Calcium
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While some complementary and alternative techniques have been studied scientifically, high-quality data regarding safety, effectiveness, and mechanism of action are limited or controversial for most therapies. Whenever possible, it is recommended that practitioners be licensed by a recognized professional organization that adheres to clearly published standards. In addition, before starting a new technique or engaging a practitioner, it is recommended that patients speak with their primary healthcare provider(s). Potential benefits, risks (including financial costs), and alternatives should be carefully considered. The below monograph is designed to provide historical background and an overview of clinically-oriented research, and neither advocates for or against the use of a particular therapy.

Related Terms:
- AdvaCAL®, Alka-Mints®, Apo-Cal®, atomic number 20, Bica®, Bo-Ne-Ca®, bone meal, bovine cartilage, Ca, Cal-100®, Calciforte®, Calcefor®, Calci Fresh®, Calcigamma®, Calcilax®, Calcit®, calcitonin, Calcitridin®, calcitriol, calcium acetate, calcium aspartate, calcium carbonate, calcium chelate, calcium chloride, calcium citrate, calcium citrate malate, Calcium Dago® (Germany), calcium formate, calcium gluconate, calcium gluconate, Calcium Klopfer® (Austria), calcium lactate, calcium lactate gluconate, calcium lactogluconate, calcium orotate, calcium oxalate, Calcium Pharmavit® (Hungary), calcium phosphate, calcium pyruvate, Calcium-Sandoz Forte® (Bulgaria), Calcurex® (Finland), Caldosal® (Colombia), Calmate® 500 (Philippines), CalMax®, Calmicid®, Cal-Quick®, Calsan® (Mexico, Peru, Philippines), Calsup®, Cal-Sup® (New Zealand), Caltab® (Thailand), Caltrate®, Caltrate® (Puerto Rico, Colombia, Malaysia, Mexico, South Africa), Caltrate 600® (Canada, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, Nicaragua, Panama, Peru, Venezuela), Cantacid® (Korea), Cartilade®, CC-Nefro 500® (Germany), Chooz®, Chooz Antacid Gum 500® (Israel), Citrical®, coral calcium, dairy products (milk, cheese, yogurt, etc.), dicalcium phosphate, Dimacid®, dolomite, Estroven®, Fixical® (France), Gaviscon®, heated oyster shell-seaweed calcium, hydroxyapatite, (oral 44Ca and intravenous 42Ca), isotopically enriched milk, LeanBalance®, Living Calcium®, Maalox®, Maalox® Quick Dissolve (Canada), magnesium, Netra® (Israel), Neutralin®, Noacid® (Uruguay), nonfat milk, Orocalc® (France), Os-Cal®, Os-Cal® (Canada), Ospar® Ca 500 (Germany), Osteocal® 500 (France), osteocalcin, osteocalcin concentration, Osteomin® (Mexico), OsteoPrime®, Osteo Wisdom®, oyster shell calcium, oyster shell electrolysat (OSE), Pepcid® Complete, Pluscal® (Argentina), Posture-D®, Renacal (Germany), Rocaltrol®, Rolaid®, salmon calcitonin, Sandocal®, Sandocal (India), shark cartilage, tricalcium phosphate, Tums®, Tums® (Israel, Mexico), Tums Ultra Assorted Berries® (Israel), Tums Ultra Spearmint® (Israel), Tzarevet X® (Israel), Viactiv®.

BACKGROUND

- The Romans used lime (calcium oxide), clacked lime (calcium hydroxide) and hydraulic cement in construction works. Calcium (Latin calx, meaning "lime") was first isolated in its metallic form by Sir Humphrey Davy in 1808 through the electrolysis of a
A mixture of calcium oxide and mercury oxide.

- Chelated calcium refers to the way in which calcium is chemically combined with another substance. Calcium citrate is an example of such a chelated preparation. Calcium may also be combined with other substances to form preparations such as calcium lactate or calcium gluconate. Calcium carbonate, which can be refined from limestone, natural elements of the earth, or from shell sources, such as oyster. Shell sources are often described on the label as a "natural" source. Calcium carbonate from oyster shells is not "refined" and can contain variable amounts of lead.

