

QUESTIONS & ANSWERS

about **CALCIUM** *and* **VITAMIN D**

IOWA STATE UNIVERSITY
Extension and Outreach



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UNDERSTANDING THE ROLE OF CALCIUM

What is calcium and what does it do?

Calcium is a mineral. Most people are familiar with its function in building and maintaining bone, which helps prevent osteoporosis. But it's also important in forming teeth, regulating heart activity and muscle contractions, and helping blood to clot. Research also has shown that calcium may protect against high blood pressure (particularly during pregnancy), colon cancer, and kidney stones.

Are you meeting your daily calcium goal?

Recommendations for calcium are provided by the Dietary Reference Intakes (DRIs) developed by the Institute of Medicine (IOM) of the National Academy of Sciences. For calcium, the Recommended Dietary Allowance (RDA) is the amount determined to meet the needs of approximately 98 percent of the population. A recent IOM report suggests that most people receive enough calcium (with the exception of 9 to 18 year old girls). Other reports suggest many do not get enough calcium including girls 9 to 18 years old, women 50 years and older, vegetarians avoiding dairy foods, individuals with lactose intolerance, individuals with eating disorders, and women who exercise so much they stop having a monthly period (amenorrhea).

RECOMMENDED CALCIUM INTAKE

LIFESTAGE GROUP	RECOMMENDED DAILY ALLOWANCE (mg/day)	UPPER LIMIT (mg/day)
0 to 6 months	200*	1000
7 to 12 months	260*	1500
1 to 3 years	700	2500
4 to 8 years	1000	2500
9 to 18 years	1300	3000
19 to 50 years	1000	2500
51 to 70 year old male	1000	2000
51 to 70 year old female	1200	2000
71+ years	1200	2000
PREGNANT/LACTATING		
14 to 18 years	1300	3000
19 to 50 years	1000	2500

*For infants birth to 12 months recommendation is an AI (Adequate Intake)

To meet the demands of rapid growth, recommendations for 9- and 10-year-olds are as high as those for teenagers.

Since the ability to absorb calcium decreases with age, adults over age 50 need more calcium. The decline in calcium absorption is more likely in women than men and may be related to estrogen deficiency.

Research suggests that pregnant and lactating women have an enhanced ability to absorb calcium; therefore, recommendations are not different than for non-pregnant women.

The Upper Limit (UL) for calcium also is determined by the IOM. Too much calcium can cause constipation, decrease absorption of iron and zinc, and increase the risk of kidney stones for some individuals. Most people would find it challenging to consume the UL of calcium through food alone; it would take 7 to 10 cups of milk for most. Excessive calcium intake is more likely the result of calcium supplementation (see pg 10 for more information on supplementation).

WHERE IS CALCIUM?

Fat is necessary for growth. Low-fat dairy products are not appropriate for children under age two.

Dairy products

Milk-based products, including yogurt and cheese, are naturally high in calcium and are the most common sources of calcium for most people. According to MyPlate and the Dietary Guidelines for Americans, individuals aged two and older should consume two to three cups of dairy products per day. One cup is equal to:

- 1 cup (8 fluid ounces) milk
- 8 ounces yogurt
- 1.5 ounces natural cheese (examples: cheddar, mozzarella)
- 2 ounces processed cheese (example: American)

Lower fat dairy products—such as fat-free and low-fat milk and low-fat yogurt and cheese—contain as much calcium as (and sometimes more than) higher fat dairy products.

LACTOSE INTOLERANCE

About 25 percent of all adults in the United States have a limited ability to digest the sugar in milk (lactose). If an individual lacks the enzyme to digest lactose, consuming dairy products can result in bloating, cramping, gas, and diarrhea.

However, lactose intolerant individuals often can drink small amounts of milk (such as ½ cup) with meals or at various times throughout the day.

Some stores carry enzyme products (e.g., Lactaid®) that can be added directly to milk or can be taken orally to “digest” some of the lactose when dairy products are consumed.

In addition, many calcium-rich foods are naturally low in lactose; for example, aged cheeses, yogurts with live cultures, lactose-reduced milk (e.g., Lactaid®), and calcium-fortified soy beverages.

Plant-based products

When using vegetables to meet calcium needs, be prepared to eat more. It generally takes a greater quantity of vegetables than dairy products to get a similar amount of calcium. In addition, the “absorbability” of calcium from non-dairy products tends to be less than that of dairy products. For example, 25 to 35 percent of the calcium in a cup of milk is absorbed but only about 5 percent of the calcium in spinach is absorbed. On the other hand, more than 50 percent of the calcium in kale is absorbed because it contains only a small amount of oxalic acid, a compound known to decrease calcium absorption (see page 7 for more information about calcium absorption).

Cups of cooked vegetables and legumes needed to provide calcium equivalent to 1 cup of milk:

RECOMMENDED CALCIUM INTAKE

Spinach	1 ¼ cups
Soybeans	2 cups
Chinese cabbage (pak-choi)	2 cups
Navy beans	2½ cups
Kale	3 cups
Garbanzo beans	4 cups
Pinto beans	4 cups
Black beans	6 cups
Kidney beans	6 cups
Peas	10 cups
Lima beans	10 cups
Broccoli	10 cups

Calcium-fortified products

The increased variety of calcium-fortified foods (for example, fruit juices, fruit drinks, tofu, and cereals) makes it easier to meet calcium needs without taking supplements. For example, one cup of calcium-fortified orange juice supplies as much calcium as one cup of milk. Some breads and cereals are calcium-fortified, and even those that aren’t fortified can contribute significantly to calcium intake because they are consumed so frequently.

