Abstract


α-Tocopherol bioavailability is lower in adults with metabolic syndrome regardless of dairy fat co-ingestion: a randomized, double-blind, crossover trial.

Mah E, Sapper TN, Chitchumroonchokchai C, Failla ML, Schill KE, Clinton SK, Bobe G, Traber MG, Bruno RS.

Human Nutrition Program, Department of Human Sciences and Division of Medical Oncology, Department of Internal Medicine, The Ohio State University, Columbus, OH, and Linus Pauling Institute, Oregon State University, Corvallis, OR.

BACKGROUND: Increasing dietary fat intake is expected to improve α-tocopherol bioavailability, which could be beneficial for improving α-tocopherol status, especially in cohorts at high cardiometabolic risk who fail to meet dietary α-tocopherol requirements.

OBJECTIVE: Our objective was to assess dose-dependent effects of dairy fat and metabolic syndrome (MetS) health status on α-tocopherol pharmacokinetics in plasma and lipoproteins.

DESIGN: A randomized, crossover, double-blind study was conducted in healthy and MetS adults (n = 10/group) who ingested encapsulated hexadeuterium-labeled (d6)-RRR-α-tocopherol (15 mg) with 240 mL nonfat (0.2 g fat), reduced-fat (4.8 g fat), or whole (7.9 g fat) milk before blood collection at regular intervals for 72 h.

RESULTS: Compared with healthy participants, those with MetS had lower (P < 0.05) baseline plasma α-tocopherol (µmol/mmol lipid) and greater oxidized low-density lipoprotein (LDL), interleukin (IL)-6, IL-10, and C-reactive protein. Regardless of health status, d6-α-tocopherol bioavailability was unaffected by increasing amounts of dairy fat provided by milk beverages, but MetS participants had lower estimated d6-α-tocopherol absorption (±SEM) than did healthy participants (26.1% ± 1.0% compared with 29.5% ± 1.1%). They also had lower plasma d6-α-tocopherol AUC from 0 to 72 h, as well as maximal concentrations (Cmax: 2.04 ± 0.14 compared with 2.73 ± 0.18 µmol/L) and slower rates of plasma disappearance but similar times to Cmax. MetS participants had lower d6-α-tocopherol AUC from t = 0-12 h (AUC0- t final) in lipoprotein fractions [chylomicron, very-low-density lipoprotein (VLDL), LDL, high-density lipoprotein]. Percentages of d6-α-tocopherol AUC0- t final in both the chylomicron (r = -0.46 to -0.52) and VLDL (r = -0.49 to -0.68) fractions were inversely correlated with oxidized LDL, IL-10, IL-6, and C-reactive protein.

CONCLUSIONS: At dietary intakes equivalent to the Recommended Dietary Allowance, α-tocopherol bioavailability is unaffected by dairy fat quantity but is lower in MetS adults, potentially because of greater inflammation and oxidative stress that limits small intestinal α-tocopherol absorption and/or impairs hepatic α-tocopherol trafficking. These findings support higher dietary α-tocopherol requirements for MetS adults. This trial was registered at www.clinicaltrials.gov as NCT01787591.

PMID: 26447154