- Calcium is the most abundant mineral in the human body and has several important functions. More than 99% of total body calcium is stored in the bones and teeth where it supports the structure. The remaining 1% is found throughout the body in blood, muscle, and the intracellular fluid. Calcium is needed for muscle contraction, blood vessel constriction and relaxation, the secretion of hormones and enzymes, and nervous system signaling. A constant level of calcium is maintained in body fluid and tissues so that these vital body processes function efficiently.

- The body gets the calcium it needs in two ways. One method is dietary intake of calcium-rich foods including dairy products, which have the highest concentration per serving of highly absorbable calcium, and dark, leafy greens or dried beans, which have varying amounts of absorbable calcium. Calcium is an essential nutrient required in substantial amounts, but many diets are deficient in calcium.

- The other way the body obtains calcium is by extracting it from bones. This happens when blood levels of calcium drop too low and dietary calcium is not sufficient. Ideally, the calcium that is taken from the bones will be replaced when calcium levels are replenished. However, simply eating more calcium-rich foods does not necessarily replace lost bone calcium, which leads to weakened bone structure.

- Hypocalcaemia is defined as a low level of calcium in the blood. Symptoms of this condition include sensations of tingling, numbness, and muscle twitches. In severe cases, tetany (muscle spasms) may occur. Hypocalcaemia is more likely to be due to a hormonal imbalance, which regulates calcium levels, rather than a dietary deficiency. Excess calcium in the blood can cause nausea, vomiting and calcium deposition in the heart and kidneys. This usually results from excessive doses of vitamin D and can be fatal in infants.

- The Surgeon General's 2004 report "Bone Health and Osteoporosis" stated that calcium has been singled out as a major public health concern today because it is critically important to bone health and the average American consumes levels of calcium that are far below the amount recommended. Vitamin D is important for good bone health because it aids in the absorption and utilization of calcium. There is a high prevalence of vitamin D insufficiency in nursing home residents, hospitalized patients, and adults with hip fractures.

- Calcium supplements are widely used to reduce bone resorption in osteoporosis, and many studies support this use. Calcium supplementation is also used for colorectal neoplasia and in pregnancy.

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**Uses**

These uses have been tested in humans or animals. Safety and effectiveness have not always been established.
Some of these conditions are potentially serious, and should be evaluated by a qualified healthcare provider.

<table>
<thead>
<tr>
<th>Antacid (calcium carbonate)</th>
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<tr>
<td>Calcium carbonate is an FDA (Food and Drug Administration) approved over the counter (OTC) drug used to treat gastric hyperacidity (high acid levels in the stomach).</td>
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<tr>
<th>Bone loss (prevention)</th>
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<tr>
<td>Multiple studies of calcium supplementation in the elderly and postmenopausal women have found that high calcium intakes can help reduce the loss of bone density. Studies indicated that bone loss could be prevented in many areas including ankles, hips, and spine.</td>
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<th>Cardiopulmonary resuscitation (CPR)</th>
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<tr>
<td>Calcium chloride may be given intravenously (IV) by a qualified health care professional in cardiac resuscitation, particularly after open-heart surgery, when epinephrine fails to improve weak or ineffective myocardial contractions. Calcium chloride is contraindicated for cardiac resuscitation in the presence of ventricular fibrillation. CPR with calcium chloride should only be done under supervision of a qualified healthcare professional.</td>
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<th>Deficiency (calcium)</th>
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<tr>
<td>Calcium gluconate is used to treat conditions arising from calcium deficiencies such as hypocalcaemic (low blood calcium) tetany (muscle spasms), hypocalcaemia related to hypoparathyroidism (low levels of the parathyroid hormone) and hypocalcaemia due to rapid growth or pregnancy. It is also used for the treatment of hypocalcaemia for conditions requiring a prompt increase in plasma calcium levels (e.g., tetany in newborns and tetany due to parathyroid deficiency, vitamin D deficiency and alkalosis) and for the prevention of hypocalcaemia during exchange transfusions. Treatment of hypocalcaemia should only be done under supervision of a qualified healthcare professional.</td>
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<th>High blood phosphorous level</th>
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<td>Hyperphosphatemia (high phosphate level in the blood) is associated with increased cardiovascular mortality in adult dialysis patients. Calcium carbonate or acetate can be used effectively as phosphate binders. Use may increase calcium-phosphate products in blood. Treatment of high blood phosphorous levels should only be done under supervision of a qualified healthcare professional.</td>
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**Osteoporosis**

Osteoporosis is a disorder of the skeleton in which bone strength is reduced, resulting in an increased risk of fracture. Although osteoporosis is most commonly diagnosed in white postmenopausal women, women of other racial groups and ages, men, and children may also develop osteoporosis.

