



# Food for Thought

## Calcium and optimal bone health

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### Question

A 14-year-old girl occasionally eats yogurt and cheese, but refuses to drink milk. What advice should I give her about food choices, calcium supplements, and bone health?

### Answer

Milk is one of the best sources of calcium, but yogurt and cheese also provide it. Only fluid milk, however, is fortified with vitamin D. Both calcium and vitamin D are important for optimal bone health, along with other nutrients, such as vitamin K, magnesium, copper, zinc, and vitamin C. A dietary assessment can determine whether she is getting sufficient calcium; she might need to take a calcium supplement that contains vitamin D.

### Dietary sources of calcium and vitamin D

Milk and other dairy products are by far the best sources of calcium, but salmon and sardines with bones, fortified juices and other beverages, and nuts are also good sources of calcium. **Table 1** lists a variety of foods that have at least 50 mg of calcium per serving.<sup>1</sup> Vitamin D content is stated for the few foods that contain, or are fortified with, vitamin D.<sup>2</sup>

Fruit, such as papayas, dried figs, and prunes, can contribute to adolescents' calcium needs, but these products are not widely popular. Bok choy and Swiss chard also contain calcium, but other than in Chinese food or as a salad ingredient, would not be consumed regularly by most adolescents. Fortification of orange juice has provided an additional source of calcium in today's diet. Fruit juices are generally

**Table 1. Calcium and vitamin D content of selected foods**

FOOD	SERVING SIZE	APPROXIMATE CALCIUM CONTENT (MG)	VITAMIN D CONTENT (IU)
Milk	250 mL	300	100
Hard cheese	52 g (four slices)	200-300	
Yogurt	175 g	200-300	
Ice cream	125 mL	80-90	
Hazelnuts	125 mL	120	
Almonds	125 mL	150	
Mixed nuts	125 mL	50	
Walnuts	125 mL	50	
Broccoli	125 mL	50	
Kidney beans	250 mL	50	
Baked beans	250 mL	130	
Canned salmon or sardines with bones	125 mL (four sardines)	180	
Canned pink salmon	84 g		530
Canned light tuna*	84 g		200
Spinach	250 mL	60	
Fortified margarine	10 mL		53
Fortified rice or soy drink	250 mL	300	100
Fortified orange juice	250 mL	300	

\*Fish-liver oils, from fish such as cod and tuna, contain vitamin D; mammals' livers contain little vitamin D.

popular with adolescents; fortified orange juice contains 300 mg of calcium per 250-mL serving.

### Calcium, vitamin D, and bone health

The new dietary reference intake for calcium was set after examining growth demands, calcium losses, peak calcium retention, and bone mineral

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content. There was insufficient evidence to set an estimated average requirement, so an adequate intake was set as a goal for individual consumption (Table 2).<sup>3</sup>

Peak calcium retention usually occurs at about 13 years for girls and 14.5 years for boys,<sup>4</sup> but measures of sexual maturity are better predictors of

**Table 2. Adequate intake of calcium and vitamin D by age**

AGE (Y)	CALCIUM (MG/D)	VITAMIN D (IU/D*)
4-8	800	200
9-13	1300	200
14-18	1300	200
19-30	1000	200
31-50	1000	200

\*40 IU = 1 µg.

calcium retention than chronologic age. Calcium retention is at its highest from 9 to 18 years of age. After menarche, calcium retention, bone formation, and bone resorption decline rapidly. Peak bone mineral density occurs later in boys (17.5 years) than in girls (15.8 years) because weight is a factor in bone mineral density.<sup>3</sup>

The committee responsible for setting daily reference intakes agreed that research shows that higher calcium intake throughout growth is necessary to maintain adequate peak bone mass. This means that children need to consume adequate amounts of calcium between ages 9 and 18.

Suggesting a dietary change or use of a calcium supplement to a 14-year-old girl is wise, given that her time of peak bone mineral density is approaching. Immediate intervention can help ensure long-term bone health, even though peak calcium retention might have been reached already.

The primary biologic function of vitamin D is to maintain serum calcium levels within the normal range, so calcium and vitamin D requirements are interdependent.<sup>5</sup> Vitamin D helps with absorption of calcium, but might also have an independent role in bone health due to its relationship with serum 25-hydroxyvitamin D, the substrate for 1,25-

dihydroxyvitamin D.

Further studies to relate vitamin D levels directly to bone health are needed, but recent evidence indicates that at least 1000 IU of vitamin D are needed to maximize bone health. The recommended adequate intake for vitamin D, therefore, might be insufficient, particularly for people living in northern climates, such as Canadians.<sup>6</sup> Scientists are currently discussing the need to raise the adequate intake level for vitamin D. Heaney<sup>7</sup> provides excellent insight into nutrition policy formation using vitamin D as an example.

Optimal bone health appears to be maintained only among people who have an adequate intake of calcium throughout life, so whatever nutritional intervention is chosen, it should be one that can be sustained long term. Recommending a calcium supplement that also contains vitamin D is an appropriate choice for those who drink little or no milk.

### Calcium supplements

Calcium supplements containing various amounts of calcium are available. Calcium can be obtained from tablets, liquids, and soft chews in a variety of forms including calcium carbonate, calcium citrate, and calcium gluconate. The most economic and best source of elemental calcium is calcium carbonate. This supplement should be taken with food. If two tablets are being taken, they should be taken at different times of day to maximize absorption. ❁

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### References

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