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Vitamin B₁ (Thiamin)

Technical Background

- Vitamin B₁ (also called thiamin) is a water-soluble vitamin required for normal energy metabolism and cell division.¹ Like all true vitamins, thiamin is a coenzyme, meaning that it works in tandem with one or more enzymes to catalyze metabolic reactions.² It plays a central role in the production of energy from sugars, starch, and other fuels.
- Thiamin is involved in the production of five-carbon sugars required for synthesis of DNA and RNA. It also plays a role in fatty acid synthesis.
- Vitamin B₁ is thought to modulate proper nerve function by regulating the flow of sodium and other ions across the membranes of nerve cells.³ There is some evidence that thiamin supplementation improves some aspects of cognitive functioning.⁴
- Some studies found that a high intake of thiamin may help prevent the development of nephropathy associated with diabetes.⁵
- Severe thiamin deficiency causes beriberi, a disease capable of causing extensive neurological and cardiovascular damage.¹
- Though rare, clinical and subclinical manifestations of thiamin deficiency are seen in the developed world. Alcoholism is a leading cause, as ethanol interferes with thiamin absorption in the gut.¹ Frequent ingestion of coffee, tea, raw fish and raw shellfish can further contribute to mild deficiencies. When consumed in moderation, none of these foods pose a significant risk of creating or causing a vitamin B₁ deficiency.
- Metabolic acidosis and heart failure have also been attributed to severe thiamine deficiencies.^{7,8}

Sources and Recommended Intake

- The RDA for thiamin is 1.2 mg/day for men and 1.1mg/day for women.⁶ Higher levels may be required during periods of intense physical activity. Eating excessive amounts of sugar and smoking also give cause to increase vitamin B₁ intake.¹
- The most important dietary sources of vitamin B₁ are whole grains and whole grain products.¹ Because most of the thiamin content is lost in production of white flour and polished rice, these processed foods are often enriched with B vitamins.
- Other significant food sources of vitamin B₁ include meats (especially pork), vegetables, fruits, nuts, legumes, and dairy products.
- Thiamin is unstable to heat and easily leached from foods by water. As such, significant losses can occur during cooking. It is stable to freezing.

Abstracts

Babaei-Jadidi R, Karachalias N, Ahmed N, Battah S, Thornalley PJ. Prevention of incipient diabetic nephropathy by high-dose thiamine and benfotiamine. *Diabetes*. 2003 Aug;52(8):2110-20. Accumulation of triosephosphates arising from high cytosolic glucose concentrations in hyperglycemia is the trigger for biochemical dysfunction leading to the development of diabetic nephropathy—a common complication of diabetes associated with a high risk of cardiovascular disease and mortality. Here we report that stimulation of the reductive pentosephosphate pathway by high-dose therapy with thiamine and the thiamine monophosphate derivative benfotiamine countered the accumulation of triosephosphates in experimental diabetes and inhibited the development of incipient nephropathy. High-dose thiamine and benfotiamine therapy increased transketolase expression in renal glomeruli, increased the conversion of triosephosphates to ribose-5-phosphate, and strongly inhibited the development of microalbuminuria. This was associated with decreased activation of protein kinase C and decreased protein glycation and oxidative stress—three major pathways of biochemical dysfunction in hyperglycemia. Benfotiamine also inhibited diabetes-induced hyperfiltration. This was achieved without change in elevated plasma glucose concentration and glycated hemoglobin in the diabetic state. High-dose thiamine and benfotiamine therapy is a potential novel strategy for the prevention of clinical diabetic nephropathy.

References

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