Calcium is the nutrient consistently found to be the most important for attaining peak bone mass and preventing osteoporosis. Adequate vitamin D intake is required for optimal calcium absorption. Adequate calcium and vitamin D are deemed essential for the prevention of osteoporosis in general, including postmenopausal osteoporosis.

Although calcium and vitamin D alone are not recommended as the sole treatment of osteoporosis, they are necessary additions to pharmaceutical treatments. The vast majority of clinical trials investigating the efficacy of pharmaceutical treatments for osteoporosis have investigated these agents in combination with calcium and vitamin D. So, although calcium alone is unlikely to have an effect on the rate of bone loss following menopause, osteoporosis cannot be treated in the absence of calcium. Treatment of postmenopausal osteoporosis should only be done under supervision of a qualified healthcare professional.

<table>
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<th>Toxicity (magnesium)</th>
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<tr>
<td>Calcium gluconate is used in the treatment of hypermagnesemia (high level of magnesium in the blood). Case studies suggest intravenous calcium can aid in the improvement of symptoms. Treatment of magnesium toxicity should only be done under supervision of a qualified healthcare professional.</td>
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<tr>
<th>Black widow spider bite</th>
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<tr>
<td>Calcium supplementation is used in the treatment of black widow spider bites to relieve muscle cramping in combination with antiserum, analgesics (pain relievers) and muscle relaxants. Treatment of a black widow spider bite should only be done under supervision of a qualified healthcare professional.</td>
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<th>High blood potassium level</th>
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<tr>
<td>Calcium gluconate may aid in antagonizing the cardiac toxicity and arrhythmia (abnormal heart rhythm) associated with hyperkalemia (high blood potassium), provided the patient is not receiving digitalis drug therapy. Treatment of hyperkalemia should only be done under supervision of a qualified healthcare professional.</td>
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### High blood pressure

Several studies have found that introducing calcium to the system can have hypotensive (blood pressure lowering) effects. These studies indicate that high calcium levels lead to sodium loss in the urine, and lowered parathyroid hormone (PTH) levels, both of which result in the lowering of blood pressure. However, one study found that these results did not hold true for middle-aged patients with mild to moderate essential hypertension.

In the DASH (Dietary Approaches to Stop Hypertension) study, a calcium enriched three servings per day of low-fat dairy products reduced systolic and diastolic blood pressure. This research indicates that a calcium intake at the recommended level may be helpful in preventing and treating moderate hypertension. Treatment of high blood pressure should only be done under supervision of a qualified healthcare professional.

### Premenstrual syndrome (PMS)

There is a link between lower dietary intake of calcium and symptoms of premenstrual syndrome. Calcium supplementation has been suggested in various clinical trials to decrease overall symptoms associated with PMS, such as depressed mood, water retention and pain.

### Bone stress injury prevention

Calcium supplementation above normal daily dietary intake did not reduce stress fractures in men. Thus calcium supplementation may not be effective in preventing stress fractures but further studies must be done to validate these results.

### Colorectal cancer

Colorectal cancer is the most common gastrointestinal cancer and the second leading cause of cancer deaths in the US. Colorectal cancer is caused by a combination of genetic and environmental factors, but the degree to which these two factors influence the risk of colon cancer in individuals varies. Most large prospective studies have found increased calcium intake to be only weakly associated with a decreased risk of colorectal cancer. Further studies are needed to verify these results. Treatment of colorectal cancer should only be done under supervision of a qualified healthcare professional.

### Growth (mineral metabolism in very low birth weight infants)

Growth of very low birth weight infants correlates with calcium intake and retention in the body. It is possible that human milk fortifiers commonly used may have inadequate levels of calcium for infants of very low birth weight. Bone mineralization is also lower in very low birth weight infants at theoretical...
Bone mineralization is also lower in very low birth weight infants at theoretical term than infants born at term. Use of a formula containing higher levels of calcium has been suggested to allow improved bone mineralization in these infants.