Calcium and the Nutrition Facts Panel

Calcium is one of the mandatory nutrients required on the Nutrition Facts Panel. The amount of calcium is identified as a percent of the DV (Daily Value). DVs reflect the RDA (established by the IOM), or DRV (established by the FDA when an RDA does not exist), based on a 2000-calorie diet. For calcium, the DV is 1000 mg. The percent DV helps determine if a serving of food is high or low in a nutrient; less than 5 percent is considered low while 20 percent or higher is considered high.

SELECTED FOOD SOURCES OF CALCIUM

FOOD	CALCIUM (mg)	% DV*
Yogurt, plain, low fat, 8 oz	415	42%
Yogurt, fruit, low fat, 8 oz	245-384	25-38%
Sardines, canned in oil, with bones, 3 oz	324	32%
Cheddar cheese, 1 ½ oz shredded	306	31%
Milk, non-fat, 8 fl oz	302	30%
Milk, reduced fat (2% milk fat), no solids, 8 fl oz	297	30%
Milk, whole (3.25% milk fat), 8 fl oz	291	29%
Milk, buttermilk, 8 fl oz	285	29%
Milk, lactose reduced, 8 fl oz**	285-302	29-30%
Mozzarella, part skim 1 ½ oz.	275	28%
Tofu, firm, made w/calcium sulfate, ½ cup***	204	20%
Orange juice, calcium fortified, 6 fl oz	200-260	20-26%
Salmon, pink, canned, solids with bone, 3 oz	181	18%
Pudding, chocolate, instant, made w/ 2% milk, ½ cup	153	15%
Cottage cheese, 1% milk fat, 1 cup unpacked	138	14%
Tofu, soft, made w/calcium sulfate, ½ cup***	138	14%
Spinach, cooked, ½ cup	120	12%
Instant breakfast drink, various flavors and brands, powder prepared with water, 8 fl oz	105-250	0-25%
Frozen yogurt, vanilla, soft serve, ½ cup	103	10%
Ready to eat cereal, calcium fortified, 1 cup	100-1000	10-100%
Turnip greens, boiled, ½ cup	99	10%
Kale, cooked, 1 cup	94	9%
Kale, raw, 1 cup	90	9%
Ice cream, vanilla, ½ cup	85	8.5%
Soy beverage, calcium fortified, 8 fl oz	80-500	8-50%
Chinese cabbage, raw, 1 cup	74	7%
Tortilla, corn, ready to bake/fry, 1 medium	42	4%
Tortilla, flour, ready to bake/fry, one 6" diameter	37	4%
Sour cream, reduced fat, cultured, 2 Tbsp	32	3%
Bread, white, 1 oz	31	3%
Broccoli, raw, ½ cup	21	2%
Bread, whole wheat, 1 slice	20	2%
Cheese, cream, regular, 1 Tbsp	12	1%

* DV on Nutrition Facts Panel are based on 1000 mg.

**Content varies slightly according to fat content; average =300 mg calcium

*** Calcium values are only for tofu processed with a calcium salt. Tofu processed with a non-calcium salt does not contain significant amounts of calcium.

IS IT HARD TO GET ENOUGH CALCIUM FROM FOOD?

No, not if you plan ahead.

The best way to meet calcium needs is through smart food and beverage choices. That's because food can supply nutrients in addition to calcium that are important for overall health, especially for healthy bones. It may be easier to make a habit of consuming calcium-rich foods daily than it is to remember to take supplements every day.

Simple ways to increase calcium content of meals

- Sprinkle Parmesan cheese on vegetables, salads, soups, and pasta.
- Use non-fat plain yogurt to replace half the mayonnaise in salad dressings.
- Add one to two tablespoons of nonfat dry milk powder per individual serving to hot cereals, soups, stews, meatloaf, casseroles, sauces, mashed potatoes, and baked products.
- Select calcium-fortified 100% juice for your breakfast juice.
- Substitute non-fat plain yogurt for sour cream on baked potatoes and in fruit and vegetable dips.
- Use low-fat or fat-free milk instead of water in cooked cereals and cream soups.
- Incorporate calcium-rich greens (spinach, kale, turnip greens) into your salads.
- Add tofu (check label for added calcium) to casseroles, salads, and stir-fries.
- Choose low-fat or fat-free milk instead of soft drinks.

Factors Affecting Calcium Balance

The amount of calcium available for the body's use is influenced by both absorption and excretion.

Calcium absorption Calcium is absorbed when the digestive tract extracts calcium from food, enabling it to enter the bloodstream. The most important factors that determine calcium absorption are calcium need and vitamin D status. Infants and young children need calcium for building bones, and can absorb calcium at a rate of up to 60 percent. Pregnant and breastfeeding women can absorb calcium at a rate of up to 50 percent. Generally, however, adults absorb calcium at a rate of only 15 to 20 percent, an amount that decreases with age. This decrease is even greater among women due to lower estrogen activity after menopause. Estrogen therapy in postmenopausal women has been shown to improve calcium and vitamin D status. Vitamin D improves calcium absorption and can be obtained from food or made by the body when skin is exposed to sunlight (see page 13).

