

## Calcium –An Important Mineral for Women : A Review

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### **Abstract**

*Calcium is the fifth most abundant element in the body with >99% residing in the skeleton as hydroxyapatite, a complex calcium phosphate molecule. This mineral supplies the strength to bones that support locomotion, but it also like nerve function, blood clotting, muscle health, and other areas. Its metabolism is regulated by serves as a reservoir to maintain serum calcium levels. Calcium plays a central role in a wide range of essential functions three major transport systems: intestinal absorption, renal reabsorption and bone turnover. Calcium insufficiency manifests as decreased bone mass and osteoporotic fracture. In rapidly growing child, calcium deficiency causes rickets. The only source of calcium is from the diet. While calcium is the key mineral for both sexes, it is especially important for the health of women.*

**Keywords:** Calcium intake, Nutrition, Growth, Bone formation

## **Introduction**

Calcium is represented by the atomic symbol Ca and has the atomic number 20. It is the fifth most common element in the earth's crust (and also in seawater) so it is very plentiful. Calcium is quite reactive, so it never occurs "in the wild" in its elemental form, but instead, is found in an astonishing array of minerals. It is very useful, being a component of concrete, insecticides and food additives as well as other substances that are too numerous to list here.

Calcium is a key nutrient in the human body. The primary emphasis on calcium consumption during its initial scientific discovery was focused on early human life primarily during growth periods of infancy and childhood. The interest on calcium requirements during the last decade has been expanded to apply to the entire life cycle from birth through elder years. Many commercial food and nutrition supplement products contain calcium fortification today in response to a wider audience.

The purpose of this narrative review is a) to examine the role of calcium in human health, b) to compare nutrient requirements for calcium across lifecycle groups and global populations, c) to review relationships between calcium intake, chronic disease risk and fractures, and d) to discuss strategies to address diet deficiencies and lactose intolerance.

## **The Role of Calcium In Human Health** **Calcium as a key nutrient**

Calcium is the most abundant stored nutrient in the human body. More than 99% (1.2-1.4 kg) is stored in the bones and teeth. Less than 1% is found in extracellular serum calcium. When adults consume calcium as food or supplements, the average absorption rate is approximately 30%. The rate can vary widely due to multiple factors. For example, in pregnancy when more calcium is required for the growing fetus the calcium absorption rate increases. (National Institutes of Health (2013), (Goodman WG (2008)), (Institute of Medicine Standing Committee (1997))

### **Basic functions of calcium.**

Calcium's most important feature is biological: it is essential for life. As already mentioned, calcium is a major component of bones and teeth, and it's also found in shells and hard corals, but it also has a more subtle function: cell signaling. Calcium ions function as messengers that mediate or trigger cascades of biological events inside cells. These events include propagation of electrical signals down neurons, contraction of muscles (including heart muscles!), cell growth, secretion of hormones, neurotransmitters and other molecules and it even signals when an egg has been fertilised. Your body uses 99 percent of its calcium to keep your bones and teeth strong, thereby supporting skeletal structure and function. Cells use calcium to activate certain enzymes, transport ions across the cellular membrane, and send and receive neurotransmitters during communication with other cells. As an electrolyte, or a particle that helps conduct electricity in the body,

calcium is also one of the key players in maintaining a regular heartbeat. (National Institutes of Health (2013)) (Institute of Medicine Standing Committee (1997))

### **Identifying At-Risk Populations for Calcium Deficiency**

There are three major population groups that are at highest risk for dietary calcium deficiency. These include women (amenorrhoeic, the female athlete triad, postmenopausal), individuals with milk allergy or lactose intolerance, and at-risk groups for dietary deficiency intake (adolescents and the elderly).

At particular risk are female adolescents when bone formation and growth is most crucial. Later in the life cycle, women continue to be at highest risk and this risk is elevated if early baseline bone is not strong during adolescence. Women who have diagnosed eating disorders or exhibit physical hyperactivity with female athlete triad syndrome have been shown to be at high risk for calcium deficiency. Postmenopausal women, due to hormonal changes that may affect bone mineralization processes, have also been widely studied for calcium deficiency risk [Institute of Medicine Standing Committee (1997), Bonjour JP (2013)].

Individuals with milk allergy or lactose intolerance often exhibit calcium deficiency due to the dietary restriction of calcium-containing foods. These individuals can be effectively treated with dietary modifications which will be discussed later

in the manuscript [National Digestive Diseases Information Clearinghouse (2013)].

Both adolescents and elderly populations often have high risk of calcium deficiency due to dietary habits. Adolescents throughout the world are growing in risk due to dietary pattern changes. Many adolescents decrease calcium intake by substituting dairy products particularly beverages or by decreasing total intake of calcium. Eating disorders in both male and female teens may result in nutrient deficiencies that include calcium. The elderly are at risk for multiple reasons including low calcium intake over time, medication interactions that may decrease dietary calcium absorption, and the underlying chronic disease osteoporosis which changes bone formation and strength [National Institutes of Health (2013), Institute of Medicine Standing Committee (1997), Choi YS (2013), Wu L (2010)].