**High blood pressure (pregnancy-induced)**

For the general population, meeting current recommendations for calcium intake during pregnancy may help prevent PIH. Further research is required to determine whether women at high risk for PIH would benefit from calcium supplementation above the current recommendations. Treatment of pregnancy-induced hypertension should only be done under supervision of a qualified healthcare professional.

**Hyperparathyroidism (secondary)**

In patients on hemodialysis, calcium supplementation may reduce secondary hyperparathyroidism (high blood levels of parathyroid hormone due to another medical condition or treatment). Treatment of hyperparathyroidism should only be done under the supervision of a qualified healthcare professional.

**Lead toxicity (acute symptom management)**

A chelating treatment of calcium has been suggested to reduce blood levels of lead in cases of lead toxicity. Reduced symptoms have been observed in most, but not all, patient case reports and case histories. Adequate calcium intake appears to be protective against lead toxicity. Treatment of lead toxicity should only be done under supervision of a qualified healthcare professional.

**Osteomalacia / rickets**

Rickets and osteomalacia (bone softening) are commonly thought of as diseases due to vitamin D deficiency; however, calcium deficiency may also be another cause in sunny areas of the world where vitamin D deficiency would not be expected. Calcium gluconate is used as an adjuvant in the treatment of rickets and osteomalacia, as well as a single therapeutic agent in non-vitamin D deficient rickets. Research continues into the importance of calcium alone in the treatment and prevention of rickets and osteomalacia. Treatment of rickets and osteomalacia should only be done under supervision of a qualified healthcare professional.

**Osteoporosis prevention (steroid-induced)**

Calcium supplementation in patients on long-term, high-dose inhaled steroids for asthma may reduce bone loss due to steroid intake. Treatment using the
for asthma may reduce bone loss due to steroid intake. Treatment using the prescription drug pamidronate with calcium has been shown to be superior to calcium alone in prevention of corticosteroid-induced osteoporosis. Inhaled steroids have been reported to disturb normal bone metabolism, and they are associated with a decrease in bone mineral density. Results suggest that long-term administration of high-dose inhaled steroid induces bone loss that is preventable with calcium supplementation with or without the prescription drug etidronate. Long-term studies involving more patients should follow to confirm these preliminary findings.

**Prostate cancer (increased risk)**

The lack of agreement among these studies suggests complex interactions among risk factors for prostate cancer. Until the relationship between calcium and prostate cancer is clarified, it is reasonable for men to consume recommended intakes as per the Food and Nutrition Board of the Institute of Medicine. Treatment of prostate cancer should only be done under supervision of a qualified healthcare professional.

**Weight loss**

Diets with higher calcium density (high levels of calcium per total calories) have been associated with a reduced incidence of being overweight or obese in several studies. While more research is needed to understand the relationships between calcium intake and body fat, these findings emphasize the importance of maintaining an adequate calcium intake while attempting to diet or lose weight.

**Vaginal disorders (atrophy, wasting or thinning or the vaginal tissue)**

Stopping treatment with topical hormone replacement therapy and switching to treatment with calcium plus vitamin D made vaginal atrophy worse in one study. Increases in painful or difficult intercourse and urinary leaks were reported. Menopausal complaints of hot flashes and night sweats were also worse than before calcium plus vitamin D therapy.

*Key to grades: A: Strong scientific evidence for this use; B: Good scientific evidence for this use; C: Unclear scientific evidence for this use; D: Fair scientific evidence against this use (it may not work); F: Strong scientific evidence against this use (it likely does not work).*

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**TRADITION/THEORY**

The below uses are based on tradition, scientific theories, or limited research. They often have not been thoroughly tested in humans, and safety and effectiveness have not always been proven. Some of these conditions are potentially serious, and should be evaluated by a qualified healthcare provider. There may be other proposed uses that are not listed below.
Bone density improvement (lactating women), bone loss (bone marrow transplantation), bone loss (renal transplantation), carcinoma, cardiac arrest, diarrhea, high cholesterol, intestinal disorders, ischemic stroke (prevention), leg cramps (pregnancy), medullary thyroid cancer (diagnosis), multiple sclerosis, neuromuscular blockade (antagonize), psoriasis, reducing fluoride levels (children), Zollinger-Ellison (diagnosis).

