



THE SUPPLEMENT

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VITAMIN E AND CYSTIC FIBROSIS

This issue of The Supplement focuses on vitamin E and CF. Vitamin E initially was recommended to avoid the neurological complications associated with deficiency. More recently, research has been directed towards the vitamin's role as an antioxidant. Although the papers discussing vitamin E and CF published in the past two years focus on the vitamin's role as an antioxidant, the intent of this newsletter is to provide an overview of vitamin E nutrition and CF.

FEATURED PAPERS:

Increased plasma fatty acid concentrations after respiratory exacerbations are associated with elevated oxidative stress in cystic fibrosis patients. Wood LG. Fitzgerald DA. Gibson PG. Cooper DM. Garg ML. *American Journal of Clinical Nutrition*. 75(4):668-75, 2002 Apr. **Objective:** To study oxidative stress during acute pulmonary exacerbation. **Subjects:** 15 CF patients, 11 male. Mean age 15.9 yrs \pm 1.7 yrs, range 7 to 29 yrs. All pancreatic insufficient (PI). **Methods:** Clinical and biochemical markers of oxidative stress measured prior to and following 10 to 14 days of intravenous antibiotic treatment for pulmonary exacerbation. **Results:** After treatment respiratory status improved, quality of well being improved, but measures of oxidative stress did not decrease. Total energy, fat, carbohydrate, and protein intake increased, however dietary antioxidant intake remained unchanged. **Conclusions:** Biochemical markers of oxidative stress were strongly linked to increased plasma fatty acids and remained elevated after treatment for pulmonary exacerbation. Antioxidant intervention during treatment for, and recovery from, acute infection in CF should be considered.

Improved antioxidant and fatty acid status of patients with cystic fibrosis after antioxidant supplementation is linked to improved lung function. Wood LG. Fitzgerald DA. Lee AK. Garg ML. *American Journal of Clinical Nutrition*. 77 (1):150-9, 2003 Jan. **Objective:** To examine the effect of short-term antioxidant supplementation on

biochemical and clinical markers of oxidative stress.

Subjects: 46 CF patients, 21 male, 38 PI. **Methods:** Subjects were assigned to either the low dose of supplement (10 mg vitamin E and 500 mcg vitamin A) or the high dose supplement (200 mg vitamin E, 300 mg vitamin C, 25 mg beta-carotene, 90 mcg selenium, and 500 mcg vitamin A). Biochemical and clinical markers were measured prior to and following 8 weeks of supplementation. **Results:** Antioxidant defenses did not improve in the low dose, but did improve in the high dose. **Conclusions:** Means of reducing oxidative stress while maintaining a high-fat, high-energy diet must be investigated.

Hypothesis: vitamin E complements polyunsaturated fatty acids in essential fatty acid deficiency in cystic fibrosis. Wood LG. Fitzgerald DA. Garg ML. *Journal of the American College of Nutrition*. 22(4):253-7, 2003 Aug. The authors provided a review of the possible reasons for essential fatty acid (EFA) deficiency in CF patients. Based on their previous research, evidence was presented to support the hypothesis that EFA deficiency in CF may result from oxidative damage and impaired antioxidant defenses, particularly vitamin E.

SPECIAL POINTS OF INTEREST:

- *Antioxidant intervention during treatment for, and recovery from, acute infection in CF should be considered. (Wood, et al 2002)*
- *Wood, et al 2003 presented evidence to support the hypothesis that EFA deficiency in CF may result from oxidative damage and impaired antioxidant defenses, particularly vitamin E.*

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REVIEW

Vitamin E includes eight chemically similar compounds, the most common and physiologically active being alpha-tocopherol. Vitamin E is found in plants and plant oils. Formulated alpha-tocopherol is used as a supplement in foods and in supplements. For a full review of vitamin E the reader is directed to a current advanced nutrition text, the DRIs, [1], the European Consensus Statement, [2] and a review paper by Brigelius-Flohe.[3].

Vitamin E requires bile, pancreatic juices, and dietary fat for optimal absorption. Complications impacting the availability of bile acids will reduce vitamin E absorption. [4] Patients with liver disease with mild cholestasis maintain vitamin E levels when supplemented [5] and vitamin E level improves with use of URSO [6]. Absorbed vitamin E equilibrates with total plasma lipids and is highly correlated with plasma lipids. Therefore, serum vitamin E levels can vary with lipid levels. To overcome the variation, a ratio of vitamin E to lipid often is reported in vitamin E research. [7] The use of the ratio in evaluating vitamin E in CF is not fully documented. [8] Erythrocyte vitamin E has been suggested as a less variable measure, but is not generally clinically available. [9] Although it is well recognized that patients with PI are at high risk for vitamin E deficiency, low levels are found in PS patients. [10, 11]

Supplemental vitamin E, available as water-miscible or fat-soluble, is equally well absorbed when taken with enzymes. [12,13] Studies have noted that the two chemical forms of alpha-tocopherol (RRR-alpha-tocopherol and all-rac-alpha-tocopheryl acetate) are

ALTHOUGH REPORTS OF CLINICAL SIGNS OF VITAMIN E DEFICIENCY ARE RARE FOR THE GENERAL PUBLIC, SUCH REPORTS DESCRIBING THE NEUROLOGICAL CONSEQUENCES OF VITAMIN E DEFICIENCY HAVE APPEARED FOR PERSONS WHO HAVE CF.

equally well utilized. [14] Low plasma vitamin E levels have been reported in patients taking multivitamins not formulated for persons who have CF, [15,16] probably due to the amount of vitamin E contained in the products.

Nutrition status of infants identified through newborn screening noted vitamin E deficiency, [17] which, in some patients, continued into childhood. [18] Although reports of clinical signs of vitamin E deficiency are rare for the general public, such reports describing the neurological consequences of vitamin E deficiency have appeared for persons who have CF. [19,20,21] More recently, interest has turned to the role of vitamin E as an antioxidant. As evidenced in the three papers featured in this issue, vitamin E plays an important role as it works in concert with the other antioxidants in fighting oxidative stress common in patients who have CF. These papers noted inadequate intake of antioxidants in stable patients and in those hospitalized for pulmonary exacerbation, which continued after discharge.

CLINICAL APPLICATIONS

Based on a patient's age, the CFF Nutrition Consensus Report recommends at least 50 to 400 IU daily of vitamin E and that vitamin E levels be measured at diagnosis and annually. [22] Extremes in lipid levels may influence interpretation of vitamin E results. The dietitian needs to assess patients'

antioxidant intake from both foods and supplements. This is particularly important during and following exacerbations. Diets high in polyunsaturated fats increase people's requirement for vitamin E. Multivitamins designed for the general public may not maintain adequate vitamin E status. Although use of a CF specific multivitamin may avoid deficiency in the majority of patients, some patients will require additional vitamin E to maintain blood levels. Vitamins should be taken with food and enzymes.

ALTHOUGH USE OF A CF SPECIFIC MULTIVITAMIN MAY AVOID DEFICIENCY IN THE MAJORITY OF PATIENTS, SOME PATIENTS WILL REQUIRE ADDITIONAL VITAMIN E TO MAINTAIN BLOOD LEVELS.

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