

TOCOTRIENOLS: ANTIOXIDANTS FOR BETTER PROTECTION

TOCOTRIENOLS, FOUND IN VITAMIN E, CAN BE USED AS A FUNCTIONAL INGREDIENT TO BE INCORPORATED IN FOOD AND BEVERAGE APPLICATIONS SO AS TO HELP CONSUMERS PROTECT AGAINST VARIOUS DISEASES. BY **DAVOS LIFE SCIENCE**

VITAMIN E is an essential vitamin which is not synthesised by the human body, thus it has to be obtained from diet. Deficiency of vitamin E can cause nerve damage, blood disorders and infertility. In 2010 the US Food and Drug Administration (FDA) granted 'Generally Recognised as Safe' (GRAS) status to palm-derived vitamin E tocotrienols, making them safe to be incorporated in foods and beverages.

Vitamin E is an essential lipid soluble nutrient that consists of eight naturally occurring isomers: four tocopherols (alpha, beta, gamma, delta) and four tocotrienols (alpha, beta, gamma,

delta). Tocotrienol's distinct chemical structure gives it more fluidity, enabling its cellular uptake in biological systems to be up to 70 times higher than alpha-tocopherol. In addition, it is shown to possess up to 60 times more superior antioxidative activity compared to alpha-tocopherol.

The importance of consuming tocopherols and tocotrienols is clearly demonstrated in numerous studies that show tocotrienols can offer greater antioxidant protection and broader health benefits than alpha-tocopherol alone.

DIETARY SOURCES

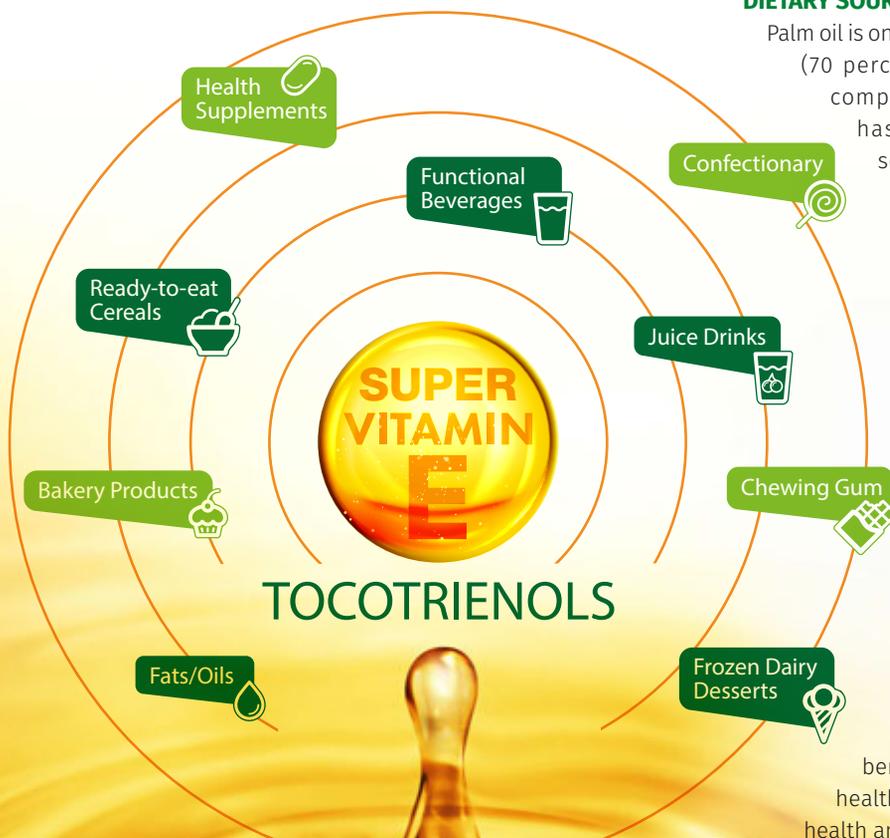
Palm oil is one of the most significant sources of tocotrienols (70 percent), and the only natural source with a complete spectrum of tocotrienols isomers; it has therefore consistently been used as a source of tocotrienols supplementation. The other sources of tocotrienols (that have an incomplete spectrum of isomers) include rice bran oil as well as wheat germ, oats and barley.

Despite the presence of tocotrienols in these food sources, the amounts available would not be enough to be clinically significant. For example, it takes 1,000 kg of crude palm oil to produce one kilogram of a specific brand of tocotrienols commonly used in dietary supplements. One would have to consume 100-200 g of palm oil or about three kilograms of wheat germ, barley, or oat to achieve doses that have been scientifically shown to have clinically significant biological activity.

Tocotrienols are being researched for benefits in cardiovascular protection and heart health, neuroprotection and cognitive health, liver health and many more.

