

Calcium, Vitamin D, and Osteoporosis

The importance of lifestyle choices and reasons to avoid calcium supplements

by Miles Hassell MD

This handout is a supplement to *Good Food, Great Medicine* (3rd edition), a Mediterranean diet and lifestyle guide and cookbook. The book is a practical, easy-to-read resource offering both the evidence and the tools to help prevent or reverse heart disease and type 2 diabetes, control high blood pressure, improve cholesterol levels, reduce risk of stroke, dementia, and cancer, and lose weight without deprivation. *Good Food, Great Medicine* presents simple food and lifestyle choices to reduce medications and improve your long term health. (For more principles to eat by, see *Fat Is Good, Bagels Are Bad* on the resources tab at goodfoodgreatmedicine.com)

The prevention and management of osteoporosis and osteopenia has many facets. This handout addresses those lifestyle choices which seem to be the most effective in achieving the primary goal of preventing fractures (broken bones) and improving bone strength and resilience.

We will explore the following lifestyle choices:

- Exercise
- Calcium and calcium supplements
- Whole foods to support bone health
- Vitamins D, B12, and K
- Mediterranean diet and strong bones
- A few bone-friendly recipe ideas

Daily exercise is critical!

Healthy bones need exercise, especially the weight-bearing kind like walking, climbing stairs, jumping rope, and weight training. This improves bone strength as well as balance and flexibility, making us less likely to fall – and lowering the risk of a broken bone if we *do* fall. This is especially important for women at risk for osteoporosis.¹

Exercise also strengthens the muscles that support the bones. Although physical activity is important

for everyone, the decision to exercise daily is especially vital for someone who already has osteoporosis. I strongly recommend a daily exercise program that involves both weight bearing and muscle building components, and encourage those who are able to also include 2 minutes of “hopping”.² A physical therapist can design a program to follow at home to improve bone strength, and reduce fracture risk, as well.

Get calcium from whole foods, not calcium supplements

Calcium is important for bone health, but 800-1,200 mg a day from food sources appears to be plenty. In contrast to naturally occurring calcium found in whole foods, there is substantial (and growing) evidence that calcium from supplements may actually be harmful. **I do not recommend calcium supplements for anybody.** Adequate calcium from food sources is easily achieved if you include two or three servings of calcium-rich foods daily (see box on page 2). Avoid calcium-fortified foods like juice and commercial breakfast cereal in favor of naturally occurring calcium in whole foods. **Calcium-fortified foods are just another form of calcium supplement.**

Why I don't recommend supplemental calcium or calcium-fortified foods

- Most studies show that calcium supplements do not seem to prevent fractures^{3,4} and contribute little to bone density.^{5,6}
- Calcium supplements appear to be associated with significant risk for harm, particularly an increased risk of heart disease⁷ and dementia.⁸

² Kemmler, W. et al. *Osteoporos Int* 2015 Oct;26(10):2491-9

³ Warensjo, E. et al. *BMJ* 2011; 342:d1473 doi:10.1136/bmj.d1473

⁴ Bolland, M.J. et al. *BMJ* 2015;351:h4580

⁵ Tai, V. et al. *BMJ* 2015;351:h4183doi:10.1136/bmjH4183

⁶ Michaelsson, K. *BMJ* 2015;351:h4825 doi:10.1136/bmj.h4825

⁷ Reid, I.R. et al. *J Intern Med* 2015;doi:10.1111/joim.12394

⁸ Kern, J. et al. *Neurology* 2016;87:1-7

¹ Kemmler, W. et al. *Arch Intern Med* 2010;170:179-85

- In contrast, calcium from food sources appears to protect against heart disease.⁹
- There appears to be an increase in age-related macular degeneration with calcium supplements in observational studies.¹⁰
- Also, avoid supplements with boron and strontium (see below).

Other nutritional supplements

I do not recommend over-the-counter nutritional supplements that claim to build bone, such as those with vitamin K, boron or strontium. The evidence does not support the claims. Before taking nutritional supplements consult with a physician who is educated in both the benefits *and* risks – and as a general principle I recommend you think twice before you buy supplements from the person who recommends them! Consumerlab.com is one of the better information sources regarding nutritional supplements.

