

Magnesium

Physiological Functions

Magnesium has roles in energy metabolism, muscle contraction, and nerve impulse transmission, and bone mineralization. It is a required cofactor for an estimated 300 enzymes. Among the reactions catalyzed by these enzymes are fatty acid synthesis, protein synthesis, and glucose metabolism. Magnesium status is important for regulation of calcium balance through parathyroid hormone-mediated reactions. Secretion of parathyroid hormone and end-organ responsiveness to the hormone are dependent on availability of the mineral.

As a positively charged divalent cation, magnesium acts as a calcium antagonist at the cell membrane level which is necessary to maintain normal electrical potentials and to coordinate muscle contraction-relaxation responses. In muscle, increased intracellular calcium concentration triggers contraction while increased intracellular magnesium concentration counteracts this effect resulting in relaxation. Magnesium is also involved in metabolism of ATP which enables release of energy stored in the high-energy phosphate ester bond. It is also a potent vasodilator. Magnesium and calcium coordinate the constriction/relaxation of capillary blood vessels which contributes to regulation of blood pressure.

Factors Affecting Availability

Milling of whole grains reduces the magnesium content of the processed flour to 20% of the amount initially present. High intakes of calcium can inhibit magnesium absorption.

Deficiency

Magnesium deficiencies are usually observed as secondary to other clinical conditions rather than due to inadequate dietary intake. Use of diuretics, alcohol abuse, renal disease, and acidosis can contribute to magnesium deficiency through increasing urinary losses. Symptoms of magnesium deficiency include tremors, muscular weakness, confusion, nervousness, hallucinations and swallowing difficulties.

Toxicity

Exposure to magnesium from dietary sources is unlikely to result in toxicity. Individuals who take magnesium-containing laxatives may experience diarrhea without any other adverse effects.

Since magnesium balance is regulated by renal mechanisms, patients with renal disease are prone to toxicity. Initial symptoms of magnesium toxicity include diarrhea, nausea, vomiting, and low blood pressure. Advanced stages of toxicity are characterized by cardiovascular and muscular irregularities.

❖ *The upper limit of safety for magnesium established by the Food and Nutrition Board of the Institute of Medicine is approximately 350 mg daily for adults. See table below for more age- and gender specific guidelines.*

Magnesium Tolerable Upper Intake Levels	
Life Stage	Magnesium (mg/day)
Infants	
0-6 mo	N/A
7-12 mo	N/A
Children	
1-3 y	65
4-8 y	110
Males, Females	
9-13 y	350
14-18 y	350
19-70 y	350
70 y	350
Pregnancy	
≤ 18 y	350
19-50 y	350
Lactation	
≤ 18 y	350
19-50 y	350

Requirements

The Daily Reference Intakes (DRI) for magnesium are shown in the table below.

Magnesium Requirements Daily Reference Intakes	
Life Stage	Magnesium mg
Infants	

0-6 mo	30
7-12 mo	75
Children	
1-3 y	80
4-8 y	130
Males	
9-13 y	240
14-18 y	410
19-30 y	400
31-50 y	420
51-70 y	420
70 y	420
Females	
9-13 y	240
14-18 y	360
19-30 y	310
31-50 y	320
51-70 y	320
70	320
Pregnancy	
18 y	400
19-30 y	350
31-50 y	360
Lactation	
18 y	360
19-30 y	310
31-50 y	320

Dietary Sources

Rich sources of magnesium include nuts and seeds, soybeans, tofu, chocolate, dark-green vegetables, legumes, yogurt, wheat germ and dairy products. See table below for detailed listing.

Magnesium Content of Food	
Food	Magnesium (mg)
Pumpkin seeds, _ cup roasted	303
Almonds, _ cup	238
Soynuts, _ cup	196
Cashews, _ cup	157
Tofu, firm, _ cup	128
Peanuts, _ cup	125

Chili with beans, 1 cup	115
Molasses, 2 Tbl	100
Wheat germ, toasted, _ cup	90
Unsweetened chocolate, 1 oz	88
Sunflower seeds, _ cup	82
Halibut, baked, 3 oz.	78
Swiss chard, cooked, _ cup	75
Spinach, _ cup cooked	66
Black beans, _ cup	60
Oatmeal, 1 cup cooked	56
Peanut butter, 2 Tbl	51
Baked potato with skin, 1	55
Cereal, raisin bran, 1 oz.	48
Lowfat yogurt, 1 cup	43
Milk, nonfat, 1 cup	28
Chicken, breast, 3 oz.	25
Green peas, cooked, _ cup	23