CARDIOVASCULAR HEALTH

Elevated total and low-density lipoprotein (LDL) cholesterol are established risk factors for cardiovascular disease. The cardioprotective effects of tocotrienols are mediated through



their ability to influence the activity of HMGCoA-reductase, the enzyme responsible for biosynthesis of cholesterol in our body.

Several studies have demonstrated the ability of tocotrienols to reduce both total and LDL cholesterol levels. In addition, tocotrienols help protect the cardiovascular system via their ability to provide antioxidant support. These antioxidant activities are mediated through induction of antioxidant enzymes such as superoxide dismutase and glutathione peroxidase. Studies also demonstrate the potent anti-inflammatory properties of tocotrienols, which involve the activation of NF-Kb, the suppression of TNF and COX-2.

In a study involving human subjects, narrowing of neck blood vessels regressed in 32 percent of patients given tocotrienol formulation for two years, suggesting that tocotrienols delay the plaque formation (atherosclerosis) in blood vessels.

Prolonged and uncontrolled hypertension and diabetes can disrupt the lining of blood vessel walls. In pre-clinical studies, tocotrienols improved blood vessel function when administered to hypertensive animal models.

COGNITIVE HEALTH

The dry weight of the brain is approximately 60 percent phospholipid. The majority of the phospholipid resides in the cell membrane, and it is here that vitamin E plays a significant role by helping protect the membrane against oxidative damage.

Tocotrienols have been shown to help reduce neurodegeneration by regulating key signalling processes involved in neurotoxicity. Activation of the signalling mediators c-SRC and 12-LOX (12-lipoxygenase) is a key step in the chemical cascade that leads to glutamate-induced neurotoxicity. This activation can be inhibited by alpha-tocotrienol. A recent study showed alpha-tocotrienol targets specific pathways to protect against neural cell death and rescues the brain after stroke injury.

Based on the study from Malaysia and UK, daily supplements of mixed tocotrienols may protect against the progression of white matter lesions (WMLs) in human brain. The study involved 121 people aged 35 and above with cardiovascular risk factors and WML, which are linked to development of neurodegenerative diseases and to an increased stroke risk. Volunteers were randomly assigned to receive either 200 mg of mixed tocotrienols or placebo twice daily for two years.

Data indicated that the mean WML volume of the placebo group increased whereas those who received tocotrienols supplementation remained unchanged. This study clearly demonstrates neuroprotective effect of tocotrienols supplementation in human, as reflected by significant decrease of WML volume. Brain WMLs are closely related to vascular events of the brain and an independent prognostic measure of future stroke risk.

Oral tocotrienols have also been shown to protect against and minimise stroke-related brain damage in many

studies. Tocotrienols work by: (1) reducing the inflammation after an acute stroke; (2) reducing the effects of specific oxidant damage-inducing molecules in brain tissue; and (3) increasing the development of blood vessels to rapidly restore blood flow to areas injured by stroke.

LIVER HEALTH

Metabolic syndrome contributes to the development of non-alcoholic fatty liver disease (NAFLD), a common medical condition that can lead to inflammation (hepatitis) and scarring (cirrhosis) of the liver. Tocotrienols are not only anti-obesogenic and anti-diabetic; evidence also suggests that they can directly help in improving liver health.

In a 2010 study, Davos Life Science showed that tocotrienols improved NAFLD by reducing hepatic triglyceride synthesis. The company and their collaborators have subsequently done further studies which corroborate and further extend these findings by showing that the added anti-inflammatory activity of tocotrienols can further protect the liver.

In a clinical trial involving hypercholesterolaemic patients with ultrasound-proven NAFLD, supplementation with mixed tocotrienols 200 mg twice daily for one year resulted in significantly higher normalisation of hepatic echogenic response compared to the placebo group.

CONCLUSION

Like most other nutrients, tocotrienols work synergistically to perform a myriad of biological functions. The days of consuming only tocopherol supplements because they were the only ones available are over. The demand for tocotrienols supplements is gradually increasing.

In order to reap the full benefits of tocotrienols, one must find and use a supplement that provides the complete spectrum. This can better help ensure you are giving your body what it needs to achieve optimal health and wellness.

As tocotrienols have been concluded as GRAS for its intended use in foods and beverages, they are used as a functional ingredient in foods and beverages as a source of natural vitamin E and antioxidants. With various commercially available forms in the market, these are easily incorporated into a myriad of, not limiting to fats or oils, bakery products, ready-to-eat cereals, meal replacement, functional beverages, juice drinks, frozen dairy desserts, confectionary and chewing gum.

Tocotrienols are potent gene regulators and modulators of many enzymes involved in human health, helping to suppress the inflammation, glycation, and other processes that contribute to age-related diseases. As interest continues to grow, more studies are investigating their potential roles in protecting against cancer, heart disease, stroke, diabetes, liver disease, neurodegenerative diseases and even osteoporosis. 

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