NATIONAL CANCER INSTITUTE FactSheet

Calcium and Cancer Prevention: Strengths and Limits of the Evidence

Key Points

- Calcium is an essential dietary mineral that can be obtained from food and supplements (see Question 1).
- Research results overall support a relationship between higher intakes of calcium and reduced risks of colorectal cancer, but the results of studies have not always been consistent (see Question 5).
- Whether a relationship exists between higher calcium intakes and reduced risks of other cancers, such as breast and ovarian cancer, is unclear; however, some research suggests that a high calcium intake may increase the risk of prostate cancer (see Question 6).
- The National Cancer Institute (NCI) does not recommend the use of calcium supplements to reduce the risk of colorectal or any other type of cancer (see Question 9).

Note: The information in this fact sheet is not to be used as the basis for making health claims about calcium-containing products.

1. What is calcium?

Calcium is an essential dietary mineral commonly found in milk, yogurt, cheese, and dark green vegetables. It also is found in certain grains, legumes (including peas, beans, lentils, and peanuts), and nuts.

Calcium is a major component of bones and teeth. It also is required for the clotting of blood to stop bleeding and for normal functioning of the nerves, muscles, and heart.

2. How much calcium is needed for good health?

Calcium is an important part of a healthy diet; however, the recommended intake differs according to age. As can be seen in the following table, the highest recommended intake is for children and adolescents between the ages of 9 and 18, when bones are growing rapidly.

Dietary Recommendations for Calcium, Males and Females*

Age Group	Dietary Recommendations (mg**/day)
0–6 months	210 mg
7–12 months	270 mg
1–3 years	500 mg
4–8 years	800 mg
9–18 years	1300 mg
19–50 years	1000 mg
51 years and older	1200 mg

**1997 National Academy of Sciences Panel on Calcium and Related Nutrients (1).*
***mg = milligram.*

For adults (including women who are pregnant or breastfeeding) and for children age 1 or older, the safe upper limit of calcium intake is 2.5 grams (or 2500 mg) per day (1).

Too much calcium in the diet and from dietary supplements can lead to unwanted side effects (see Question 4 for information about side effects).

The U.S. Department of Agriculture's 1994–1996 Continuing Survey of Food Intakes by Individuals showed that the average daily calcium intakes in the United States for males and females over age 9 were 925 mg and 657 mg, respectively, or less than the recommended intake (2).

3. How much calcium is in foods and calcium supplements?

Calcium is found in many foods. Foods high in calcium include dairy products, dark green vegetables, some soy products, fish, nuts, and legumes. The following table shows how much calcium is contained in some common foods.

Calcium Amounts in Some Common Foods*

Food, Standard Amount	Calcium (mg)
Fruit yogurt, low-fat yogurt, 8 oz**	345
Mozzarella cheese, part-skim, 1.5 oz	311
Fat-free (skim) milk, 1 cup	306
Sardines, Atlantic, in oil, drained, 3 oz	325
Tofu, firm, prepared with nigari, ½ cup	253
Spinach, cooked from frozen, ½ cup	146
White beans, canned, ½ cup	96

**Note: This list is not intended to be exhaustive. Adapted from the U.S. Department of Health and Human Services Dietary Guidelines for Americans 2005.*
***oz = ounces.*

Packaged foods are required to have a Nutrition Facts label (3). On foods that contain calcium, this label lists how much calcium there is in each serving of the packaged food. However, the Nutrition Facts labels on packaged foods do not list the calcium content in mg. They only provide the Percent Daily Value (%DV), which is the amount one serving of a food item contributes to the *total amount of calcium you need* each day. The %DV for calcium is based on a recommended Daily Value of 1000 mg per day. Therefore, a food with 20%DV or more contributes a fair amount of a person's daily total, whereas a food with 5%DV or less contributes only a little. As an example, 1 cup of milk provides 300 mg of calcium and 30%DV.

Calcium supplements most often contain either calcium carbonate or calcium citrate, which are calcium salts. Sometimes, they contain both compounds. Calcium carbonate and calcium citrate have different amounts of elemental calcium, which is the actual amount of usable calcium in a supplement. Specifically, calcium carbonate has about 40 percent elemental calcium, meaning that 500 mg of calcium carbonate actually contains 200 mg of elemental calcium or 20%DV. In contrast, calcium citrate has approximately 21 percent elemental calcium. Therefore, nearly twice as much calcium citrate is needed to obtain the equivalent amount of elemental calcium as in calcium carbonate. Calcium supplements may also contain other calcium salts, but the body may not be able to use the calcium in these compounds. As with food labels, you should look at the Nutrition Facts label on a supplement to determine how much calcium it contains.

4. Is it safe to take calcium supplements?

For most people, it is safe to eat foods containing calcium and to take calcium supplements that together do not exceed the tolerable upper intake level of 2.5 grams of calcium per day. This upper level for daily calcium intake in adults is the highest level that likely will not pose risks of unwanted side effects in the general population. The upper level of 2.5 grams a day is an average recommendation for all healthy people who are older than a year, regardless of gender.

