

# USANA Technical Bulletin

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## Tocotrienols

### Technical Background

- Tocotrienols are compounds within the vitamin E family. They are structurally and functionally similar to vitamin E and other tocopherols. Like the tocopherols, several forms of tocotrienols are known (alpha-, beta-, delta-, and gamma-tocotrienols).
- Tocotrienols have been shown to be potent antioxidants in their own right, with *in vitro* biological efficacy rivaling – or in some cases surpassing – vitamin E.<sup>1,2,3</sup>
- The strong antioxidant activity of tocotrienols greatly benefits the cardiovascular system. Tocotrienols at doses as small as 42 mg/day have been found to reduce blood cholesterol levels by 5-35% in a number of different clinical trials.<sup>4,5,6</sup>
- Further studies have found that daily doses of tocotrienol-rich fraction has the potential to lower triglycerides, lower LDL cholesterol, and decrease the chances of coronary heart disease, hyperlipidemia, and hypercholesterolemia.<sup>7,8</sup>
- Studies with humans and animals have found that tocotrienols (particularly gamma-tocotrienol) may have potential anti-cancer capabilities.<sup>9,10</sup> Several studies have found that tocotrienols can inhibit the growth of breast cancer and pre-cancer cells.<sup>11,12,13</sup> This activity is enhanced by the addition of Tamoxifen, a drug commonly used in breast cancer treatment.<sup>14</sup>

### Sources and Recommended Intake

- No Recommended Dietary Allowance (RDA) has been established for tocotrienols. Commercial tocotrienol products typically supply 10 to 50 mg/day of mixed tocotrienols.
- Rice bran oil and palm kernel oil contain approximately 0.1% tocotrienols. Other unrefined plant oils (e.g. soybean, corn, canola, and sunflower) contain virtually no tocotrienols.
- Supplemental tocotrienols are obtained from refined fractions of either rice or palm oils in which the tocotrienols have been extracted and concentrated.
- Like vitamin E, tocotrienols are extremely safe. Human studies have shown no adverse effects with consumption of 240 mg/day for 18-24 months.<sup>7, 15</sup>

### Abstracts

*Sylvester PW, Shah SJ. Mechanisms mediating the antiproliferative and apoptotic effects of vitamin E in mammary cancer cells. Front Biosci. 2005 Jan 1;10:699-709.* Tocopherols and tocotrienol represent the two subgroups within the vitamin E family of compounds, but only tocotrienols display potent anticancer activity at doses that have little or no effect on normal cell growth or function. Tocotrienols are potent antioxidants, but antitumor activity is independent of antioxidant activity. The exact reason why tocotrienols are more potent than tocopherols is not completely understood, but at least part of the reason is because of greater cellular accumulation. Furthermore, dose-response studies show that growth inhibitory doses of tocotrienols are 5-6 times lower than their corresponding

lethal doses, suggesting that the antiproliferative and cytotoxic effects of tocotrienols are mediated through different mechanisms. Recent studies showed that tocotrienol-induced programmed cell death (apoptosis) results from the activation of specific intracellular cysteine proteases (caspases) associated with death receptor activation and signal transduction. Furthermore, combined treatment with specific caspase inhibitors blocked the cytotoxic effects of tocotrienols in malignant mammary epithelial cells. In contrast, tocotrienol inhibition of cell proliferation appears to involve the suppression of multiple hormone- and growth factor-receptor mitogenic signaling pathways. Although additional studies are required to clarify the intracellular mechanisms mediating the anticancer effects of tocotrienols, experimental evidence strongly suggests that dietary supplementation of tocotrienols may provide significant health benefits in lowering the risk of breast cancer in women.

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