The human body also absorbs calcium more easily from some foods than from others. For example, naturally occurring substances in some plant foods can bind to calcium and prevent it from being absorbed. Two examples of such substances are oxalic acid (found in spinach, collard greens, beet greens, rhubarb, peanuts, and dried beans) and phytic acid (associated with fiber and found in whole grain breads, beans, seeds, nuts, grains, and soy isolates).

Fiber also can prevent calcium absorption; however, the average fiber intake of Americans is less than that needed to affect calcium absorption.

ACHIEVING CALCIUM BALANCE

These items have a positive effect on calcium balance:

- + body's need for calcium based on age or other factors
- + vitamin D
- + dairy foods
- + some vegetables (kale, broccoli, Chinese cabbage)
- + estrogen

These items have a negative effect on calcium balance:

- sodium/salt
- high protein diets (1.5 gms/kg or more)
- caffeine
- oxalic acid
- phytate/fiber
- alcohol
- smoking
- aging (see page 10)
- steroid medications (see page 11)

WHY IS OSTEOPOROSIS A HEALTH CONCERN?

- **threatens 44 million Americans**
- **10 million already have it**
- **another 34 million have low bone mass, which increases their risk**
- **women account for 80 percent of those who have or are at risk for developing osteoporosis**
- **one of every two women and one of four men age 50 and older will experience an osteoporosis-related fracture during their life**
- **expenses related to osteoporosis and related fractures total \$18 billion annually**

Calcium excretion Calcium is excreted through normal body elimination, especially in the urine. Calcium excretion is influenced by other nutrients, including protein, sodium, caffeine, and alcohol.

Diets high in protein have previously been linked to increased calcium excretion. However, more recent research suggests that high protein intake may not adversely affect whole body calcium retention.

Diets high in sodium have been shown to increase calcium excretion. One way to counteract the negative effect of a high sodium diet is to increase potassium intake by eating seven to eight servings daily of fruits and vegetables.

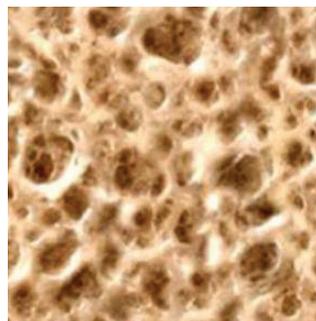
Caffeine intake also increases calcium loss, but to a lesser degree than sodium. Finally, alcohol reduces absorption of calcium and can interfere with vitamin D metabolism.

These factors are of concern only to those with marginal or inadequate intakes of calcium. Acquiring adequate calcium intake minimizes the risk of these nutrient interactions.

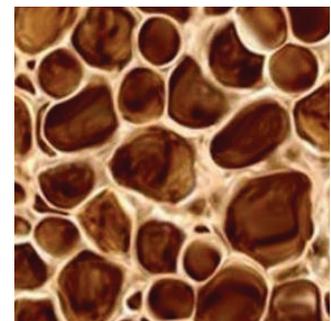
HOW DOES CALCIUM AFFECT BONE HEALTH?

The **majority** of bone mass is accumulated by approximately 18 years of age, although a small percentage can be added in young adulthood. Thus, peak bone mass—the stage at which bones are at their peak density—is thought to be attained between 20 and 30 years of age (although it may occur as late as 40 years), depending upon the location in the body.

Bone is constantly being broken down and replaced in a process called “remodeling.” This bone remodeling repairs and alters the inner shape of bone. **About one-fifth of the adult skeleton is replaced each year.** That’s why it is so important to maintain calcium intake throughout life—to build bone when young and to minimize bone loss with aging.



HEALTHY BONE



OSTEOPOROTIC BONE

Low calcium intake often increases the risk for osteoporosis—“porous bones.” When calcium and phosphorus are withdrawn from bones and channeled to other uses without being replaced, total bone mass decreases, making the remaining bone more porous and less strong. This loss can lead to fractures of the hip, spine, wrist, ribs, and other bones.

Besides calcium, many other nutrients play a role in bone health—including vitamins C, D, and K, as well as the minerals magnesium, phosphorus, zinc, fluoride, manganese, and copper. When calcium intake is inadequate, intake of these other nutrients also may be low.

Bone mass in women is protected by the hormone estrogen. When estrogen levels decline at menopause, bone loss accelerates and may continue for a period of 5 to 10 years, with a gradual slowing of bone loss as time proceeds. Bone mass decreases 3 to 5 percent per year during the years immediately following menopause; many women lose up to 15 percent of their bone mass in the first 5 to 10 years after menopause. Increased calcium intake during menopause cannot offset menopause bone loss. In fact, calcium absorption decreases with menopause.

Osteoporosis develops silently over a lifetime. It usually goes unrecognized until a hip breaks, or the vertebrae collapse causing a loss in height or a curving of the spine.

Does calcium affect other health conditions?

Calcium is most commonly associated with bone health; however, emerging evidence suggests that calcium also may influence other aspects of health.

Cancer—Studies examining calcium and cancer are strongest relative to the risk and incidence of colorectal cancer. Adequate, not excessive, calcium intake has been associated with decreased risk of colorectal cancer.

