Importance of Plant Sources of Magnesium for Human Health

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Magnesium Functions

- Needed for enzymatic reactions involved in DNA, RNA, protein and adenylate cyclase synthesis; cellular energy production and storage; glycolysis; and cellular electrolyte balance
- Controlling factor in nerve transmission, skeletal and smooth muscle contraction, cardiac excitability, vasomotor tone, blood pressure, and bone turnover

Magnesium Dietary Reference Intakes (DRIs)

- **United States and Canada Estimated Average Requirements (EARs) for adults**
  - **Men – 330-350 mg/day**
  - **Women – 255-265 mg/day**
- **United States and Canada Recommended Dietary Allowances (RDAs) for adults**
  - **Men – 410 -420 mg/day**
  - **Women – 310-320 mg/day**

Magnesium Deficiency Occurrence

- **Moderate to marginal (subclinical) or chronic latent magnesium deficiency (50-<100% of requirement) commonly occurs**
- **In the United States, a 2005/2006 survey indicated that 60% of all adults did not meet the EAR for magnesium**

Magnesium Deficiency Occurrence

- **In 2010, United States Department of Agriculture and Department of Human and Health Services indicated that magnesium is not a major nutrient of concern for health and well-being beyond those that take drugs or have disorders that inhibit its absorption or induce its excretion.**

Reason for Magnesium Deficiency Dichotomy

- **Magnesium deficiency not consistently found in pathological conditions with which it is associated such as cardiovascular disease**
- **Use of this reason fails to take into account that magnesium deficiency may be a risk or disposing factor for pathological conditions through exacerbating or inducing chronic inflammatory stress, which may be alleviated or prevented by other factors that have anti-inflammatory action**

Reason for Magnesium Deficiency Dichotomy

- **EARs and RDAs based on highly variable balance data in 1997 were set too high**
- **Resulted in people not actually magnesium deficient being considered magnesium deficient and not showing any pathology**

Balance Data Supporting Revised EARs and RDAs

- Neutral balance without surface loss
  - 165 mg/day, 95% prediction interval of 113 and 237 mg/day
  - 2.36 mg/kg body weight/day, 95% prediction interval of 1.58 and 3.38 mg/day
- Data suggests for 70, 80, 90, and 100 kg persons
  - EARs of 170, 195, 220, and 245 mg/day
  - RDAs of 245, 280, 315, and 350 mg/day

Association Between Low Magnesium Intakes and Decreased Indicators of Bone Health (38% of 224 subjects <237 mg/d)

Whole Body Bone	Ca		Ca + Cu + Zn	
Subjects	≥237 mg Mg/d	<237 mg Mg/d	≥237mg Mg/d	<237 mg Mg/d
Mineral Content, g	2103	2007	2120	2018
Mineral Density, g/cm^3	1.094	1.056	1.100	1.068
T Score	-0.09	-0.53	-0.03	-0.40

Magnesium Deficiency and Chronic Inflammatory Stress

- **Dietary magnesium significantly and inversely associated with serum C-reactive protein (CRP) concentrations**
- **CRP concentrations >3.0 mg/L (threshold for chronic inflammatory stress) consistently found with magnesium intakes <250 mg/day**
- **Magnesium supplementation alleviates elevated serum CRP and increases deficient serum magnesium concentrations.**

Effect of Magnesium Supplementation on Plasma C-Reactive Protein in Subjects with Baseline Values >3.0 mg/L

Treatment	Number of Subjects	Δ C-Reactive Protein 5&7 Week Mean−Baseline	Ratio C-Reactive Protein 5&7 Week Mean/Baseline
Placebo	17	+1.51±0.77	1.23±0.13
+300 mg Mg/day	19	−1.66±0.46	0.80±0.06
P Value		0.001	0.008

Studies showing no effect of magnesium supplementation on serum C-reactive protein (CRP) or magnesium concentrations often involve subjects without elevated serum CRP or deficient serum magnesium concentrations

The lack of response indicates that some dietary factor, including perhaps an adequate magnesium intake, prevented chronic inflammatory stress and thus diseases with chronic inflammatory stress component

Subclinical or chronic latent magnesium deficiency may be a predisposing factor for chronic inflammatory stress, and the risk of chronic diseases such as cardiovascular disease and diabetes mellitus, especially in obese individuals, which are a significant portion of populations throughout the world.

Rich food sources of magnesium include green leafy vegetables, whole grains, nuts, and pulses; these foods are also rich in phytonutrients or phytochemicals with anti-inflammatory and anti- oxidant action.

Milk is a moderate source of magnesium and contains anti-inflammatory conjugated linoleic acid.

Meat is a moderate source of magnesium

Refined and processed foods generally have the lowest magnesium content

Magnesium in Plants

- Magnesium fertilization increases magnesium in grains and vegetative parts of plants
- Most magnesium deficiency in cultivated crops caused by excessive potassium fertilization or concentrations in the soil
- Magnesium preferentially accumulates in grain when magnesium availability is low
- When magnesium supplies approach adequacy, vegetative structures become storage sinks for magnesium

Conclusions

- **Marginal to moderate magnesium deficiency commonly occurs and significantly contributes to the occurrence of chronic diseases through being a predisposing or risk factor for chronic inflammatory stress**
- **The magnesium content of foods of plant origin can be a sigificant determinant of whether a diet provides adequate magnesium for health**