

# CALCIUM: FORM & FUNCTION

By Gene Bruno, MS, MHS


calcium intake and/or resorption of bone calcium into the blood (to be used for other purposes) may result in osteoporosis over a long period of time.<sup>3</sup> In addition, calcium is necessary for nerve impulse transmission, muscle contraction, relaxation and constriction of blood vessels, and secretion of hormones (e.g., insulin).<sup>4,5</sup> Calcium is also needed to stabilize a number of proteins and enzymes, including vitamin K-dependent clotting factors that stops bleeding through clot formation.<sup>6</sup>

## Osteoporosis

Calcium's role in the prevention and treatment of osteoporosis is also well established.<sup>7</sup> Furthermore, calcium supplementation has been shown to effectively slow bone loss.<sup>8-11</sup> Research overwhelmingly supports the use of calcium supplementation, alone or in combination with other therapies, for slowing or stopping the progression of osteoporosis.<sup>12</sup> As a matter of fact, FDA-approved therapy for the treatment of postmenopausal osteoporosis includes calcium supplementation.<sup>13</sup> In addition, osteoporosis can lead to an increased incidence of fractures. Research has clearly shown that calcium supplementation can help to reduce the risk of, and even prevent fractures in osteoporosis.<sup>14-17</sup> In fact, the data on calcium and osteoporosis is so compelling that the FDA has approved either of these healthy claims: "Adequate calcium throughout life, as part of a well-balanced diet, may reduce the risk of osteoporosis," or "Adequate calcium as part of a healthful diet, along with physical activity, may reduce the risk of osteoporosis in later life."

## Colorectal Cancer

Analysis of 10 prospective cohort studies which involved 534,536 men and women, showed that those consuming the highest calcium intake (1,051 mg) from food had a 14 percent lower risk of colorectal cancer compared to those consuming the least calcium (674 mg).<sup>18</sup> In addition, other human clinical research found modest decreases in the recurrence of colorectal adenomas (precancerous polyps) when calcium was sup-



**C**alcium may be the best researched of all the minerals. It has the distinction of being the only one with an FDA-approved health claim (more on this later), and is by far the most prevalent mineral in the human body with 99 percent of it found in bones and teeth, and the remaining one percent found in blood and soft tissue.<sup>1</sup> As with other minerals, issues have been raised about which forms of calcium are best absorbed, and whether calcium supplementation may be associated with risk factors in certain population groups.

## Functions of Calcium in the Body

First and foremost, calcium is a major structural element in bones and teeth along with phosphate. Together, these two minerals form hydroxyapatite crystals, a major component of bone.<sup>2</sup> Inadequate

# DOES CAFFEINE DECREASE CALCIUM RETENTION?

**S**ome data suggests that low calcium intake together with drinking two to three cups of coffee daily accelerated bone loss in postmenopausal women,\* while other research showed no association between caffeine intake and bone loss.\*\* Most likely, a cup of coffee (8-oz.) will decrease calcium retention by about 2-3 mg,\*\*\* so there does not appear to be any real basis for concern that drinking coffee will reduce calcium levels.

\*Harris SS, Dawson-Hughes B. *Am J Clin Nutr.* 1994;60(4):573-578.

\*\*Lloyd T, Johnson-Rollings N, Egli DF, et al. *J Am Coll Nutr.* 2000;19(2):256-261.

\*\*\*Weaver CM, Heaney RP. Calcium. In: Shils M, Olson JA, Shike M, Ross AC, eds. *Modern Nutrition in Health and Disease.* 9th ed. Baltimore: Lippincott Williams & Wilkins; 1999:141-155.



plemented at 1,200-2,000 mg daily.<sup>19,20</sup> Other large prospective studies indicated that calcium intakes are only weakly associated with a decreased risk of colorectal cancer; this may be due to the fact that the people in the studies had lower circulating levels of IGF-1.<sup>21</sup>

## Hypertension

Twenty-three large observational studies showed significant reductions in systolic and diastolic blood pressure.<sup>22</sup> A systematic review of 42 randomized controlled studies found that calcium supplementation ranging between 500-2,000 mg daily reduced blood pressure more effectively than a placebo.<sup>23</sup> Furthermore, research on people consuming a diet providing a total of about 1,200 mg of calcium daily found significant decreases in blood pressure.<sup>24,25</sup> This research suggests that a daily intake of about 1,000-1,200 mg calcium may be helpful in preventing and treating moderate hypertension.<sup>26</sup> In addition, a review of placebo-controlled studies demonstrated that calcium supplementation reduced the incidence of high blood pressure in pregnant women at high risk for pregnancy-induced hypertension and in pregnant women with low dietary calcium intake.<sup>27</sup>

## Premenstrual Syndrome (PMS)

Double-blind, placebo-controlled, clinical

research has demonstrated that 1,200 mg of calcium daily reduced total symptom scores in PMS by 48 percent; although supplementation had to take place over the course of three menstrual cycles to achieve results.<sup>28</sup> Other clinical research using 1,000 mg of calcium daily, showed similar positive benefits.<sup>29,30</sup> Research in which women obtained about 1,283 mg daily of calcium from food showed a 30 percent lower risk of developing PMS.<sup>31</sup>

