonfat, reduced fat, and whole, vitamin D-fortified, 8 ounces (240 mL)	100	2.5
Orange juice fortified with vitamin D, 8 ounces (240 mL) (check product labels, as amount of added vitamin D varies)	100	2.5
Yogurt, fortified with vitamin D, 6 ounces (180 mL) (more heavily fortified yogurts provide more of the DV)	80	2
Margarine, fortified, 1 tablespoon (15 g)	60	1.5
Sardines, canned in oil, drained, 2 sardines	46	1
Liver, beef, cooked, 3.5 ounces (100 g)	46	1
Ready-to-eat cereal, fortified with vitamin D, 6 to 8 ounces (227 g) (more heavily fortified cereals might provide more of the DV)	40	1
Egg, 1 whole (vitamin D is found in yolk)	25	0.6
Cheese, Swiss, 1 ounce (29 g)	6	0

In the United States, reference values are listed on food labels as a percentage of DVs (%DV), based on a 2000 calorie daily energy intake.

DV: daily value; %: percent.
* Vitamin D content of fish varies substantially even within species. Wild salmon tends to have higher vitamin D content than farmed salmon.

Reference:

1. US Department of Agriculture, Agricultural Research Service. USDA Nutrient Database for Standard Reference, Release 28, 2017.

Graphic 77982 Version 7.0

Definitions of normal bone density, osteopenia, and osteoporosis

T-score	Bone density
+1 to –1	**Normal bone density** Bone density that is between 0 and 1 SD below the mean is considered to be normal. This may be reported as a T-score of +1 to –1. Treatment is not usually recommended for people with normal bone density, although preventive measures (eg, calcium supplements, weightbearing exercise) are recommended to prevent osteopenia and osteoporosis.
Between –1 and –2.5	**Osteopenia** Bone density that is between 1 and 2.5 SD below the mean is called osteopenia. A person with osteopenia does not yet have osteoporosis but is at risk of developing it if not treated.
–2.5 or less	**Osteoporosis** Osteoporosis is defined as a BMD 2.5 or more SD below the mean of normal young women. The lower the bone density, the greater the risk of fracture.

The WHO has defined normal bone density as a value within 1 SD from average peak bone mass. SD is a statistical measure that defines how much a patient's result varies from the "average" young adult.

SD: standard deviation; BMD: bone mineral density; WHO: World Health Organization.

Graphic 74669 Version 5.0

Contributor Disclosures

Harold N Rosen, MD Nothing to disclose **Clifford J Rosen, MD** Nothing to disclose **Jean E Mulder, MD** Nothing to disclose

Contributor disclosures are reviewed for conflicts of interest by the editorial group. When found, these are addressed by vetting through a multi-level review process, and through requirements for references to be provided to support the content. Appropriately referenced content is required of all authors and must conform to UpToDate standards of evidence.

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