DOSING

The below doses are based on scientific research, publications, traditional use, or expert opinion. Many herbs and supplements have not been thoroughly tested, and safety and effectiveness may not be proven. Brands may be made differently, with variable ingredients, even within the same brand. The below doses may not apply to all products. You should read product labels, and discuss doses with a qualified healthcare provider before starting therapy.

General:

Recommended doses are based on those most commonly used in available trials, or on historical practice. However, with natural products it is often not clear what the optimal doses are to balance efficacy and safety. Preparation of products may vary from manufacturer to manufacturer, and from batch to batch within one manufacturer. Because it is not often clear what the active components of a product are, standardization may not be possible, and the clinical effects of different brands may not be comparable.

A good food source of calcium contains a substantial amount of calcium in relation to its calorie content and contributes at least 10 percent of the U.S. Recommended Dietary Allowance (U.S. RDA) for calcium in a selected serving size. The U.S. RDA for calcium is 1,000mg per day for adults (except pregnant or lactating women) and children over four years of age and is used as the standard in nutrition labeling of foods. This allowance is based on the 1968 Recommended Dietary Allowances (RDA) for 24 sex-age categories set by the Food and Nutrition Board of the National Academy of Sciences. Adequate intake (AI) recommendations published in August 1997 were set at 1,000mg for men and women aged 19-50 and 1,200mg for individuals older than age 50.

Adults (18 years and older):
Oral (by mouth):

Does ranging from 400-3,000mg daily of a calcium supplement has been taken by mouth in several studies. Note that there are many forms available. Different conditions may require unique dosing and should be discussed with a qualified healthcare provider. Intravenous (through the vein) calcium may be given by a qualified healthcare provider.

Children (younger than 18 years):
Oral (by mouth):

Healthy adolescents have received a calcium supplement containing 1,000mg supplemental calcium daily as calcium citrate malate for 14 days, or 1,000mg effervescent calcium tablet daily. A dose of 850mg daily calcium has also been given orally to prepubertal boys in food products. Special dosing may be recommended by a
qualified healthcare provider for certain indications.

**SAFETY**

The U.S. Food and Drug Administration does not strictly regulate herbs and supplements. There is no guarantee of strength, purity or safety of products, and effects may vary. You should always read product labels. If you have a medical condition, or are taking other drugs, herbs, or supplements, you should speak with a qualified healthcare provider before starting a new therapy. Consult a healthcare provider immediately if you experience side effects.

**Allergies**

- Avoid if known allergy/hypersensitivity to calcium supplements or any of their ingredients. Some people are lactose intolerant. Dairy products contain lactose and dairy products are a common food source of calcium. Lactose intolerance can cause cramping, bloating, gas and diarrhea. Lactose intolerance effects the population in varying degrees.
- Avoid calcium supplementation in those who are very sensitive to any component of a calcium-containing supplement, or who have hypocalcaemia (high levels of calcium in the blood). Conditions causing hypocalcaemia include sarcoidosis (inflammation in the lymph nodes and other organs), hyperparathyroidism (high levels of parathyroid hormone), and hypervitaminosis D (high levels of vitamin D).

