Identification and quantification of tocomonoenols in food sources and evaluation of their potential as vitamin E congeners

A. Montoya[I], K. Lehnert[II], A. Muñoz-González[III], T. Wagner[II], V. Brand[II], C. Toro-González[III], J. Warner[III], M. Müller[II], A. Kröpfl[II], N. Sus[II], U. Schmid-Staiger[IV], V.M. Jiménez[III], P. Esquivel[III], W. Vetter[II], J. Frank[II]

[I]University of Hohenheim, Institute of Nutritional Sciences, Stuttgart, Germany, [II]University of Hohenheim, Stuttgart, Germany, [III]University of Costa Rica, San José, Costa Rica, [IV]Fraunhofer IGB, Stuttgart, Germany

Introduction. Tocomonoenols (T1) are structurally related with tocopherols (T) and tocotrienols (T3), the current members of the vitamin E family. T, T1 and T3 have a chromanol ring and a sidechain and are collectively known as tocochromanols. Based on methylation of the ring, tocochromanols are classified into α-, β-, γ- and δ-congeners. T contain a saturated sidechain, while T1 and T3 contain mono-, and three-fold unsaturated sidechains, respectively. αT is considered the most active vitamin E congener, while other T and T3 are rapidly metabolized and excreted. Limited information exists regarding T1 isomers since standard methods for vitamin E determination do not allow their identification and quantification. The aim of the present study was to determine the content of T1 in foods and to evaluate their potential as vitamin E congeners based in their metabolic transformation by liver cells. Methodology: T1 congeners were identified in food matrices by a combination of HPLC, LC-MS and GC-MS approaches after hexane extraction. A liver model of HepG2 cells was used to evaluate the metabolic conversion of α- and γT1 congeners in comparison to corresponding T and T3 congeners. Metabolism of tocochromanols was evaluated by HPLC-based quantification of short chain metabolites. Results: αT1 and γT1 were tentatively detected in leaves and flowers of Urtica leptophylla, while the presence of αT1 was confirmed in edible cyanobacteria and microalgae. In microalgae αT1 content reached up to 17% of total tocochromanol profile, as the second most abundant congener after αT. Metabolism of tocochromanols increased in order T<T1<T3 with higher metabolic conversion for γ- compared to α-forms. αT1 exerted higher similarity to the metabolic conversion of αT suggesting high potential as vitamin E congener. Conclusion: T1 are underestimated tocochromanols in foods and αT1 might be the second most active vitamin E congener based on its transformation into short chain metabolites.