Consuming too much calcium—in excess of 5 grams a day, or 3 grams a day in people with existing kidney problems (4)—can lead to several harmful side effects. Most of these side effects result from people taking too many calcium supplements. Rare harmful side effects from excess calcium include kidney stones (5), hypercalcemia (too much calcium in the blood), and kidney failure (1). In addition, excessive consumption of milk (which is high in calcium) and some types of antacids, especially antacids containing calcium carbonate or sodium bicarbonate (baking soda), over a long period of time can cause milk-alkali syndrome, a condition that can also lead to calcium deposits in the kidneys and other tissues and to kidney failure (4,6,7).

5. Is there evidence that calcium may help reduce the risk of colorectal cancer?

The results of epidemiologic studies regarding the relationship between calcium intake and colorectal cancer risk have not always been consistent.

In the American Cancer Society's Cancer Prevention Study II Nutrition Cohort, the diet, medical history, and lifestyle of more than 120,000 men and women were analyzed (8). Men and women who had the highest intakes of calcium through both their diet and supplement use had a modestly reduced risk of colorectal cancer compared with those who had the lowest calcium intakes. However, the benefit from calcium appeared to plateau, or level off, at an intake of approximately 1200 mg per day. When calcium from the diet was analyzed by itself, no reduction in colorectal cancer risk was found. However, the use of calcium supplements in any amount was associated with reduced risk. This association was strongest (a 31 percent reduction in risk) for people who took calcium supplements of 500 mg per day or more.

A stronger relationship between calcium intake and colorectal cancer risk was found when participants of the Nurses' Health Study and the Health Professionals Follow-up Study were combined in an analysis that included more than 135,000 men and women (9). Individuals who had a calcium intake of more than 700 mg per day had a 35 percent to 45 percent reduced risk of cancer of the distal (lower) part of the colon than those who had a calcium intake of 500 mg or less per day. No association was found between calcium intake and risk of cancer of the proximal (middle and upper) part of the colon (9). Another large study of Finnish men showed a similar relationship between higher calcium intake and reduced risk of colorectal cancer (10). This study, however, did not evaluate proximal and distal colorectal cancers separately.

In a study that included more than 61,000 Swedish women, colorectal cancer risk was approximately 28 percent lower among individuals who had the highest calcium intakes (approximately 800–1000 mg per day) compared with those with the lowest calcium intakes (approximately 400–500 mg per day) (11). Data from this study also suggested that the benefit associated with calcium was limited to the distal colon (11). In a study that involved more than 34,000 postmenopausal Iowa women, high intakes of calcium (approximately 1280 mg per day or more) compared with lower calcium intakes (approximately 800 mg per day or less) from both the diet and supplements were associated with a 41 percent reduction in risk of rectal cancer (12). Reduced risks of rectal cancer were also observed for dietary calcium alone and supplemental calcium alone, but these associations were not statistically significant (12).

In an analysis involving more than 293,000 men and 198,000 women in the National Institutes of Health-American Association of Retired Persons (NIH-AARP) Diet and Health Study, high intakes of total calcium, dietary calcium, and supplemental calcium were associated with an approximately 20 percent lower risk of colorectal cancer among men and an approximately 30 percent lower risk of colorectal cancer among women (13).

Findings from two large randomized, placebo-controlled clinical trials, the Calcium Polyp Prevention Study (14, 15) and the European Cancer Prevention Organisation Intervention Study (16) showed that daily supplementation with 1200 to 2000 mg elemental calcium was associated with a reduced risk of recurrence of colorectal polyps known as adenomas in both men and women. Adenomas are thought to be the precursors of most colorectal cancers. In these trials, individuals who previously had one or more

large adenomas removed during colonoscopy were randomly assigned to receive calcium supplementation or a placebo, and the rates of polyp recurrence and other factors were compared between the groups.

The Calcium Polyp Prevention Study involved 930 participants who were randomly assigned to receive 3 grams of calcium carbonate (1200 mg elemental calcium) daily for 4 years or a placebo and then receive follow-up colonoscopies approximately 9 months later and again 3 years after that. Compared with those in the placebo group, the individuals assigned to take calcium had about a 20 percent lower risk of adenoma recurrence (14, 15).

The European Cancer Prevention Organisation Intervention Study involved 665 participants who were randomly assigned to one of three treatment groups: 2 grams of elemental calcium daily (from calcium gluconolactate and calcium carbonate), 3 grams of fiber supplementation daily, or a placebo (16). The results showed that calcium supplementation was associated with a modest reduction in the risk of adenoma recurrence, but this finding was not statistically significant.

The results of another clinical trial conducted as part of the Women's Health Initiative showed that supplementation with 1000 mg elemental calcium (from calcium carbonate) per day for an average duration of 7 years was not associated with a reduced risk of colorectal cancer (5). The calcium supplements in this trial also contained vitamin D (400 international units [IU]). During the trial, 128 cases of invasive colorectal cancer were diagnosed in the supplementation group and 126 cases were diagnosed in the placebo group.

In 2007, the World Cancer Research Fund/American Institute for Cancer Research (WCRF/AICR) published the most authoritative review of existing evidence relating food, nutrition, and physical activity to cancer risk. The report concluded that calcium probably has a protective effect against colorectal cancer (17).