Examples of whole foods which deliver about 300 mg of calcium per serving:

- 1¼ cups cooked greens like spinach, kale, chard, or collard greens
- ¾ cup edamame (fresh soy beans)
- 3 ounces canned sardines (with bones)
- 4 ounces canned salmon (with bones)
- 8 ounces of plain yogurt or kefir
- 1½ ounces of hard cheese like extra-sharp cheddar and Parmesan
- ½ cup ricotta cheese
- ½ cup tofu (made with the natural coagulant calcium sulphate)

Dairy as a calcium source

Two or three servings per day are probably a reasonable maximum, and the evidence favors cultured dairy foods such as aged cheese, yogurt, and kefir (a yogurt-like cultured milk drink) rather than milk itself. This is not to condemn milk, but simply to point out that the greatest historical evidence for benefit favors cultured dairy foods. Although I can't make a strong case, I believe the evidence favors whole milk or 2% dairy over 1% or non-fat. However, I can make a *very* strong case against sugar delivery systems disguised as dairy foods, such as sweetened non-fat yogurt (see below). But even honest dairy foods are not critical to a healthy diet; if you are intolerant of dairy, don't fret. There are plenty of other whole food sources of calcium that are not dairy-based. (See box on left.)

▪ **Plain yogurt and kefir** with live cultures (probiotics) are immune boosting and have high available calcium content. (Kefir has a different spectrum of good microorganisms.) For the best value from yogurt and kefir choose plain unsweetened, with active cultures clearly noted on the label. Add your own sweetening, such as fruit or honey – like us, good bugs do better in sugar-free environments. These helpful microbes even partially predigest the lactose in milk, which allows some people with lactose intolerance to enjoy the benefits of yogurt. Choose 2% or whole milk versions – non-fat yogurt usually includes additives for flavor and “mouthfeel” to make up for the missing fat. (Eight ounces of pre-sweetened non-fat yogurt can include as much as 6–9 teaspoons of added sugar!) Avoid commercial frozen yogurt – it is generally junk food. (For more about yogurt, see pages 32, 135, and 142 of *Good Food, Great Medicine*.)

▪ The evidence favors **aged cheeses** like extra-sharp cheddar and Parmesan. These traditionally cultured cheeses have higher levels of vitamin K, and as they are stronger and richer than softer, younger cheeses, they have a higher “satiety factor” (meaning they are more satisfying). This may be due to their more intense flavor, or perhaps extended aging affects fats and proteins.

⁹Anderson, J.J.B et al. J Am Heart Assoc 2016;5:e003815

¹⁰Kakigi, C.M. et al. JAMA Ophthalmol 2015;133(7):746-54

Get vitamin D from natural sources

This is a complex issue. Vitamin D levels in the range of 20–40 ng/ml are associated with healthy bones as well as lower rates of mortality (death),¹¹ obesity, type 2 diabetes, heart disease, high blood pressure, depression, and some cancers. However, blood levels **above** 40 ng/ml may be associated with harm, including higher death rates.¹¹ As with the case of calcium from food compared to supplemental calcium, it appears that naturally occurring vitamin D may have much better effects than supplemental vitamin D. In fact, after decades of research it is still unclear whether vitamin D *supplements* prevent fractures, osteoporosis, or other diseases, and higher levels of supplementation (e.g. 2,400 units per day) may be associated with harm.¹² In my practice we aim for a blood level of 20–40 ng/ml, supplementing with 1,000–2,000 iu daily only if we are unable to get enough vitamin D from natural sources like oil-rich fish and sunlight. (When reading studies that discuss blood levels of vitamin D, note which measuring unit is used: “ng/ml” or “nmol/l.” If you need to compare, multiply ng/ml by 2.5 to convert to nmol/l.)

Getting D the old-fashioned way

The natural sources of vitamin D are sunlight and eating oil-rich fish (like salmon, light or yellowfin tuna, sardines, and herring) or cod liver oil. An example of sensible sunlight exposure is to expose as much of your skin to the sun as you reasonably can, without sunscreen, for 10-15 minutes most days in sunny months. The more square inches that are exposed to the sun, the more vitamin D you will make. The farther you live from the equator, the more difficult it is to get vitamin D from the sun – but avoid getting sunburnt! To achieve the blood levels thought to be beneficial, most of our patients require supplements. Mushrooms exposed to ultraviolet light may be emerging as another vitamin D source.

Get vitamin K from whole foods

Although the data are fuzzy, it looks like Vitamin K from food (especially phylloquinone) is an important factor in fracture risk reduction.¹³ Some of the richer food sources of vitamin K include the family of leafy green vegetables (especially kale and collards) and naturally fermented foods such as sauerkraut, kimchi, tempeh or natto (fermented soybeans), or aged cheese. I recommend a daily serving of leafy greens and one of the fermented foods, if possible – **but I do not recommend vitamin K supplements.**

Get vitamin B12 from whole foods, too

Low B12 levels increase risk of fracture, and once again, the best way to raise your levels is through food. There is no evidence that B12 supplements help.¹³ Good whole food sources of B12 are shellfish, oil-rich fish like salmon and sardines, and unprocessed red meat. Two or three servings a week is probably enough.