High blood pressure—Studies have shown that the DASH (Dietary Approaches to Stop Hypertension) diet lowers blood pressure with increased calcium intake.

Kidney stones—It used to be common practice to advise a low calcium diet for people with a tendency to form calcium-containing kidney stones. Some research has shown that individuals who consumed the most calcium (within recommended amounts) were the least likely to form calcium stones. Calcium can provide protection from calcium stones because it binds with oxalate. Oxalate, a common component in kidney stones is also found in foods such as spinach, beet greens, and rhubarb. When these foods are eaten at the same time as calcium-containing foods or supplements, the calcium binds with the oxalate in the intestine, which then can be eliminated without being absorbed. Calcium only presents risk for development of kidney stones among individuals with a family history of kidney stones, urinary tract infections, kidney disorders, and certain metabolic disorders.

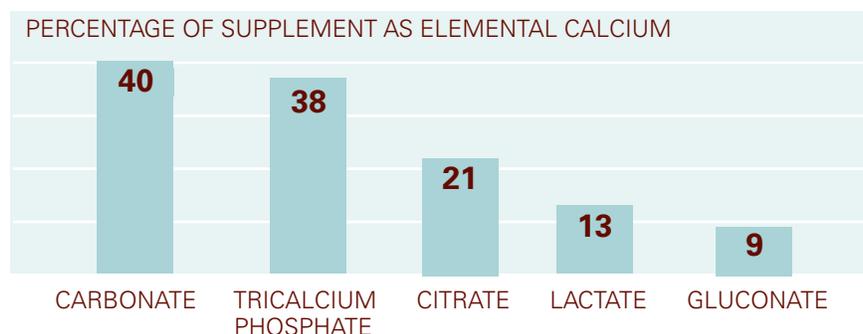
Weight management—Studies have suggested that consumption of dairy products may affect weight management. Most recent research examining supplemental calcium and weight management suggests other components of dairy products, such as protein, may be responsible for the observations.

CALCIUM SUPPLEMENTS: TIPS AND PRECAUTIONS

What are calcium supplements?

The most common forms of calcium supplements are calcium carbonate and calcium citrate. Calcium carbonate is the most common because it is inexpensive and convenient. Calcium carbonate supplements contain 40 percent calcium while calcium citrate supplements contain 21 percent calcium. Thus, an individual would have to take more of the calcium citrate supplement to get the same amount of calcium as a calcium carbonate supplement. Absorption of calcium carbonate and citrate are similar; however, calcium citrate is absorbed better in those who have decreased stomach acid. Calcium citrate malate is a form of calcium used in the fortification of certain juices that is also absorbed well.

Other forms of calcium in supplements or fortified foods include calcium gluconate, lactate, and phosphate. The amount of calcium obtained from various supplements depends on the amount of elemental calcium in the tablet. The graph below compares the elemental calcium content of various supplements.



Who needs calcium supplements?

The Dietary Guidelines for Americans, which are based on the DRIs, recommend consuming a variety of foods to meet nutrient needs because no single food can supply all the nutrients in the amounts needed. However, for some people, it may be necessary to take calcium supplements to meet the recommended intake level. In fact, calcium supplements are one of the highest selling supplements on the market. These groups are most likely to benefit from using supplements:

Menopausal women—Calcium and vitamin D supplements are beneficial in the prevention of excessive bone loss in the years just before menopause (perimenopause) and especially in the years after menopause (postmenopause). Women who do not use hormone replacement therapy should especially consider taking calcium supplements. If some calcium is consumed in the diet, supplementation up to 1,000 mg is probably adequate.

Older adults—Calcium absorption typically decreases with age. Older adults also are likely to use medications; some can interfere with calcium absorption.

Strict vegetarians—Those who do not consume any dairy products may need a calcium supplement.

Steroid medication users—Certain steroids, such as Prednisone (prescribed for disorders such as asthma, emphysema, rheumatoid arthritis, and inflammatory bowel disease) cause bone loss and may interfere with calcium absorption. People using steroid medications should take supplemental calcium (1,500 mg) and vitamin D (800 IU) each day.

Does dosage or timing make a difference when taking calcium supplements?

The amount of calcium absorbed from the supplement not only depends on the form of the calcium supplement (thus elemental calcium available for absorption) but also on the total amount of calcium consumed at one time and whether the calcium supplement is taken with food or on an empty stomach. Absorption from supplements is best in doses of 500 mg or less because the percent of calcium absorbed decreases as the amount of calcium in the supplement increases. In other words, if you are taking 1,000 mg of calcium as a supplement, you should take 500 mg twice a day instead of 1,000 mg calcium at one time. A dose of 500 mg is about as much as the body can absorb at one time.

In addition, it is generally best to take a calcium supplement with food, such as at mealtime. The presence of food slows the emptying of the stomach and allows more time for stomach acid to help dissolve the calcium tablet, thus improving absorption. This timing is especially important for older people, who often have a decrease in stomach acid production, which may result in a lower rate of calcium absorption.

USP

These letters mean the supplement has met United States Pharmacopoeia standards of dissolving in the acid environment of human intestines and thus can be absorbed and used by the body. However, this does not necessarily mean that supplements without “USP” on the label will not dissolve and be absorbed.