**Clinical Implications of Dietary Calcium Deficiency** [Thacher TD (1999), Pettifor JM (2004), Oginni LM (2003), Clements MR (1987), Mughal MZ (1999), Ganpule A (2006)]

- Metabolic bone disease of prematurity
- Calcium deficiency rickets in childhood
- Inadequate bone mass accrual in childhood and adolescence
- Inadequate foetal bone mass accrual/other metabolic effects and programming
- Possible secondary vitamin D deficiency
- Osteoporosis - postmenopausal and senile (brittle, thin, porous bones that easily

break)

### Dietary Recommendations

The preferred source of calcium is calcium-rich foods such as dairy products. Some people will need to take a calcium supplement. How much calcium you need depends on your age and gender. Other factors, such as pregnancy and illnesses, are also important.

Recommendations for calcium, as well as other nutrients, are provided in the Dietary Reference Intakes (DRIs) developed by the Food and Nutrition Board at the Institute of Medicine. DRI is a term for a set of reference intakes that are used

to plan and assess the nutrient intakes of healthy people.

### Source of Calcium

The main calcium contenders are milk, yogurt, and cheese, but if you don't drink milk or eat cheese or you are lactose intolerant, can't drink milk, there are plenty of other ways to get your calcium. Dairy shouldn't be the only dietary pit stop to fill up on this nutrient. Leafy greens, seafood, legumes, and fruit also contain calcium and many foods and drinks are fortified with the mineral. Just remember to try and pair non-dairy sources of calcium with vitamin D: The body needs vitamin D to help absorb calcium! [greatist.com/health].List given below:-

Table- 1

LIFE STAGE GROUP	CALCIUM RECOMMENDED Dietary Allowance(mg/day)	VITAMIN D RECOMMENDED Dietary Allowance (IU/day)
Infants 0 – 6 months	*	**
Infants 6 – 12 months	*	**
1 – 3 years old	700	**
4 – 8 years old	1000	600
9 – 13 years old	1300	600
14 -18 years old	1300	600
19 – 30 years old	1000	600
31 – 50 years old	1000	600
51 – 70 years old	1000	600
51 – 70 years old females	1200	600
71 years above old	1200	800
14 – 18 yrs old pregnant / Lactating women	1300	600
19 – 50 yrs old pregnant/ Lactating women	1000	600

\*For infants, adequate intake is 200 mg/day for 0 to 6 months of age and 260 mg/day for 6 to 12 months of age.

\*\*For infants, adequate intake is 400 IU/day for 0 to 6 months of age and 400 IU/day for 6 to 12 months of age.

Sources of Calcium

Table- 2

1. White Beans ---	191 mg (19% DV) in 1 cup canned.
2. Canned Salmon ---	232 mg (23% DV) in ½ can with bones (which provides the calcium!)
3. Sardines ---	321 mg (32% DV) in about 7 sardines fillets
4. Dried Figs ---	107 mg (10% DV) in 8 whole dried figs
5. Bok Choy ---	74 mg (7% DV) in 1 cup.
6. Blackstrap Molasses ---	172 mg (17% DV) in 1 tablespoon.
7. Kale ---	188 mg (19% DV) in 2 cups raw (chopped).
8. Black-eyed Peas ----	185 mg (18% DV) in 1/2 cup canned.
9. Almonds -----	72 mg (7% DV) in ¼ cup dry roasted (about 20 nuts).
10. Oranges -----	65 mg (6% DV) in 1 medium fruit.
11. Turnip Greens ----	197 mg (20% DV) in 1 cup cooked (chopped).
12. Sesame Seeds ---	88 mg (9% DV) in 1 tablespoon.
13. Seaweed -----	126 mg (13% DV) in about 1 cup raw.
14. Instant Oatmeal ---	187 mg (19% DV) in 1 cup.
15. Orange Juice ---	500 mg (50% DV) in 1 cup
16. Soy milk ---	300 mg (30% DV) in 1 cup.
17. Firm Tofu ---	861 mg (86% DV) in ½ cup
18. Cheerios ---	114 mg (14% DV) in 1 cup.

**Who should Consider Calcium Supplements?**

Even if you eat a healthy, balanced diet, you may find it difficult to get enough calcium if you:

- Follow a vegan diet
- Have lactose intolerance and limit dairy products
- Consume large amounts of protein or sodium, which can cause your body to excrete more calcium
- Have osteoporosis
- Are receiving long-term treatment with corticosteroids
- Have certain bowel or digestive diseases that decrease your ability to absorb calcium, such as inflammatory bowel disease or

celiac disease.

In these situations, calcium supplements may help you meet your calcium requirements. Talk to your doctor or dietician to determine if calcium supplements are right for you. [[mayoclinic.org/healthy-lifestyle](http://mayoclinic.org/healthy-lifestyle)].

