Naturale³ tocotrienols – Potent natural super antioxidant

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Vitamin E has well established scientifically proven antioxidant properties in the human body. Apart from its direct antioxidant properties, vitamin E also interacts with a wide range of antioxidant processes in vivo, *including being a potent defence against free radicals. Various* in vitro *and* in vivo *studies have shown that tocotrienols have unique antioxidant and other health-promoting properties distinct from the rest of the Vitamin E family, namely tocopherols.*

TOCOTRIENOLS – NATURAL POWERFUL ANTIOXIDANT

Vitamin E is widely known as an important lipid-based antioxidant that is key to protection of unsaturated fatty acids on cell membranes. Although α-tocopherol is known as the isoform with high vitamin E activity, tocotrienol has been shown to have much higher free radical scavenging ability than α-tocopherol within the cell (1). This is due to the higher penetration of tocotrienol molecules into the cell while α-tocopherol mainly resides on the plasma membrane (2). Hence, tocotrienol is able to protect important intracellular structures including organelles like the mitochondria (responsible for energy production) and DNA (genetic code) from oxidative stress induced damage better than α-tocopherol.

SOURCES

Tocopherols and tocotrienols are naturally found in various types of plant seeds, ranging from wheat, rice, soybean, palm and grape seed to peanut, walnut and pecan. Most of these seeds contain only tocopherols; only a few contain both compounds. Tocotrienols are found mainly in palm fruit and from wheat and rice bran which form the hard outer layer covering the seed beneath the husk. It is believed that tocopherols and tocotrienols are nature's way of protecting seeds and seedlings from the damaging effects of ultraviolet light and oxidation (3).

CHEMICAL STRUCTURE AND BIOLOGICAL PROPERTIES

Tocotrienol delivers excellent antioxidation in lipid systems. Compared to tocopherols, tocotrienols have up to 60 times more powerful antioxidation properties in the body due to its more uniform distribution in cell membranes, stronger effect on membrane lipids and its higher recycling efficiency *in vivo* (4). Another study showed that cellular uptake of tocotrienols is up to 70 times faster initially than tocopherol (5). It is tocotrienol's distinct chemical structure in the unsaturated double bonds in its tail as compared to saturated bonds of tocopherols that gives it health properties not seen in tocopherols. Tocotrienols can be further distinguished into four

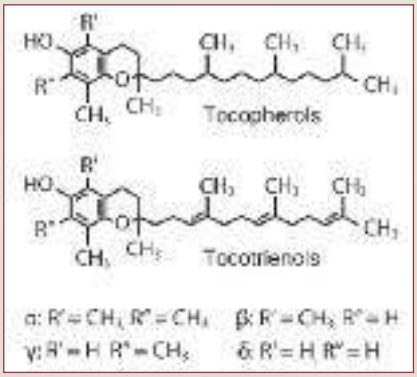

Figure 1 – Structure of natural forms of vitamin E.

isomeric forms: alpha (α), beta (β), gamma (γ), and delta (δ) depending on the location and number of methyl groups (CH_3) on the chromanol ring (α is 5,7,8-trimethyl, β is 5,8-dimethyl, γ is 7,8-dimethyl and δ is 8-monomethyl) (Figure 1).

IN VIVO ANIMAL AND HUMAN STUDIES

In an animal study, researchers injected hamsters with bacterial lipopolysaccharide (to mimic acute infection), zymosan (to mimic acute systemic inflammation), or turpentine (to mimic acute localized inflammation), which are responsible for the generation of plenty of free radicals that causes oxidative stress. Feeding the stressed hamsters with 10 mg of tocotrienols reversed and normalized the altered levels of enzymatic and nonenzymatic antioxidants in liver and kidney (6). Molecular docking study showed that tocotrienols were interacting directly and strongly with antioxidant enzymes.

A randomized, double-blind, placebo-controlled study of 64 subjects aged 37-78 years old has showed a significant reduction of DNA damage in their blood samples after 3 months of 160 mg daily dose of tocotrienols and the positive effects continued to the end of the trial at 6 months (7).

In another study, the immune cells from young adults (aged 35-49) and from older adults (age over 50) were exposed to hydrogen peroxide to induce free radical cell damage. The researchers then used advanced genomic analysis to determine which proteins had changed in response to the stress. Subsequently the cells were exposed to tocotrienols and protein changes measured (8). In addition to improvement in antioxidant gene signaling the researchers also discovered that tocotrienols activated gene signaling within the cells to make them more resistant to stress. Not only were antioxidants enzymes working better but the cells themselves had improved fitness to withstand the trauma, including in the immune cells of older adults.

These studies show the potency of tocotrienols to influence multiple gene signaling involved with natural defence. This is in addition to the direct antioxidant capacity of tocotrienols, which is also superior to tocopherols. As there is general decline in antioxidant enzyme function as well as a cell's ability to defend itself with aging, tocotrienol is likely to have anti-aging properties.