Supplement Facts		
Serving Size: 3 tablets		
Servings Per Container: 60		
	Amount Per Serving	% Daily Value
Vitamin D	400 IU	100%
Calcium (elemental)	600 mg	60%
Magnesium	50 mg	13%
Zinc	7.5mg	50%
Copper	1 mg	50%
Manganese	2 mg	100%
Molybdenum	75 mcg	100%
Boron	250 mcg	*
Genistein	27mg	*
*Daily Value not established		
INGREDIENTS: Source of calcium: Calcium Carbonate, Calcium Citrate; Polyethylene Glycol, Magnesium Oxide, Croscarmellose Sodium, Genistein (Soy Isoflavone), Manganese Gluconate, Hypromellose, Titanium Dioxide, Zinc Oxide, Magnesium Silicate, Copper Gluconate, Molybdenum Amnio Acid Chelate, Sodium Borate, Magnesium Stearate, Vitamin D3 (Cholecalciferol)		

HOW TO INTERPRET A CALCIUM SUPPLEMENT LABEL

Information that follows is based on this **servicing size**.

Your own needs may be more or less than the **% Daily Value**.

Many calcium supplements are combined with **vitamin D**.

Amount of vitamin D in one serving.

Amount of **calcium** in the serving.

Source of **calcium**.

KIND	NAME	CALCIUM CONTENT (mg/tablet)	AVAILABLE WITH VITAMIN D (IU/tablet)	RELATIVE COST PER 500 mg	CHEWABLE?
CALCIUM CARBONATE	Caltrate 600	600	no	\$\$	no
	Caltrate 600 D	600	yes (400 IU)	\$\$	no
	Caltrate 600 D + Minerals	600	yes (400 IU)	\$\$	yes
	Finest Natural Calcium 500 + D	500	yes (125IU)	\$	no
	Finest Natural Calcium 600 + D	600	yes (200 IU)	\$	no
	Nature Made Calcium 500 w/Vit D	500	yes (200 IU)	\$	no
	Nature Made Calcium 600 w/Vit D	600	yes (200 IU)	\$	no
	Nature Made Calcium 650 + D + K	750	yes (500 IU)	\$	no
	Nature Made Calcium +D +K	750	yes (500 IU)	\$	no
	Nature Made Liquid Softgel Calcium w/Vit D	600	yes (200 IU)	\$\$	no
	Os-Cal	500	yes (200 IU)	\$\$	no
	Os-Cal	500	yes (400 IU)	\$\$	yes
	Os-Cal Ultra	600	yes (200 IU)	\$\$	no
	Viactiv Calcium	500	yes (200 IU)	\$\$	yes
	Viactiv Flavor Guides	500	yes (500 IU)	\$	yes
	Walgreen's High Potency Calcium 500 + D	500	yes (400 IU)	\$	no
	Walgreen's High Potency Calcium 600	600	no	\$	no
	Walgreen's High Potency Calcium 600+D	600	yes (400 IU)	\$	no
	Walgreen's High Potency Calcium 600 + Soy	600	yes (200 IU)	\$\$	no
	Walgreen's Ultra Calcium 600 Plus	600	yes (200 IU)	\$	no
	Walgreen's Calcium 1200	1200	yes (1000 IU)	\$	yes
	Walgreen's Calcium Creamies	600	yes (400 IU)	\$\$	yes
	Hy Vee Health Market Calcium 100 + D	100	yes (800 IU)	\$\$\$	no
	Hy Vee Health Market Calcium 600	1200	no	\$	no
	Hy Vee Health Market Calcium 600 + D	1200	yes (400 IU)	\$	no
	Hy Vee Health Market Calcium Plus	1200	yes (400 IU)	\$	no
	Hy Vee Health Market Liquid Filled Calcium 600 + D	1200	yes (400 IU)	\$	no
	Nature's Bounty Liquid Calcium w/ Vit A and D	600	yes (825 IU)	\$	no
	Nature's Bounty Absorbable Calcium + Vit D	1000	yes (100 IU)	\$	no
	Nature's Bounty Absorbable Calcium 1200 mg + Vit D	1200	yes (200 IU)	\$	no
	Origin Calcium 600	1200	no	\$	no
	Origin Calcium 600 + D	1200	yes (250 IU)	\$	no
	Target Calcium Chews 500 mg + D + K	600	yes (200 IU)	\$	yes
Target Calcium Plus w/ Minerals	600	yes (400 IU)	\$	yes	
GNC Active Cal Dietary Supplement	500	yes (100 IU)	\$\$	yes	
GNC Adora	500	yes (100 IU)	\$\$\$	yes	
GNC Calcium 600	600	no	\$	no	
GNC Calcium Plus 1000 w/ Mg and Vit D	1000	yes (800 IU)	\$\$	no	
GNC Calcium Plus with Mg	600	no	\$\$	no	
GNC Fast Cal 500	500	no	\$	no	
Equate Oystershell Calcium 500 + D	500	yes (400 IU)	\$	no	
Equate Calcium 600 + D	600	yes (400 IU)	\$	no	
Spring Valley Calcium 600	1200	no	\$	no	
Spring Valley Calcium 600 mg w/ Vit D	1200	yes (800 IU)	\$	no	
Spring Valley Liquid-Filled Calcium 600 mg w/ Vit D	1200	yes (200 IU)	\$	no	