The Mediterranean diet & strong bones

The omnivorous Mediterranean diet appears to be associated with lower rates of hip fractures,¹⁴ arguably one of the most important measures of bone health. In contrast, vegetarian diets are associated with *more* osteoporosis and fractures.¹⁵ Foods most strongly associated with better bone health include whole foods like vegetables, fruit, whole grains, seafood, dairy, and moderate wine intake. Processed foods have been found to be detrimental to bone health in multiple studies¹⁶ – another good reason to prepare your own food!

¹¹ Kramer, H. et al. PLOS ONE 2012;7:e47458

¹² Bischoff-Ferrari, H. et al. JAMA Intern Med 2016;176:175-83

¹³ Sahni, S. et al. Curr Osteoporosis Rep 2015;doi 10.1007

¹⁴ Haring, B. et al. JAMA Intern Med. 2016;176(5):645-652

¹⁵ Tucker, K. AJCN 2014;100(suppl):329S-355

¹⁶ Sahni, S. et al. Curr Osteoporosis Rep 2015;doi 10.1007

Prunes and black tea

- Prunes (dried plums), 5–10 per day, help improve bone strength.¹⁷ (A favorite snack is a few of *Trader Joe's* non-sorbate pitted prunes with a handful of raw almonds. You can also find individually-wrapped *Sunsweet* prunes at the grocery store.)
- Black tea, 3 or more cups a day with or without milk (but not green tea), is associated with lower total and 42% lower hip fracture risk.¹⁸ (For a good-tasting tea bag, try *PG Tips*, an English black tea with pyramid shaped bags.)

Medical evaluation and medications

There are several approaches to prescription medications for osteoporosis, and these vary in their effectiveness at reducing the risk of broken bones as well as side effects and cost. **It is important to understand that increasing bone density does not necessarily reduce fractures.** For example, some medicines formerly used to treat osteoporosis were found to increase bone density, *but actually increased fractures* because they made the bones more brittle. Simply improving bone density is not enough, the goal is to prevent fractures.

- Before taking any medication or nutritional supplement, ask if it has been shown to *prevent fractures* in patients with your characteristics.
- Certain medical conditions, some common, predispose to weak bones.
- Also, many medications have the side effect of weakening bones.

So, in addition to exercising daily, eating calcium-rich whole foods, getting adequate vitamin D, and avoiding calcium supplements and calcium-fortified foods, it would be wise to discuss the above aspects of your bone health with your physician.

Some whole food recipes providing extra calcium and vitamins D, K, & B12

Here are some easy-to-prepare whole food recipes from *Good Food, Great Medicine* (3rd edition) which put bone-strengthening principles to work in your kitchen:

Plain yogurt or kefir:

- *Definitive Dip* (page 146)
- *Faux Ranch Dressing* (page 145)
- *Goop (Rich Yogurt Aioli)* (page 144)
- *Smoothies* (page 136 and 137)
- *Tzatziki* (page 145)
- *Yogurt Dessert Cream* (page 142)
- *Homemade Kefir* (page 143)

Cooked greens:

- *Green Eggs and Rice* (page 244)
- *Greens and Beans* (page 242)
- *Red Lentil Soup with greens* (page 241)
- *Sautéed Sturdy Greens* (page 186)
- *Speedy Spinach Soup* (page 182)
- *Spinach and Cheese Crepes* (page 245)
- *Spinach Frittata* (page 134)
- *Spinach Timbale (Custard)* (page 188)
- *Creamy Spinach (Palek Paneer)* (page 193)

Soy beans and tofu:

- *Seductive Soybeans* (page 202)
- *Soybeans in the Pod* (page 202)
- *Tofu in Soy Ginger Marinade* (page 203)
- *Tofu Pâté* (page 155)

Oil-rich fish:

- *Sardine Pâté* (page 152)
- *Salmon Cakes* (page 227)
- *Tuna and Broccoli Pasta* (page 231)
- *Tuna and White Bean Salad* (page 232)

Red meat:

- *Meat Loaf* (page 234)
- *Chili con Carne* (page 235)
- *Beef Stew* (page 236)

¹⁷ Hooshmand, S. et al. *Br J Nutr* 2011;106:923-30

¹⁸ Prince, R. *Am Soc Bone Mineral Research* 10/9/2015

Green Eggs and Quinoa

(Adapted from page 244 of *Good Food, Great Medicine*)

This is a pro-bone, anti-osteoporosis one-dish meal which also happens to be easy to make. The greens, onion, cheese, milk, and eggs contribute a veritable symphony of calcium and vitamins D and K to feed and strengthen your bones and the bones of those you love. Frozen spinach is the easiest option, but barely-steamed fresh spinach, cooked kale, and chopped leftover broccoli are additions we love. You can use brown rice instead of quinoa, crumbled feta cheese instead of cheddar, and so on. You can prepare it in advance through step 2 (store it in the refrigerator if overnight), bringing it to room temperature and mixing again before transferring to dish. The leftovers reheat well.