6. Is there evidence that calcium can help reduce the risk of other cancers?

The results of some studies suggest that a high calcium intake may decrease the risk of one or more types of cancer, whereas other studies suggest that a high calcium intake may actually increase the risk of prostate cancer.

In a randomized trial that included nearly 1200 healthy, postmenopausal Nebraska women, individuals were randomly assigned to receive daily calcium supplementation alone (300–600 mg elemental calcium), calcium supplementation (300–600 mg elemental calcium) combined with vitamin D supplementation (1000 IU), or a placebo for 4 years (18). The incidence of all cancers combined was approximately 60 percent lower for women who took the calcium plus vitamin D supplements compared with women who took the placebo. A lower risk of all cancers combined was also observed for women who took calcium supplements alone, but this finding was not statistically significant. The numbers of individual types of cancer diagnosed during this study were too low to be able to draw reliable conclusions about cancer-specific protective effects.

The results of some but not all studies suggest that a high intake of calcium may increase the risk of prostate cancer. For example, the European Prospective Investigation into Cancer and Nutrition analyzed the intakes of animal foods (meat, poultry, fish, dairy products, etc.), protein, and calcium in relation to prostate cancer risk among more than 142,000 men and found that a high intake of protein or calcium from dairy products was associated with an increased risk of prostate cancer (19). Calcium from nondairy sources, however, was not associated with increased risk (19). In addition, a prospective analysis of dairy product and calcium intakes among more than 29,000 men participating in the National Cancer Institute's (NCI) Prostate, Lung, Colorectal, and Ovarian (PLCO) Cancer Screening Trial showed increased risks for prostate cancer associated with high dietary intakes of calcium and dairy products, particularly low-fat dairy products (20). Calcium from supplements was not associated with increased prostate cancer risk (20). In contrast, results from the NIH-AARP Diet and Health Study showed no increased risk of prostate cancer associated with total calcium, dietary calcium, or supplemental calcium intakes (14, 21).

Other studies have suggested that intakes of low-fat milk, lactose, and calcium from dairy products may reduce the risk of ovarian cancer, but this risk reduction has not been found in all studies (14, 22).

An analysis from the Nurses' Health Study that included more than 3,000 women found that higher calcium intakes (more than 800 mg per day) from dairy products—particularly low-fat or nonfat milk, yogurt, and cheese—compared with lower calcium intakes (200 mg or less per day) from dairy products was associated with a reduced risk of breast cancer among premenopausal but not postmenopausal women (23). Calcium from nondairy sources was not associated with a reduction in risk (23). Another analysis that involved more than 30,000 women in the Women's Health Study found a reduced risk of breast cancer associated with higher (1366 mg per day or more) versus lower (less than 617 mg per day) total intakes of calcium among premenopausal but not postmenopausal women (24). In this study, higher versus lower calcium intakes from the diet, from supplements, and from total dairy products were not associated with reduced risk (24).

7. How might calcium help prevent cancer?

Although the exact mechanism by which calcium may help reduce the risk of colorectal cancer is unclear, researchers know that, at the biochemical level, calcium binds to bile acids and fatty acids in the gastrointestinal tract to form insoluble complexes known as calcium soaps. This reduces the ability of the acids (or their metabolites) to damage cells in the lining of the colon and stimulate cell proliferation to repair the damage. Calcium may also act directly to reduce cell proliferation in the lining of the colon or cause proliferating colon cells to undergo differentiation, which, in turn, leads to a reduction in cell proliferation. Calcium also may improve signaling within cells and cause cancer cells to differentiate and/or die (25, 26).

8. How does the body absorb calcium from foods and supplements?

Calcium is absorbed passively (no cellular energy required) in the intestines by diffusing through the spaces between cells. It is also absorbed actively (cellular energy required) through intestinal cells by binding to a transport protein known as calbindin. The production of calbindin is dependent on vitamin D (27).

9. Does NCI recommend the use of calcium supplements to prevent colorectal cancer?

No. Although substantial evidence suggests that calcium may provide some protection against colorectal cancer, the evidence of potential benefit from calcium supplements is limited and inconsistent. Therefore, NCI does not recommend the use of calcium supplements to reduce the risk of colorectal or any other type of cancer.

Selected References

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Related NCI materials and Web pages:

- National Cancer Institute Fact Sheet, *Colorectal Cancer Research from the Prostate, Lung, Colorectal and Ovarian (PLCO) Cancer Screening Trial: NCI Fact Sheet* (http://www.cancer.gov/cancertopics/factsheet/ColorectalPLCO)
- *PDQ® Prevention Summary for Health Professionals on Colorectal Cancer* (http://www.cancer.gov/cancertopics/pdq/prevention/colorectal/HealthProfessional)

- Cancer Prevention Home Page (http://www.cancer.gov/cancertopics/prevention-genetics-causes/prevention)
- Colon and Rectal Cancer Home Page (http://www.cancer.gov/cancertopics/types/colon-and-rectal)
- Energy Balance: Weight and Obesity, Physical Activity, Diet Home Page (http://www.cancer.gov/cancertopics/energybalance)

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