\$ LOW \$\$MEDIUM \$\$\$ HIGH

KIND	NAME	CALCIUM CONTENT (mg/tablet)	AVAILABLE WITH VITAMIN D (IU/tablet)	RELATIVE COST PER 500 mg	CHEWABLE?
CALCIUM CARBONATE	Spring Valley Calcium Chew 500 mg w/Vit D and K	500	yes (400 IU)	\$	Yes
	Drinkables Liquid Coral Calcium	381	yes (200 IU)	\$\$\$	no
	Sundown Calcium 600 mg + D	1200	yes (250 IU)	\$	no
	Sundown Liquid-Filled Calcium + D	1200	yes (200 IU)	\$\$	no
	Vitasmart Calcium 500 mg w/ D	500	yes (200 IU)	\$	no
	Vitasmart Calcium 500 mg w/Vit D	500	yes (400 IU)	\$	no
	Vitasmart Calcium 600 mg	600	no	\$	no
	Vitasmart Calcium 600 mg w/ 400 IU Vit D	600	yes (400 IU)	\$	no
	Vitasmart Calcium Soft Chews	500	yes (200 IU)	\$\$	yes
	Vitasmart Oyster Shell Calcium 600 mg	600	no	\$\$	no
	Vitasmart Essentials Calcium 500 mg w/ Vit D	500	yes (200 IU)	\$	no
	Vitasmart Essentials Calcium 600 mg	600	no	\$	no
	Vitasmart Select Calcium 1200 mg w/ 1000 IU Vit D	1200	yes (1000 IU)	\$	no
CALCIUM CARBONATE BLEND	GNC Chewable Calcium Plus 600 w/Vit D3	600	yes (400 IU)	\$\$	yes
	Calcet Triple Calcium + Vit D	300	yes (200 IU)	\$\$	no
	Nature Made Advanced Calcium with Vitamin D + Mg	500	yes (200 IU)	\$	no
	Prevention High Potency Multi Source Calcium	1000	yes (400 IU)	\$\$\$	no
	Critical Plus Bone Density Plus	600	yes (400 IU)	\$\$	no
CALCIUM CITRATE	Nature Made Advanced Calcium with Vitamin D + Mg	500	yes (200 IU)	\$	no
	Critical 250 + D	500	yes (400 IU)	\$	no
	Critical Petites with Vitamin D	400	yes (500 IU)	\$\$	no
	Critical Plus with Magnesium	500	yes (250 IU)	\$	no
	Critical With Vitamin D	630	yes (500 IU)	\$\$	no
	Walgreen's Calcium Citrate	400	no	\$	no
	Walgreen's Calcium Citrate Plus with Magnesium	500	yes (250 IU)	\$	no
	Hy Vee Health Market Calcium Citrate	400	no	\$\$	no
	Hy Vee Health Market Calcium Citrate + D	630	yes (400 IU)	\$	no
	Hy Vee Health Market Calcium Citrate w/ Soy Isoflavones	500	no	\$\$\$	no
	Nature Made Calcium Citrate	750	yes (300 IU)	\$\$\$	no
	GNC Calcium Citrate 1000	1000	no	\$\$	no
	Calcium + D Calcium Citrate	630	yes (400 IU)	\$	no
	Calcium Citrate + D	630	yes (400 IU)	\$	no
	Calcium Citrate w/Vit D	630	yes (400 IU)	\$	no
CALCIUM CITRATE MALATE	Target Calcium + D Calcium Citrate	630	yes (400 IU)	\$	no
	Vitasmart Calcium Citrate + w/Vit D	630	yes (400 IU)	\$\$	no
	GNC Calcimate Complete	800	yes (800 IU)	\$\$\$	no
	Calcimate 1000	1000	yes (600 IU)	\$\$\$	no
	Calcimate 800	800	yes (800 IU)	\$\$\$	no
CALCIUM PHOSPHATE	Posture-D Calcium with Vit D and Magnesium	600	yes (125 IU)	\$\$	no
	Prevention High Potency Multi Source Calcium	1000	yes (400 IU)	\$\$\$	no
OYSTER SHELL	Origin Oyster Shell Calcium 500 mg + Vit D	500	yes (125 IU)	\$\$\$	no
	Nature's Bounty Calcium 500 mg w/ Vit D	500	yes (400/125 IU)	\$	no
	Sundown Natural Oyster Shell Calcium 1000 mg + D	1000	yes (400 IU)	\$	no
CORAL CALCIUM	Hy Vee Health Market Authentic Okinawa Coral Calcium	1000	yes (400 IU)	\$\$\$	no
	GNC Coral Calcium	400	yes (200 IU)	\$\$\$	no
	Coral Pure Calcium	530	yes (820 IU)	\$\$	no
	Nature's Bounty Coral Calcium 1000 mg Plus	370	yes (400 IU)	\$\$\$	no
	Nature's Bounty Coral Calcium 1000 mg	1000	no	\$\$	no
	Vitasmart Coral Calcium 1000 mg	370	no	\$\$\$	no

No endorsement of mentioned products or firms is intended nor is criticism implied of those not mentioned.

How much is too much?

