

## Health Manifestations of Celiac Disease (CD) Section A: Nutrient Deficiencies

Affected System	Affected Nutrient	ID No.	Manifestation	Type*	Current Medical Information **	Dietary Sources
Cardiovascular Digestive Glandular Muscular Nervous Skeletal	Minerals	10	Magnesium Deficiency <sup>2,14,15</sup>	(S)	<p>[P] Common in study subjects with untreated CD.<sup>14</sup> [D] Magnesium deficiency is characterized by decreased parathyroid hormone (PTH) secretion and action and impaired nerve conduction, muscle contraction, bone density, and metabolism. The major function of magnesium may be to stabilize the structure of adenosine triphosphate (ATP) in ATP-dependent enzyme reactions. Magnesium is a cofactor for more than 300 enzymes involved in the metabolism of food components and synthesis of many products. It is required for neuro-muscular transmission and activity, working in concert and against the effects of calcium. In normal muscle contraction, calcium acts as a stimulator and magnesium acts as a relaxer. Magnesium may be absorbed along the entire length of the small intestine, but most absorption occurs in the jejunum. A carrier facilitated mechanism operates when ingested amounts are low. Simple diffusion operates throughout the length of the small intestine when ingested amounts are high.<sup>2</sup> Study investigating the magnesium status in patients at diagnosis demonstrated that magnesium deficiency was present in all patients with classical CD, but only in 1/5 of patients with CD on a GFD and 1/5 of patients with silent CD.<sup>14</sup> Study investigating magnesium status and bone mass in clinically asymptomatic CD patients on GFD and their response to magnesium therapy demonstrated that CD patients have reduction in intracellular free Mg<sup>2+</sup>, despite being clinically asymptomatic. Bone mass also appears to be reduced. Magnesium therapy resulted in a rise in parathyroid hormone, suggesting that the intracellular magnesium deficit was impairing parathyroid hormone secretion. Bone mineral density increased in response to magnesium therapy.<sup>15</sup> [M] Marked by anorexia, nausea, vomiting, hypertension, muscle pain/spasm, chronic fatigue, weakness, premenstrual syndrome, constipation, bone pain, headache, depression, irritability, personality change, confusion, anxiety, insomnia, and decreased parathyroid hormone. Contributes to osteoporosis. Serious neuromuscular disturbances may develop including tetany, cardiac dysrhythmias, myocardial ischemia, and seizures. [C] Results from malabsorption in CD, being rendered unabsorbable due to binding with unabsorbed fatty acids in the formation of soaps, and shift in electrolyte balance from loss of potassium in diarrhea. [R] CD-related deficiency responds to nutritious GFD in most patients.<sup>14,15</sup> Supplementation may be needed.</p>	Rich plant sources of magnesium include, soybeans, buckwheat, black-eyed peas, almonds, cashews, kidney beans, lima beans, Brazil nuts, pecans, whole grains, peanuts, walnuts, and bananas. Rich animal sources are halibut, then haddock, with lesser amounts in other fish, shellfish and chicken.

+ (S) = Classic sign/symptom; (AT) = Atypical sign/symptom; (AD) Associated Disorder; (C) = Complication.

++ [P] = Prevalence; [D] = Description; [M] = Sign/symptom; [C] = CD related cause; [R] = Response to gluten Free diet (GFD).