**Do Calcium Supplements have Risks?**

Calcium supplements aren't for everyone. For instance, if you have a health condition that causes excess calcium in your bloodstream (hypercalcemia), you should avoid calcium supplements. You should take only the amount of calcium recommended. Ingesting high doses of calcium each day can be harmful and can cause kidney stones. Also, many calcium supplements contain vitamin D, which is dangerous in doses above the recommended daily amounts. If you are

already taking a multivitamin, consult your doctor for help in choosing a calcium supplement. Vitamin D overdose symptoms include appetite loss, weakness, excessive thirst and/or urination, nausea, and vomiting.[medscape.com]

### **Types of Calcium Supplements**

Several different kinds of calcium compounds are used in calcium supplements. Each compound contains varying amounts of the mineral calcium — referred to as elemental calcium. Common calcium supplements may be labeled as:

Calcium carbonate (40 percent elemental calcium)

Calcium citrate (21 percent elemental calcium)

Calcium gluconate (9 percent elemental calcium)

Calcium lactate (13 percent elemental calcium)

The two main forms of calcium supplements are carbonate and citrate. Calcium carbonate is cheapest and therefore often a good first choice. Other forms of calcium in supplements include gluconate and lactate.

In addition, some calcium supplements are combined with vitamins and other minerals. For instance, some calcium supplements may also contain vitamin D or magnesium. Check the ingredient list to see which form of calcium your calcium supplement is and what other nutrients it may contain. This information is important if you have any health or dietary

concerns.[mayoclinic.org/healthy-lifestyle]

### **When Choosing a Supplement, Keep the Following Tips in Mind**

Most calcium supplements have between 200 and 500 milligrams of calcium. Remember, your goal is 1,300 milligrams of per day.

If you have to take more than one supplement per day, it is best to take them at different times of the day because your body can only absorb about 500 milligrams of calcium at a time.

Don't count on getting all of your calcium from a multivitamin. Most basic multivitamin/mineral tablets have very little calcium in them.

Look for a calcium supplement that has vitamin D added. Vitamin D helps your body absorb calcium.

Avoid "oyster shell" or "natural source" calcium supplements. These may have lead or aluminium in them and are not recommended.

Know that your dietician or health care provider will be able to support you with recommendations on what supplement will best suit your needs. [youngwomenshealth.org].

### **Why Do Women Need More Calcium? Calcium and Estrogen**

You may think of estrogen as a female sex hormone, but it also is a key factor in bone health for men and women alike. When a woman's estrogen level drops due to menopause, osteoporosis can result, significantly increasing the risk of bone

fractures. The National Osteoporosis Foundation states that bone density in women can decline by as much as 20 percent within 7 years after the onset of menopause. Adequate calcium and vitamin D consumption may help keep bones healthy during this stage of life, reducing the risk of osteoporosis and subsequent fractures. [getfit.jillianmichaels.com]

### **Calcium in Pregnancy**

Additional calcium is important for pregnant women and their developing babies. Supplemental calcium may lower your risk of preeclampsia, a dangerous pregnancy-related condition characterized by a rapid rise in blood pressure. Additionally, taking in adequate calcium when you are pregnant improves bone mineralization in your baby and is important for maintaining a regular heart rhythm in both mom and baby. Getting enough calcium is really important for mom. If your body isn't getting enough calcium from your diet, it will take from bones. This is how old wives "lose a baby, lose a tooth" originated. If you are pregnant or contemplating pregnancy, talk to your doctor about your calcium needs. [getfit.jillianmichaels.com]

### **Calcium for Female Athletes**

While athletic activities are generally beneficial for women, a subset of women athletes suffer from a dangerous condition called "female athlete triad." CalciumInfo.com states that female athlete triad is associated with eating disorders, menstrual cessation or irregularity and

osteoporosis, a weakening of the bones that often leads to stress fractures. This condition is brought on by the restrictive diets and excessive training that some women undergo in order to achieve their ideals of athletic excellence. [getfit.jillianmichaels.com]

### **Conclusion**

Calcium is needed for our heart, muscles, and nerves to function properly and for blood to clot. Inadequate calcium significantly contributes to the development of osteoporosis. Many published studies show that low calcium intake throughout life is associated with low bone mass and high fracture rates. National nutrition surveys have shown that most people are not getting the calcium they need to grow and maintain healthy bones. If you have trouble getting enough calcium in your diet, you may need to take a calcium supplement. Calcium supplements are better absorbed when taken in small doses (500 mg or less) several times throughout the day. In many individuals, calcium supplements are better absorbed when taken with food. The body needs vitamin D to absorb calcium. Without enough vitamin D, one can't form enough of the hormone calcitriol (known as the "active vitamin D"). This in turn leads to insufficient calcium absorption from the diet. In this situation, the body must take calcium from its stores in the skeleton, which weakens existing bone and prevents the formation of strong, new bone. Remember, a balanced diet rich in calcium and vitamin D is only one part of an osteoporosis prevention or treatment program. Like exercise, getting

enough calcium is a strategy that helps strengthen bones at any age. But these strategies may not be enough to stop bone loss caused by lifestyle, medications, or menopause. Your doctor can determine the need for an osteoporosis medication in addition to diet and exercise.

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