USANA Technical Bulletin

Pantothenic Acid (Calcium Pantothenate)

Technical Background

- Pantothenic acid (sometimes referred to as vitamin B_5) is an essential water-soluble nutrient widely synthesized by plants and many bacteria, but required in the diets of vertebrate animals, including humans.[1]
- The principal active form of pantothenic acid is coenzyme A (CoA).[2] Mitochondria may be the final site of CoA synthesis, since 95% of this coenzyme is found in mitochondria.[1]
- As a component of coenzyme A, pantothenic acid is essential for the production of energy from carbohydrate, fat and protein. It plays a pivotal role in energy metabolism and the production of ATP, the cell's principal energy currency.[2,3]
- Pantothenic acid and coenzyme A are involved in the synthesis of many other biochemicals, including amino acids, fatty acids, proteins, cholesterol, steroid hormones, vitamin A, vitamin D, hemoglobin, cytochrome molecules, glutathione,[4] and vitamin B_{12}.[5]
- Coenzyme A also contributes an acetyl group to the important neurotransmitter acetylcholine.[2]
- Pantothenic acid may have a protective effect against oxidative damage and ultraviolet light exposure.[6,7] Studies have also found that increasing intake of pantothenate improves wound healing.[8]
- Pantothenic acid is widely distributed in foods, where about 85% occurs as coenzyme A. Because of this broad availability, acute pantothenic acid deficiencies are rare in humans. Where such deficiencies have occurred (generally in conjunction with severe malnutrition), they have been associated with such symptoms as headache, fatigue, insomnia, numbing of the toes, and painful, burning sensations in the hands and feet.[1,5]

Sources and Recommended Intake

- The name "pantothenic acid" is derived from the Greek word "pantos," meaning "widespread." This is a reference to the fact that the nutrient is found in most foods. The richest dietary sources include meats, fish, eggs, broccoli, avocados, and legumes.[1]
- Pantothenic acid is unstable to heating, acids, and bases. As such, significant amounts can be destroyed during food preparation. Cooking is reported to destroy 15-50% of the pantothenic acid in meat, and studies have shown that 37-78% of the pantothenic acid in fruits and vegetables can be lost during processing.[9]
- The Recommended Dietary Allowance (RDA) has been set at 5mg per day for adults; most people consume 4-7 mg per day.[10]

- People with diabetes mellitus, inflammatory bowel diseases, or chronic alcoholism typically have increased requirements for pantothenic acid.[5]
- Calcium pantothenate and sodium pantothenate are the forms of pantothenic acid most often found in nutritional supplements.
- High oral doses of pantothenic acid or calcium pantothenate (up to 10 grams per day for several weeks) do not appear to be toxic to humans.[11]

Abstract

Slyshenkov VS, Piwocka K, Sikora E, Wojtczak L. Pantothenic acid protects jurkat cells against ultraviolet light-induced apoptosis. Free Radic Biol Med. 2001 Jun 1;30(11):1303-10. Human leukemic T lymphocytes (Jurkat cells) were induced to undergo apoptosis by brief irradiation with ultraviolet C light (254 nm). This was accompanied by accumulation of lipid peroxidation products in the form of conjugated dienes, a decrease of total glutathione content, and a shift of its redox state towards the oxidized form. Preincubation of the cells with 1 mM pantothenate resulted in a significant elevation of total glutathione content of the cells, reaching its maximum level, 160% of the control, after 3 h. Similar increase was observed after preincubation with 5 mM N-acetylcysteine, a known precursor of glutathione. Both pantothenic acid and N-acetylcysteine alleviated the ultraviolet-induced decrease of glutathione content, diminished lipid peroxidation, and partly protected the cells against apoptosis produced by ultraviolet irradiation.

References

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