OPTIMUM HEALTH SUPPLEMENTATION

Vitamin E supplements containing tocotrienols are now being recommended for improving health. Human ageing is affected by both genetic factors and lifestyle-related factors such as diet. Dietary intervention is simple and effective, as nutrients can affect the rate of ageing by altering the type and quantity of proteins synthesized (9) by modulating gene expression (10), thereby altering the oxidative stress of individuals (11).

In a randomized controlled clinical trial, the effects of Tocotrienol Rich Fraction (TRF) supplementation on lipid profile and oxidative status in healthy older individuals (n=62, age range 35-50 years and above) were studied. The subjects were randomized to receive either 160 mg/day TRF or placebo for 6 months. HDL-cholesterol in the TRF-supplemented group was elevated after 6 months ($p<0.01$) (Figure 2). Protein carbonyl contents were markedly decreased. Changes in enzyme activities were only observed in the >50 year-old group. Superoxide dismutase (SOD) activity was significantly decreased after 3 and 6 months of TRF supplementation whereas catalase (CAT) activity was decreased after 3 and 6 months in the placebo group. Glutathione peroxidase (GPx) activity was increased at 6 months for both treatment and placebo groups ($p<0.05$) (12).

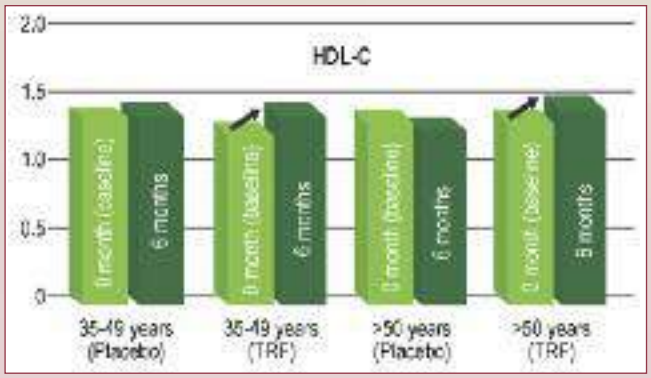

Figure 2 – Effects of Tocotrienol Rich Fraction (TRF) supplementation on lipid profile and oxidative status in healthy older individuals.

SELF-EMULSIFICATION ENHANCES BIOAVAILABILITY

Although the absorption and metabolism of vitamin E in general have been well studied, the plasma concentration of tocotrienol was found to be much lower compared to tocopherols (13). Absorption of tocotrienol in humans is enhanced in the presence of a high fat diet but there is large variability in absorption efficiency between individuals.

Davos Life Science proprietary formulation, Naturale³ Bio-Enhanced 20 overcomes this problem by dramatically improving the absorption of orally ingested tocotrienol. This newly developed Naturale³ Bio-Enhanced 20, with self-emulsifying system (SES), delivers at least two times higher bioavailability than the existing bioenhanced competing formulation. Upon ingestion, Naturale³ Bio-Enhanced 20 forms micro/nano emulsion in the gut that enables high absorption into the body and reduces breakdown in the liver, independent of dietary fat or food intake. Study showed

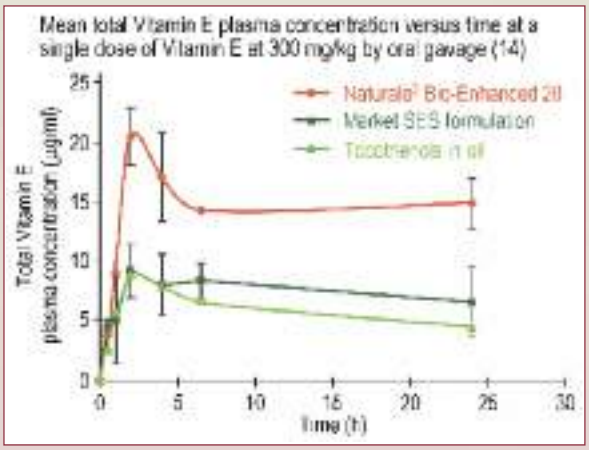

Figure 3 – Oral bioavailability of tocotrienol formulations.

that Naturale[3] Bio-Enhanced 20 delivers consistently much higher bioavailability than current commercial product in the market (Figure 3).

Vitafoos Europe 2016

DavosLife/KLK OLEO will be exhibiting at Vitafoods Europe 2016, Geneva Switzerland, May 10-12, 2016, stand No. I102. DavosLife's research work on "Beneficial role of palm oil derived-tocotrienols in cardiovascular health & metabolic syndrome" has been selected as poster presentation in Vitafoods Conference.

For scientific information, please visit www.tocotrienolresearch.org

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