(Serves 4 as a main dish, more as a side dish)

2–4 tablespoons extra-virgin olive oil
1 medium-large onion in ¼-inch dice (2–3 cups)
6 eggs
1 cup whole milk
1 teaspoon salt
1 teaspoon freshly ground black pepper
6 oz (about 2 cups) grated sharp cheddar cheese
½ cup grated Parmesan cheese
1½ cups cooked quinoa (page 208)
16 ounces frozen spinach, thawed

Preheat oven to 300 degrees. Oil an 8x8 or 9x13-inch (2–3 quart) Pyrex baking dish or similar.

1. Heat oil in a sturdy 10-inch skillet over medium-high heat and sauté onion for about 10 minutes or until very tender. Remove from heat and set aside.
2. Whisk eggs in a mixing bowl or an 8-cup Pyrex jug. Add milk, seasoning, cheeses, cooked quinoa, spinach, and sautéed onions, and mix very well.
3. Scrape into oiled baking dish and bake uncovered for about 60–75 minutes (it will cook more quickly in the larger baking dish) or until no longer wet in the center.

Note:

▶ Adding ½-pound of fresh sausage to the sautéed onions in Step 1 will kick up the flavor and the crowd-pleasing qualities. Just push the onions to the side and sauté sausage until browned and well crumbled.

Sautéed Sturdy Greens

The sauté method works best for the more tender varieties of sturdy greens like Swiss chard or beet greens. Both have stems that should be sliced and sautéed before the leaves. (Spinach, of course, barely needs cooking at all.) These greens can be served alone as a side dish or with cooked whole grains and beans for a main dish.

(About 3 cups cooked greens)

1½ pounds of greens, cleaned, stemmed, and chopped, about 2 bunches (see page 166)
-or- about 12 cups of chopped greens
3–4 tablespoons extra-virgin olive oil
Optional: a pinch of crushed red pepper flakes
1 teaspoon freshly crushed garlic

1. Heat olive oil over medium heat in a large deep skillet (10-12-inch), pot, or wok.
2. Add garlic and optional pepper flakes, and sauté for about 10 seconds. (Avoid browning the garlic!) If you have sliced stems, add and sauté until tender, about 10 minutes.
3. Add chopped greens. If you add them one big handful at a time, tossing and turning them in the hot pan as you go, you will find them easier to manage.
4. Continue to toss and turn the greens until they are tender enough for your liking. (Some like greens *al dente*, others like them very tender.) Kale and collards take longer than chard or beet greens.

Note:

▶ **Sautéing already-blanching greens:** Blanching greens don't need much (if any) cooking. We suggest always blanching the tougher greens like kale and collards before sautéing. Follow directions above but add all the blanched greens at once and sauté until hot through and tender enough for your taste.

▶ **Serving suggestions:** The simplest treatment is just a generous sprinkle of freshly grated Parmesan on the hot greens. Other ideas: toss with a tablespoon or two of vinaigrette; toss with toasted pine nuts or slivered almonds and a handful of raisins; add a couple of cups of cooked garbanzo beans (chickpeas) and crumbled feta cheese, and serve over hot brown rice or quinoa.

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Dr. Hassell established the [Integrative Medicine Program](#) at Providence Cancer Center in Portland and is a clinical instructor in the training of Internal Medicine residents, twice named *Outstanding Teacher of the Year*. He also lectures widely to physician groups about the appropriate integration of lifestyle and conventional medicine, and is often interviewed on health issues by local television and radio. He is the co-author of *Good Food, Great Medicine*, an evidence-based guide to using a whole food Mediterranean diet in the pursuit of optimal health.

In his private practice Dr. Hassell encourages the vigorous use of evidence-based food and lifestyle choices and has been chosen as one of *Portland's Top Doctors*. Dr. Hassell is available for individual consultations for diagnosis, second opinion, or to develop patient-centered solutions using evidence-based conventional and lifestyle interventions.

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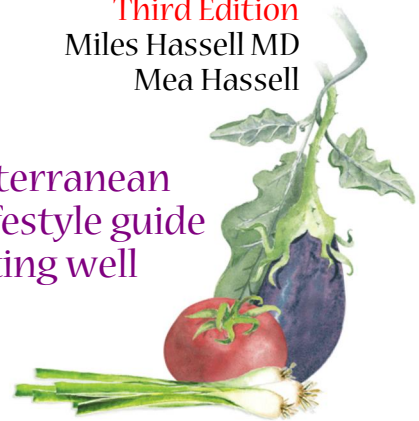
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