**Side Effects and Warnings**

- Calcium supplementation is likely safe when used orally and appropriately and when used intravenously and appropriately, by a qualified healthcare professional. It is also likely safe when used orally and appropriately in pregnancy and lactation, by a qualified healthcare professional. Routine dietary intake and supplementation in recommended doses are not associated with significant adverse effects.
- Calcium supplementation is possibly unsafe when taken by mouth (orally) in high doses. High doses of oral calcium can cause kidney stones, which might result in renal damage. Ingestion of calcium chloride has been reported to cause gastrointestinal hemorrhage (bleeding).
- Avoid calcium supplements made from dolomite, oyster shells, or bone meal because such compounds may contain unacceptable levels of lead. Use should be avoided in patients with hypercalcaemia (high blood levels of calcium), hypercalciuria (high levels of calcium in urine), hyperparathyroidism (high levels of parathyroid hormone), bone tumors, digitalis toxicity, ventricular fibrillation (ventricles of the heart contract in unsynchronized rhythm), kidney stones (renal calculi), or sarcoidosis (inflammation of lymph nodes and various other tissues).
- Excretion of abnormally large amounts of calcium in the urine is a well-established side effect of administration.
- A low level of calcium in the blood and tissues can cause low levels of calcium in the blood. Symptoms of this condition include sensations of tingling, numbness, muscle twitches and muscle spasms (tetany) may occur. It is more likely to be due to a hormonal imbalance in the regulation of calcium rather than a dietary deficiency.
- Excess calcium in the blood (hypercalcaemia) can be without symptoms or it can cause loss of appetite, nausea, vomiting, constipation, abdominal pain, dry mouth, thirst, frequent urination and calcium deposition in the heart and kidneys. This usually
results from excessive doses of vitamin D and can cause death in infants. More severe hypercalcaemia may result in confusion, delirium, coma, and if not treated, death. Hypercalcaemia has been reported only with the consumption of large quantities of calcium supplements usually in combination with antacids, particularly in the past when peptic ulcers were treated with large quantities of milk, calcium carbonate (antacid) and sodium bicarbonate (absorbable alkalai).

- Avoid high doses of calcium without food in those who are prone to the formation of calcium-containing kidney stones, as calcium supplementation in the absence of food may be associated with an increased risk of calcium oxalate stone formation. Consult a qualified healthcare professional if you are prone to kidney stones before using calcium supplements.

- Use caution in those with achlorhydria (absence of hydrochloric acid; HCl in gastric juices) as low levels of gastric acid during digestion reduces urinary phosphate and calcium excretion. Thus, it is advisable to take calcium carbonate with food to stimulate gastric acid production. Consult a qualified healthcare provider.

- Use caution in people who have kidney disease. These individuals should check with their doctors before taking calcium.

- Use with caution in those with hyperparathyroidism (high levels of parathyroid hormone) as PTH increases calcium absorption from the small intestine. Consult a qualified healthcare professional.

- Avoid cigarette smoking, as this decreases intestinal calcium absorption and may lead to decreased bone mineral density.

- Use caution in patients with renal insufficiency (kidney deterioration). Calcium carbonate supplementation increases the risk of hypercalcaemia (high calcium in the blood) and higher blood pH (alkalosis) and renal insufficiency predisposes individuals to reduced calcium absorption. Consult a qualified healthcare professional.

- Determination of dose of calcium required to saturate the urine, when calcium is taken in conjunction with estrogen supplements (HRT), may decrease the risk of nephrolithiasis (small stones in the kidney) development.

- Use caution in individuals taking large amounts of vitamin D. Excess calcium in the blood (hypercalcaemia) can cause nausea, vomiting and calcium deposition in the heart and kidneys. This usually results from excessive doses of vitamin D and can be fatal in infants. Consult a qualified healthcare provider.

- Use caution in individuals with heart arrhythmias and ventricular fibrillation (irregular heart beating). Large fluctuations in free calcium during intravenous calcium infusion can cause the heart to slow down or beat too rapidly. Consult a qualified healthcare provider.

- Avoid calcium supplementation in patients with hypercalcaemia (high levels of calcium in the blood), hypercalciuria (high levels of calcium in the urine), hyperparathyroidism (high levels of parathyroid hormone), bone tumors, digitalis toxicity, ventricular fibrillation, renal calculi, or sarcoidosis. Consult a qualified healthcare provider.

**Pregnancy & Breastfeeding**

The Standing Committee on the Scientific Evaluation of Dietary Reference Intakes, Food, and Nutrition Board suggests that current calcium recommendations for non-pregnant women are also sufficient for pregnant women because intestinal calcium
absorption increases during pregnancy.

- Pregnant women are especially vulnerable to accelerated bone turnover due to the physiologic stress of pregnancy and lactation. Studies indicate that pregnant women should take calcium supplements to prevent bone density loss. The National Academy of Sciences recommends that women who are pregnant or breastfeeding consume calcium each day. For pregnant teens, the recommended intake is higher.

- Consult a qualified healthcare professional to determine dosing during pregnancy and breastfeeding.

