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Calcium

Technical Background

- Calcium is the most abundant mineral in the body. It is needed for strength and structure of teeth and bones, for blood clotting, nerve function, muscle contraction and relaxation, enzyme regulation, and membrane permeability.
- Approximately 99% of total body calcium is found in teeth and bones. The calcium in bones is in constant flux, with some calcium being laid down and some being resorbed. In calcium homeostasis (which occurs in early adulthood), the amount of calcium deposited in the bone is the same as the amount of calcium resorbed. Around the fourth decade, bone resorption dominates bone formation, resulting in a net loss that may lead to osteoporosis.¹ Calcium supplementation may slow bone loss in post menopausal women by 30-50%.²
- Calcium plays a similar role in teeth, though the turnover of minerals in teeth is not as rapid as in bones. Fluoride hardens and stabilizes the crystals of teeth, decreasing the withdrawal of minerals.
- Several dietary constituents affect absorption and excretion of calcium. Magnesium and calcium appear to compete with each other for intestinal absorption whenever an excess of either is present in the gastrointestinal tract. Vitamin D facilitates absorption by making the necessary calcium-binding proteins. Lactose and other disaccharides also increase absorption of calcium. Caffeine, excess protein intake, and a high-fiber diet increase calcium loss through excretion.
- Calcium deficiency contributes to inadequate mineralization of bone. An excessive intake of calcium appears to be innocuous in most individuals. Importantly, there is no evidence that high calcium intakes (up to 1500 mg/day) increase the risk of developing kidney stone formation.³
- Increasing calcium intake, especially during the years when bones are at peak mineralization (11-24 years), can help prevent bone fractures and osteoporosis.^{4,5} The strength of bones is also dependent on physical activity, genetics, medications taken (including oral contraceptives), and other factors. Increasing replacement of milk with soda among adolescents is a trend that may contribute to adolescents being calcium-deficient, and may lead to higher levels of osteoporosis later in life.⁶

Sources and Recommended Intake

- Foods rich in calcium include broccoli, legumes, and fortified orange juice.
- Other foods, including certain meats (especially fish), milk, cheese, and yogurt are also high in calcium, but should be consumed in moderation. Calcium is also found in spinach, seeds, nuts, and grains, but it is not absorbed by the body as well as calcium from dairy products.⁷

- The adequate intake level of calcium for infants is 210 mg/day (0-6 months) and 270 mg/day (7-12 months). The adequate level from age 1 to 3 is 500mg/day, and from 4 to 8 it rises to 800 mg/day. From ages 9 to 18, a time of peak bone mineralization, the recommended intake is 1300mg/day. From age 19 to 50 the recommended intake is 1000mg/day for men and women. With pregnancy and lactation the recommendation rises to 1200 mg/day. For men and women aged 51-70, the recommended intake is 1200mg/day.⁴

Abstracts

Nieves JW. Osteoporosis: the role of micronutrients. Am J Clin Nutr. 2005 May;81(5):1232S-9S. Osteoporosis and low bone mass are currently estimated to be a major public health threat. Adequate nutrition plays a major role in the prevention and treatment of osteoporosis; the micronutrients of greatest importance are calcium and vitamin D. Calcium has been shown to have beneficial effects on bone mass at all ages, although the results are not always consistent. Higher doses than the current US recommendation (600 IU) of vitamin D in the elderly (age \geq 65 y) may actually be required for optimal bone health (800-1000 IU/d). The elderly can clearly benefit from increased vitamin D intakes; however, the potential importance of vitamin D in peak bone mass is just being investigated. Vitamin D has been related to falls, with supplementation reducing the number of falls. There are clear fracture benefits demonstrated in randomized clinical trials of calcium and vitamin D supplementation. The other micronutrient needs for optimizing bone health can be easily met by a healthy diet that is high in fruits and vegetables to ensure adequate intakes for magnesium, potassium, vitamin C, vitamin K, and other potentially important nutrients. Healthcare professionals need to be aware of the importance of adequate calcium and vitamin D intakes (easily monitored by serum 25(OH)D) for optimal bone health, as well as the prevention of falls and fractures. In addition, a healthy diet that includes 5 servings a day of fruits and vegetables should optimize the intake of micronutrients required for bone health.

References

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