The Upper Limit (UL) of calcium intake for healthy children (excluding infants) and adults ranges from 2,000 to 3,000 mg/day, depending on age and gender. Consuming this amount of calcium would require drinking 7 to 10 cups of milk. Excessive calcium intake is more likely the result of calcium supplementation. If you are considering a calcium supplement:

1. know your recommended calcium intake,
2. be aware of how much calcium you typically consume in a given day through your food choices, and
3. supplement **only** the difference between your recommended calcium intake and your typical consumption of calcium.

The risk of negative consequences from taking calcium supplements is small but some are possible.

Caution for those with iron deficiency—Iron absorption can be decreased if calcium is consumed at the same time in foods or supplements. This is generally only a concern for individuals who have an iron deficiency. If you are taking both a calcium and an iron supplement, it is best to take them at different times. However, consuming calcium-fortified juice does not interfere with iron absorption. The combination of calcium citrate malate used to fortify the juice and the juice's vitamin C protects iron absorption.

Potential side effects—Although calcium supplements taken within recommended dosage limits are generally well tolerated, side effects may occur. These may include constipation, intestinal bloating, and excess gas. Some individuals have found that changing the type or brand of calcium supplement may reduce or eliminate these problems. Splitting the dosage over two or three meals may help reduce constipation, which is a problem reported by some calcium carbonate users. Adequate fluid intake also can help minimize constipation.

Possible lead contamination—In the past, consumers were warned that supplements made from bonemeal or dolomite might be contaminated with lead. Today, few supplements are made from either of those sources. However, another type of calcium carbonate supplement, labeled "oyster shell" or "natural source" may contain unacceptably high levels of lead.

The Food and Drug Administration (FDA) has set an upper limit for the amount of lead a calcium supplement can contain (7.5 micrograms per 1,000 milligrams of calcium). Currently, calcium supplements are not tested by a regulatory agency for lead content before they are placed on the market. It is up to the manufacturer to assure that the lead content of their calcium supplement meets the FDA standards.

Children and pregnant/lactating women should be especially cautious when selecting a calcium supplement; it may be wise to avoid those made from oyster shells (check the label for this information). Some supplements even contain a statement declaring freedom from lead contamination; of course, this does not necessarily mean that those without such a statement are contaminated.

VITAMIN D: WHAT DOES IT DO?

The main role of vitamin D related to bone health is to keep blood calcium levels within the normal range. It does this by increasing calcium absorption from the intestine and increasing calcium removal from the bones. If not enough calcium is consumed and absorbed, vitamin D initiates the process of removing calcium from the bones to maintain normal blood levels. Although calcium can be absorbed without vitamin D, vitamin D increases the efficiency and amount of calcium absorbed. In fact, with vitamin D deficiency, calcium absorption may decrease from about 30 to 50 percent to no more than 15 percent. Also, a growing number of research reports have linked optimal vitamin D status (21 to 29 mg/mL) with protection against chronic diseases—such as type 2 diabetes and many types of cancer, including breast, colon, prostate, and ovarian cancer.

Where does vitamin D come from?

Vitamin D is unique in that it can be obtained in two different ways: from exposure to sunlight and from food or dietary supplements. The majority of people can meet their vitamin D requirements by sunlight exposure. In fact, dietary intake of vitamin D may not be necessary for those who spend adequate time in the sun.

Sunlight

Vitamin D is often referred to as the “sunshine vitamin.” This is because a vitamin D precursor is produced in the skin upon exposure to the ultraviolet B (UV-B) rays of the sun. This precursor travels through the bloodstream to the liver and then the kidneys where it is turned into the active form of vitamin D.

How much time do you need to spend in the sun to make vitamin D?

It is generally thought that exposure of the hands, face, and arms three times a week for approximately 5 to 15 minutes is more than adequate to reap all the benefits of sufficient vitamin D status.

The effectiveness of sunlight as a vitamin D source is affected by a variety of factors, including clothing choices, sunscreen use, age, and geographic location.

Sunscreens with a skin protection factor (SPF) as low as eight can almost completely block production of vitamin D precursors in the skin. This is usually not an issue for children and young adults because they are less likely to wear a sunscreen every time they are outdoors. Nor are they likely to cover all sun-exposed areas of the body. However, older adults may be more diligent in sunscreen application and may have less sun exposure. This places them at greater risk for vitamin D deficiency and increases their need for a vitamin D supplement.

Vitamin D production decreases with age. Older adults also have less of the vitamin D precursor in their skin, and kidney function tends to decline with age, resulting in less production of the active form of vitamin D. By the time people reach age 70, production of vitamin D by the skin is only 30 percent of what it was when they were young adults. Despite this inefficient production, older adults still can benefit from sunlight exposure. Even so, consuming a vitamin D supplement may be the best strategy. To increase vitamin D production, everyone over age 50 should wait 10 to 15 minutes after going outside before applying sunscreen.

Geographic location. Individuals who live in southern areas of the United States, such as Texas, synthesize vitamin D throughout the year. However, residents in the northern third of the United States produce little vitamin D during the winter months and are at greater risk for deficiency. For example, people living in Boston synthesize negligible amounts of vitamin D from November through February; those in Edmonton, Canada, synthesize little vitamin D from mid-October through mid-April.

To help compensate for this, vitamin D precursors produced during warmer months can be stored in body fat and the liver and are available for vitamin D production during the winter. However, most individuals in the northern third of the country probably need a vitamin D supplement to maintain optimal circulating vitamin D concentrations during the winter months.