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**INTERACTIONS**

*Most herbs and supplements have not been thoroughly tested for interactions with other herbs, supplements, drugs, or foods. The interactions listed below are based on reports in scientific publications, laboratory experiments, or traditional use. You should always read product labels. If you have a medical condition, or are taking other drugs, herbs, or supplements, you should speak with a qualified healthcare provider before starting a new therapy.*

**Interactions with Drugs**

- Intestinal aluminum absorption is increased in healthy and renal failure patients taking even small amounts of calcium citrate. As a result, all citrate-containing preparations are contraindicated in chronic renal failure patients taking aluminum containing compounds.

- Anticonvulsants decrease calcium absorption by increasing metabolism of vitamin D. Anticonvulsant intake can lead to hypocalcaemia (low blood calcium) and softening of the bones (osteomalacia).

- Intake of a bisphosphonate and calcium may decrease the absorption of the bisphosphonate. Patients should take biphosphonates at least 30 minutes before calcium. Optimally, the two would be consumed at different times of the day.

- Caffeine may increase urinary calcium excretion and has been implicated in osteoporosis; however, research is still conflicting. Caffeine has a small effect on calcium absorption.

- Calcitriol is a form of vitamin D that is used to treat and prevent low levels of calcium in the blood of patients whose kidneys or parathyroid glands (glands in the neck that release natural substances to control the amount of calcium in the blood) are not working normally.

- When given intravenously, calcium can reverse the effects of calcium channel blockers (commonly used for high blood pressure). Calcium channel blockers include: nifedipine (Adalat®, Procardia®), verapamil (Calan®, Isopin®, Verelan®), diltiazem (Cardizem®), isradipine (DynaCirc®), felodipine (Plendil®), and amlodipine (Norvasc®).

- Cholestyramine (commonly used for high cholesterol) can reduce the absorption of vitamin D, which, in turn, reduces the absorption of calcium.

- Corticosteroids (commonly used for inflammation) can cause significant bone loss (osteoporosis) if the recommended level of calcium and vitamin D intake is not met.

- Calcium levels should be monitored if taking the heart rhythm medication digoxin due to potential for interaction with high blood levels of calcium and need for adequate blood levels of calcium. Patients taking digoxin should consult with a qualified healthcare professional should before using calcium supplements.
Alcohol can affect calcium status by reducing the intestinal absorption of calcium. It can also inhibit enzymes in the liver that help convert vitamin D to its active form which in turn reduces calcium absorption. However, the amount of alcohol required to affect calcium absorption is unknown. Evidence is currently conflicting whether moderate alcohol consumption is helpful or harmful to bone.

Fluroquinolone antibiotics form complexes with calcium in the gastrointestinal tract, which can lead to reduced absorption of both if taken at the same time.

Use of H₂ blockers (like ranitidine commonly used to treat acid reflux) at the same time as calcium carbonate or calcium phosphate may not cause decreased absorption of these calcium salts.

Hormone replacement therapy (HRT) alone may be associated with a fall in calcium absorption efficiency. The bone-preserving effects of estrogen treatment are increased by calcium supplementation. Estrogen increases supplemental calcium absorption in postmenopausal women.

Use of inositol hexaphosphate (phytic acid) and calcium may decrease the absorption of calcium.

Mineral oil or stimulant laxatives (cascara, senna and bisacodyl), when used for prolonged periods, can reduce dietary calcium and vitamin D absorption often causing osteomalacia (bone softening).

Intake of levothyroxine (synthroid, levothroid, levoxyl) at the same time as calcium carbonate has been found to reduce levothyroxine absorption and to increase serum thyrotropin levels. Levothyroxine may adsorb (stick) to calcium carbonate in an acidic environment, which may block its absorption.

Loop diuretics including furosemide (Lasix®), bumetanide (Bumex®), ethacryninc acid (Edecrin®) and torsemide (Demadex®), at high doses, may reduce serum calcium levels because they increase urinary calcium excretion.

Orlistat (Xenical®) has been shown to induce a relative increase in bone turnover (increased resorption or bone loss), which may be due to the malabsorption of vitamin D and/or calcium.

The effect of dietary phosphorus on calcium is minimal. Some researchers speculate that the detrimental effects of consuming foods high in phosphate such as carbonated soft drinks is due to the replacement of milk with soda rather than the phosphate level itself.

Increasing dietary potassium intake in the presence of a low sodium diet may help decrease calcium excretion particularly in postmenopausal women.

