

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

Affected System	Affected Nutrient	ID No.	Manifestation	Type*	Current Medical Information **	Dietary Sources
Body-Composition Cardiovascular Digestive Muscular Nervous Reproductive Sensory	Vitamins - water soluble	20	Vitamin B <sub>1</sub> (Thiamin) Deficiency <sup>1,2</sup>	(S)	<p>[P] Common in patients with untreated CD.<sup>1</sup></p> <p>[D] Thiamin deficiency is characterized by impairment in carbohydrate metabolism, cardiac and neural function.</p> <p>Coccarboxylase, the functional form of thiamin, serves as coenzyme in energy metabolism, being involved in the metabolism of pyruvate and other a-keto acids which enter the Krebs cycle to generate energy. It is similarly required for the conversion of a-ketoglutarate and the 2- keto-carboxylates derived metabolically from the amino acids methionine, leucine, isoleucine, and valine. Thiamin pyrophosphate also serves as the coenzyme for transketolase, which catalyzes 2-carbon fragment exchange reactions in the oxidation of glucose by the hexose monophosphate shunt.</p> <p>Thiamin is absorbed from the proximal small intestine both by active transport at low doses and passive transport at doses greater than 5mg per day. Absorption is inhibited by folate deficiency. It must be supplied in the diet daily.<sup>2</sup></p> <p>[M] Marked by anorexia, weight loss, poor concentration/memory, difficulty recalling information, low morale, irritability, anxiety, sleep disturbances, apathy, mental confusion, weakness, fatigue, indigestion, abdominal discomfort, constipation, pain over heart, ophthalmoplegia, and decreased urine output.</p> <p>Late syndromes include:</p> <p>Beriberi “dry” causes changes in both legs: loss of feeling in toes, burning of the feet, muscle cramps in the calves and tenderness, and pain in the legs. Later, loss of knee jerk reflex, tense calf muscles, and atrophy of calf and thigh muscles occur.</p> <p>Beriberi “wet” causes heart muscle disease: vasodilatation and warm extremities, tachycardia, and sweating. Cardiomegaly leads to heart failure with edema of face, legs, trunk and serous cavities with lung congestion, high blood pressure, distended neck veins, fatigue and inactivity.</p> <p>Cerebral beriberi (Wernicke Kosakoff syndrome) results from acute deficiency on top of chronic deficiency: confusion, dementia, loss of speech sounds from the larynx, and con-fabulation, then loss of immediate memory, disorientation, nystagmus, staggering walk, coma and death.</p> <p>[C] Results from malabsorption in CD.</p> <p>[R] CD-related thiamin deficiency responds quickly to nutritious GFD.</p>	<p>Rich animal sources of thiamin include pork, whole milk or 2%, salmon, halibut, chicken, beef, and egg. Plant sources include pecans, sunflower seeds, filberts, walnuts, watermelon, chestnuts, beans, peanuts, avocado, peas, and whole grain rice.</p>

\* (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).