Food

Most foods do not contain any vitamin D, nor are they fortified with it. Milk is one of the few foods to which vitamin D is added during processing. Other dairy products, such as cheese and yogurt, are poor sources of vitamin D because they are generally not made with fortified milk. Fatty fish and their oils, such as tuna and cod liver oils, also naturally contain vitamin D.

One cup of vitamin D fortified milk contains 100 IU or 17% of the DV for vitamin D regardless of the fat content (skim, 1%, 2%, or whole). If Vitamin D is included on the Nutrition Facts panel of milk, the %DV will be 25% because the Nutrition Facts panel DV is based on the old DRI of 400 IU. However, researchers have found that less than 20 percent of the milk in some stores contained the stated amount of vitamin D. Some of the milk samples, especially skim milk, contained little or no vitamin D. Researchers have urged better monitoring of the fortification process.



HOW MUCH VITAMIN D DO WE NEED?

Recommendations for vitamin D intake were set in 2010 when calcium recommendations were updated by the IOM. The RDA is based on minimal sun exposure to ensure that most would receive adequate vitamin D intake.

RECOMMENDED VITAMIN D INTAKE

LIFESTAGE GROUP	RECOMMENDED DAILY ALLOWANCE (IU/day)	UPPER LIMIT (IU/day)
Birth - 6 months	400	1000
6 - 12 months	400	1500
1 - 3 years old	600	2500
4 - 8 years old	600	3000
9 - 70 years old*	600	4000
71+ years	800	4000

* including pregnant and lactating women

Higher intake of vitamin D beyond suggested levels may have desirable effects. In fact, higher intake of vitamin D (2,000 to 3,500 IU/day) has been associated with a reduced risk of breast, colon, and prostate cancer with no known toxicities. Presently, there is considerable debate regarding the health benefits and upper limit of vitamin D. Some studies suggest decreased risk of chronic disease with intakes of 10,000 IU without adverse effects.

Vitamin D supplements

Supplementation with calcium and vitamin D can help prevent excessive bone loss in postmenopausal women. Research also indicates that homebound and institutionalized older adults who take vitamin D supplements may have a reduced risk for bone fractures. Moreover, vitamin D supplementation may be important for protection against many types of cancer and type 2 diabetes.

Because Vitamin D is soluble in fat, it is best to take vitamin D supplements with food. It does not need to be taken at the same time as calcium to be effective. Vitamin D supplements are now readily available as 1,000 IU and 2,000 IU caplets. Consult with your physician before taking a vitamin D supplement.

SELECTED REFERENCES

Bourgoin BP, Evans DR, Cornett JR, Lingard SM, Quattrone AJ. "Lead content in 70 brands of dietary calcium supplements." *American Journal of Public Health* 1993; 83:1155-1160.

"Dietary reference intakes (DRIs) for calcium, phosphorus, magnesium, vitamin D, and fluoride." *Nutrition Today* 1997; 32:182-188.

Heaney RP. "Calcium supplements: Practical considerations." *Osteoporosis International* 1991; 1:65-71.

Heaney RP, Weaver CM, Hinders SM, Martin B, Packard PT. "Absorbability of calcium from Brassica vegetables: Broccoli, bok choy, and kale." *Journal of Food Science* 1993; 58:1378-1380.

Holick MF. "Vitamin D and bone health." *Journal of Nutrition* 1996; 126:1159S-1164S.

Holick MF, Shao Q, Liu WW, Chen TC. "The vitamin D content of fortified milk and infant formula." *New England Journal of Medicine* 1992; 326:1178-81.

Hunt, JR, Johnson, LK, Fariba Roughead, ZK. Dietary protein and calcium interact to influence calcium retention: a controlled feeding study. *Am J Clin Nutr.* 2009; 89:1357-1365.

"Low-calcium diets to prevent kidney stones fall out of favor." *Tufts University Health & Nutrition Letter* 1997; 15(5):8.

Packard PT, Heaney RP. "Medical nutrition therapy for patients with osteoporosis." *Journal of the American Dietetics Association* 1997; 97:414-417.

"Protecting against bone loss from steroids." *Tufts University Health & Nutrition Letter* 1998; 15(11):7.

Roughead, ZK, Lykken, GI, Hunt, JR. Controlled high meat diets do not affect calcium retention or indices of bone status in healthy post-menopausal women (abstract). *FASEB J* 2001; 15:A727.

Roughead, ZK, Hunt, JR, Lykken, GI, Johnson, LK. Substituting soy protein for meat protein did not affect calcium retention or biomarkers of bone and cardiovascular health in a controlled feeding study of healthy postmenopausal women. *FASEB J* 2003: 17:A705

Whiting SJ. "Safety of some calcium supplements questioned." *Nutrition Reviews* 1994; 52:95-97

"Yes, but which calcium supplement?" *Tufts University Health & Nutrition Letter* 1997; 14(12):4-5.

FOR MORE INFORMATION

Ask your Iowa State University Extension county office for a copy of these free publications, or for help in contacting these websites.

American Dietetic Association
www.eatright.org

Calcium Check List
www.ext.vt.edu/pubs/nutrition/348-019/348-019.html

National Osteoporosis Foundation
(800) 223-9994
www.nof.org

Osteoporosis and Related Bone Diseases National Resource Center
www.niams.nih.gov/Health_Info/Bone

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