Use of proton pump inhibitors (like esomeprazole used to treat ulcers) and calcium carbonate or calcium phosphate at the same time can cause decreased absorption of these calcium salts.

Typically, dietary sodium and protein increase calcium excretion as their intake is increased. However, if a high protein, high sodium food also contains calcium, this may help counteract the loss of calcium.

Calcium may form complexes with sotalol (a beta-blocker drug used to treat irregular heartbeats), reducing its absorption. A physician should be contacted in order to determine optimal timing of doses. Patients taking sotalol should consult a qualified healthcare professional before using calcium supplements.
Intake of a tetracycline and calcium may decrease the absorption of the tetracycline, including doxycycline, minocycline, and tetracycline. Two to four hours between tetracyclines and calcium supplements should be allowed.

Thiazides reduce calcium excretion by the kidneys. These diuretics include: chlorothiazide (Diuril®), hydrochlorothiazide (HydroDIURIL®, Esidrix®), indapamide (Lozol®), metolazone (Zaroxolyn®), and chlorthalidone (Hygroton®).

**Interactions with Herbs & Dietary Supplements**

- Calcium carbonate and aluminum hydroxide taken together have produced a significant rise in serum and urine aluminum levels.
- Combined use of inositol hexaphosphate (phytic acid) and calcium may decrease the absorption of calcium.
- Inulin, found in fresh cheese, does not appear to acutely affect serum ionized calcium concentrations.
- Stimulant laxatives (cascara, senna, and bisacodyl) when used for prolonged periods can reduce dietary calcium and vitamin D absorption often causing osteomalacia (bone softening).
- Combination with calcium salts may increase absorption or alter efficacy.
- Large doses of magnesium salts can cause hypocalcaemia (low levels of blood calcium). Oral magnesium supplements do not affect calcium absorption.
- Combined use of iron and calcium may not inhibit the absorption of iron over long periods of time. Combined use of fluoride, magnesium, or zinc, and calcium, may decrease the absorption of these minerals. However, these possible mineral interactions have not been shown to be of clinical significance.
- Mineral oil can interfere with calcium utilization and retention by reducing absorption of calcium and vitamin D.
- Combined use of non-digestible fructo-oligosaccharides or inulin and calcium may increase the absorption of calcium in the colon.
- Calcium taken orally can bind with phosphate in the gut, preventing its absorption and reducing the hyperphosphatemia (high levels of phosphate in the blood) associated with renal failure. Calcium carbonate or calcium acetate is used for this purpose, whereas calcium citrate is not recommended because it increases aluminum absorption.
- While the effect of high phosphorus intakes on calcium balance and bone health are presently unclear, the substitution of large quantities of soft drinks for milk or other sources of dietary calcium is cause for concern with respect to bone health in adolescents and adults. The effect of dietary phosphorus on calcium is minimal.
- Reports show that increased sodium intake results in increased loss of calcium in the urine. These data suggest that an effect of reducing bone loss by increasing calcium supplementation can also be achieved by halving daily sodium excretion.
- Intake of sodium alginate and calcium may decrease the absorption of calcium.
- Excessive vitamin A use has also been found to alter bone turnover. Too much preformed vitamin A can promote fractures. Avoid vitamin supplements that have large amounts of vitamin A as preformed vitamin A, unless prescribed by a doctor. Vitamin A in the form of beta-carotene does not appear to increase one's fracture risk.
Use of vitamin D and calcium increases the absorption of calcium. Vitamin D is important and recommended for optimal calcium absorption.

**AUTHOR INFORMATION**

This information is based on a systematic review of scientific literature edited and peer-reviewed by contributors to the Natural Standard Research Collaboration (www.naturalstandard.com).

**REFERENCES**

Natural Standard developed the above evidence-based information based on a thorough systematic review of the available scientific articles. For comprehensive information about alternative and complementary therapies on the professional level, go to www.naturalstandard.com. Selected references are listed below.

The information in this monograph is intended for informational purposes only, and is meant to help users better understand health concerns. Information is based on review of scientific research data, historical practice patterns, and clinical experience. This information should not be interpreted as specific medical advice. Users should consult with a qualified healthcare provider for specific questions regarding therapies, diagnosis and/or health conditions, prior to making therapeutic decisions.