



# Food for Thought

## Health benefits of selected minerals

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### Question

Do patients need to take multivitamin or mineral supplements? How were the new Dietary Reference Intakes (DRIs) for minerals and vitamins set? What is the relationship between mineral supplements and optimum health?

### Answer

Daily multivitamin and mineral supplements containing approved levels of minerals are safe for nearly everyone, but use of supplements should include individual risk assessment. The DRIs are reference values used primarily to assess and plan diets; they do not address amounts proposed for optimum health. The literature does, however, indicate that certain vitamins and minerals benefit health.

### Definitions

**Dietary Reference Intakes.** The DRIs are four nutrient-based reference values: estimated average requirement (EAR), recommended dietary allowance (RDA), adequate intake (AI), and tolerable upper intake level (UL).

**Estimated average requirement.** The EAR is the average daily intake estimated to meet the nutritional needs of half the apparently healthy people of a certain age and sex. Amount needed is determined by a specific indicator or criterion of adequacy, for example, to maintain balance or maximize enzyme activity.

**Recommended dietary allowance.** The RDA is the average daily intake estimated to meet or exceed the nutritional needs of nearly all apparently healthy people of a certain age and sex. The RDA is usually set by adding two standard deviations of the requirement distribution to the EAR.

**Adequate intake.** The AI is an intake goal set when there is insufficient evidence to set an EAR or RDA. The AI is based on experimentally determined intake levels or approximations of observed mean intake of groups of healthy people presumed to have adequate intake of a nutrient. The AI is expected to meet or exceed the amount needed to maintain a defined nutritional state or criterion of adequacy for nearly all healthy people of a certain age and sex.

**Upper intake level.** The UL is the highest average daily intake not likely to adversely affect most people. The UL is not a recommended intake but an amount that can be tolerated. For healthy people, intake above the RDA or AI has no established benefit. For people at risk or being treated for a deficiency, intake above the RDA or AI, but below the UL, is safe.

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**Calcium.** The AI for calcium, based on the relationship between calcium intake and bone mass, is intended to provide maximum calcium retention. The AI was derived by examining balance studies and data on bone mineral density and

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**Table 1. Recommended intake, upper levels, food sources, and health benefits of selected minerals for adults ≥19 years**

MINERAL (UNIT)	RECOMMENDED DIETARY ALLOWANCE OR AVERAGE INTAKE	UPPER LEVEL	FOOD SOURCES	POSSIBLE HEALTH BENEFITS
Calcium (mg/d)	1000 if ≤50 y 1200 if ≥51 y 1000 if pregnant or lactating	2500	Dairy products, salmon, sardines with bones, fortified juices, beverages, almonds	Bone health, blood pressure, colon cancer, weight management, symptoms of premenstrual syndrome
Magnesium (mg/d)	420 if male 320 if female 350 if pregnant and ≤30 y 360 if pregnant and ≥31 y 310 if lactating and ≤30 y 320 if lactating and ≥31 y	350*	Legumes, nuts, whole grains, dark green vegetables	Hypertension, cardiovascular disease, osteoporosis, diabetes
Selenium (µg/d)	55 60 if pregnant 70 if lactating	400	Organ meats, seafood, poultry, meats, plant foods	Cancer, infectious and inflammatory disease, immunity
Zinc (mg/d)	11 if male 8 if female 11 if pregnant 12 if lactating	40	Red meats, oysters, whole grains	Immunity
Chromium (µg/d)	35 if male and ≤50 y 30 if male and ≥51 y 25 if female and ≤50 y 20 if female and ≥51 y 30 if pregnant 45 if lactating	Not determined	Bran cereals, meat, fish, poultry	Blood glucose control
Iron (mg/d)	8 if male 18 if female and ≤50 y 8 if female and ≥51 y 27 if pregnant 9 if lactating	45	Meat, fish, poultry, enriched breads and cereals	Cognition
Copper (mg/d)	0.9 1 if pregnant 1.3 if lactating	10	Organ meats, seafood, nuts, seeds, cocoa products, whole grains	
Phosphorus (mg/d)	700	4000	Meat, fish, poultry, milk, eggs, processed foods	
Fluoride (mg/d)	4 if male 3 if female	10	Fluoridated drinking water, tea, seafood	
Iodine (µg/d)	150 120 if pregnant 290 if lactating	1100	Iodized salt, dairy products, seafood	
Manganese (mg/d)	2.3 if male 1.8 if female 2.0 if pregnant 2.6 if lactating	11	Grain products, tea, vegetables	
Molybdenum (µg/d)	45 50 if pregnant or lactating	2000	Legumes, grain products, nuts	

\* From sources other than food.

bone mineral content. The UL for calcium is based on studies that examined the risk of hypercalcemia and renal insufficiency.<sup>1</sup> Most men and women ingest less than adequate calcium at any stage of life.