## Weight Loss

Placebo-controlled research has shown that 1,200 mg of calcium supplemented daily in elderly women resulted in significantly greater weight loss compared to a control group.<sup>32</sup> Secondary analysis of data from a double-blind, placebo-controlled, randomized trial on 870 postmenopausal women found that 1,400 or 1,500 mg of calcium daily (with or without vitamin D3) was associated with lower trunk fat gain and higher lean trunk mass.<sup>33</sup> Likewise, research on young women obtaining 1,300-1,400 mg of calcium daily from dairy products experienced a slight reduction in body fat mass.<sup>34</sup>

## Increase in Prostate Cancer Risk

Epidemiological research suggests that men who consume 2,000 mg or more of calcium daily had an increased risk of prostate cancer; although this risk was

not seen at lower levels of intake.<sup>35</sup> A prospective study also found an increase in prostate cancer risk among male smokers consuming more than 1,000 mg of calcium daily.<sup>36</sup> However, other epidemiological and prospective studies have not found an association between calcium intake and prostate cancer.<sup>37,38</sup> In fact, one Serbian case-control study found increased calcium intake to be associated with a decreased risk of prostate cancer.<sup>39</sup> Perhaps the best advice on calcium supplementation in men came from the Linus Pauling Institute: "Until the relationship between calcium and prostate cancer is clarified, it is reasonable for men to consume a total of 1,000-1,200 mg/day of calcium (diet and supplements combined), which is recommended by the Food and Nutrition Board of the Institute of Medicine."<sup>40</sup>

## Elemental Calcium

Calcium doesn't naturally exist by itself. Rather it is attached to some type of organic or inorganic acid. Minerals attached to acids are called mineral salts. All forms of calcium used in dietary supplements provide one or more calcium salts. For example, if you attached citric acid to calcium, you would have a calcium salt called calcium citrate. The issue with different calcium salts is that they all provide different percentages of actual, or elemental, cal-

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cium by weight. Sticking with the example of calcium citrate, it provides about 22 percent elemental calcium.

By comparison, calcium carbonate is about 38-40 percent elemental calcium, much higher elemental potency, and clearly a good source of calcium. That means to obtain 500 mg of elemental calcium, one would have to consume about 2,273 mg of calcium citrate or 1,282 mg of calcium carbonate. That's roughly double the amount of calcium citrate tablets you'd have to take compared to calcium carbonate tablets.

Often when reading the labels of calcium products, the issue of elemental calcium potency can be confusing or misleading. Here's a quick primer on how to tell whether the dosage listed is being expressed as elemental calcium or the total amount of the calcium salt. If the listing on the label appears in one of these ways, the amount being expressed is elemental (the use of calcium carbonate is just an example):

**Calcium** 1,000 mg

**Calcium** 1,000 mg  
*(as calcium carbonate)*

**Calcium** 1,000 mg  
*– elemental*

If, on the other hand, the listing on the label appears as follows, the amount is being expressed as the total amount of the mineral salt, not the elemental amount:

**Calcium carbonate** 1,000 mg

### Calcium Absorption

Some research has found that approximately the same level of absorption occurs with various forms of calcium (including calcium citrate, calcium carbonate, hydroxyapatite, calcium gluconolactate and calcium pidolate)<sup>41</sup>, while other research has shown that certain forms of calcium (such as calcium citrate) are better absorbed over other forms (such as calcium gluconolactate and carbonate).<sup>42-44</sup> Still other research shows that calcium carbonate is fairly well absorbed when taken with a meal.<sup>45</sup> In any case, all of the research shows that these forms of calcium are absorbed.

Now, let's consider the practical aspects of calcium source and calcium absorption by comparing apples to apples: If one used the same amount of calcium citrate and calcium carbonate, say 1,282 mg of each, the total elemental calcium you'd receive would be 282 mg from citrate and 500 from car-

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bonate. Even with 13 percent greater calcium absorption from citrate, one would still end up with far more calcium from the carbonate source. So the bottom line is that while some calcium salts are better absorbed than others, what is most important is to get the correct elemental amount of the mineral, and to make sure to take the mineral supplement with a meal so that the hydrochloric acid in your stomach will break it down efficiently for absorption. **VR**

For a complete list of references, visit [www.vitaminretailer.com](http://www.vitaminretailer.com).

Gene Bruno, MS, MHS, the dean of academics for Huntington College of Health Sciences, is a nutritionist, herbalist, writer and educator. For more than 30 years he has educated and trained natural product retailers and health care professionals, has researched and formulated natural products for dozens of dietary supplement companies, and has written articles on nutrition, herbal medicine, nutraceuticals and integrative health issues for trade, consumer magazines and peer-reviewed publications.