Inadequate intake can adversely affect bone health, but evidence suggests it might have other effects also (Table 1).<sup>2</sup> Low-calcium diets can accelerate weight gain and fat accumulation; high-calcium diets can prevent fat accumulation.<sup>3,4</sup> Epidemiologic evidence<sup>5</sup> and at least one intervention study<sup>6</sup> have shown that higher calcium intake lowers the risk of developing colon cancer. Table 1 gives a summary of important minerals.

**Magnesium.** The RDA for magnesium is based on studies of mineral balance.<sup>1</sup> There is a need for additional research on magnesium's role in preventing chronic disease and on the relationship between balanced intake of calcium, potassium, and magnesium and hypertension.

**Selenium.** Selenium requirements are based on the amount needed to maximize activity of the enzyme glutathione peroxidase, a selenoprotein that acts as an antioxidant.<sup>7</sup> Recent evidence indicates that selenium intake above the RDA could provide important health benefits to those whose oxidative stress loads are high (eg, people with infectious diseases, such as HIV/AIDS, and those at high risk of cancer, particularly prostate cancer).<sup>8</sup>

**Zinc.** The zinc requirement was set by factorial modeling of the amount needed to maintain zinc balance. The UL was established based on evidence on the interaction between copper and high intake of zinc.<sup>9</sup> Zinc is an important mineral for growth and development, but it also appears to improve immune function in elderly people who are often deficient in several micronutrients.<sup>10</sup>

**Chromium.** The AI for chromium is based on estimated mean intake. A UL was not determined

because few serious adverse effects have been noted with excessive intake of chromium from food. Chromium is being investigated for a role in maintaining blood glucose control and could be particularly important for people with type 2 diabetes.<sup>9</sup>

**Iron.** The RDA for iron was set by factorial modeling based on the amount needed to maintain function even when ferritin stores are minimal. The RDA for adult women younger than 50 takes into account menstrual losses. The UL was based on gastrointestinal side effects associated with elemental iron, but does not apply to those being treated for iron deficiency. Recent studies have examined endurance athletes' higher iron requirements. Runners, for example, might need 30% to 70% more iron due to losses from footstrike hemolysis and gastrointestinal blood loss.<sup>9</sup> Some studies have shown that iron can improve the ability to learn, but more evidence is needed to determine its specific role.<sup>11</sup> Iron deficiency anemia is a serious problem for certain at-risk groups.<sup>9</sup>



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#### References

1. Food and Nutrition Board, Institute of Medicine. *Dietary reference intakes for calcium, phosphorus, magnesium, vitamin D and fluoride*. Washington, DC: National Academy Press; 1999.
2. Appel LJ, Moore TJ, Obarzanek E, Vollmer WM, Svetkey LP, Sacks FM, et al. A clinical trial of the effects of dietary patterns on blood pressure. DASH Collaborative Research Group. *N Engl J Med* 1997;336:1117-24.
3. Zemel MB. Role of dietary calcium and dairy products in modulating adiposity. *Lipids* 2003;38:130-46.
4. Teegarden D. Calcium intake and reduction in weight or fat mass. *J Nutr* 2003;133:249-51S.
5. Norat T, Riboli E. Dairy products and colorectal cancer. A review of possible mechanisms and epidemiological evidence. *Eur J Clin Nutr* 2003;57:1-17.
6. Holt PR, Wolper C, Moss SE, Yang K, Lipkin M. Comparison of calcium supplementation or low-fat dairy foods on epithelial cell proliferation and differentiation. *Nutr Cancer* 2001;41:150-5.
7. Food and Nutrition Board, Institute of Medicine. *Dietary reference intakes for vitamin C, vitamin E, selenium and carotenoids*. Washington, DC: National Academy Press; 2000.
8. Rayman MP. The importance of selenium to human health. *Lancet* 2000;356:233-41.
9. Food and Nutrition Board, Institute of Medicine. *Dietary reference intakes for vitamin A, vitamin K, arsenic, boron, chromium, copper, iodine, iron, manganese, molybdenum, nickel, silicon, vanadium, and zinc*. Washington, DC: National Academy Press; 2002.
10. Chandra RK. Nutrition and the immune system from birth to old age. *Eur J Clin Nutr* 2002;56(Suppl 3):S73-6.
11. Beard JL, Connor JR. Iron status and neural functioning. *Ann Rev Nutr* 2003;23:41-58.