



**Vitamin E** - d-alpha Tocopherol, d,l-alpha Tocopherol,  $\gamma$ - and  $\delta$ -tocopherols, Tocotrienols

### Common Indications

- Antioxidant
- Cardiovascular
- Neurological degenerative diseases, including Alzheimer's disease
- Cancer prevention
- Ocular health including cataracts, macular degeneration
- Type 2 diabetes/insulin resistance/impaired glucose tolerance

### General Comments

Vitamin E is actually a group of eight compounds including four tocopherols (alpha, beta, gamma, and delta) and four additional tocotrienol derivatives. Gamma-tocopherol (or  $\gamma$ -tocopherol) is the most commonly found form in our diet, whereas alpha-tocopherol (or  $\alpha$ -tocopherol) is the most biologically active form. Pure vitamin E compounds are easily oxidized, so they are manufactured as acetate or succinate esters. While tocopherols are generally present in common vegetable oils (such as soy, canola, wheat germ, sunflower), tocotrienols are concentrated in cereal grains (like oat, barley, and rye, rice bran), with the richest source found in virgin crude palm oil, a vegetable oil that is increasingly used in prepared foods due to its trans-fat free property. Natural vitamin E is d-alpha tocopherol, whereas synthetically produced vitamin E is a mixture consisting of both the d- and l-isomers as dl-alpha tocopherol. It has been reported that natural vitamin E has a substantially greater bioavailability than synthetic vitamin E.<sup>1-3</sup>

### Benefits & Mechanism of Action

#### Functions:

- Antioxidant: Vitamin E is the body's most important fat-soluble antioxidant. As such, it insures the stability and integrity of cellular tissues and membranes throughout the body by preventing free radical (lipid peroxidation) damage.<sup>21-27</sup>
- Cardiovascular diseases: Vitamin E is reported to decrease platelet adhesion, protect against development of atherosclerotic lesions, and prevention of LDL-cholesterol from being oxidized. Clinical studies report lower levels of vitamin E in those with coronary heart disease along with a decreased incidence of cardiovascular disease with increased vitamin E intake, although recent meta-analyses have reported a lack of statistically significant of clinically important benefits when using vitamin E supplements for cardiovascular disease

and/or stroke. However, it should be noted that most studies use only alpha-tocopherol or alpha-tocopheryl instead of the mixed tocopherols as nature intended.<sup>13-20</sup>

- Cancer prevention: Vitamin E is reported in clinical studies to beneficial cancer prevention and treatment. A 2012 laboratory study reported that tocotrienols inhibit PI3K/Akt signaling pathway in cancer cells, which mediates mitogen-dependent growth and survival of these cells. Tocotrienols are natural forms of vitamin E that displays potent anticancer activity at treatment doses that had little or no effect on normal cell viability.<sup>4-12</sup>
- Neurodegenerative diseases: Although clinical studies have been positive in reported that vitamin E supplementation is beneficial in neurodegenerative disorders including Alzheimer's disease. A Cochrane Database Systematic Review in 2012 reported that there was no convincing evidence that vitamin E supplementation in Alzheimer's disease. The authors also stated that use in AD should not be restricted to alpha-tocopherol. Tardive dyskinesia, neurodegenerative ataxia, and oxidative stress-induced denaturation of nerve terminal proteins involved in neurotransmission have been reported to be improved by vitamin E administration.<sup>31-34</sup>
- Diabetes mellitus and insulin resistance: A meta-analysis in 2010 reported that vitamin E administration to those with Hp 2-2 DM may increase life expectancy by 3 years. However, a 2011 meta-analysis reported that the evidence suggests no beneficial effect of vitamin E supplementation in improving glycaemic control in patients with type 2 diabetes, although HbA(1c) may decrease with vitamin E supplementation in patients with inadequate glycaemic control or low serum levels of vitamin E. Again, it should be noted that studies generally, use alpha-tocopherol in the study and not mixed tocopherols.<sup>28-30</sup>
- Exercise: During heavy exercise, vitamin E markedly reduces the amount of exercise-induced free radical damage to the blood and tissues, and also helps the body reduce the incidence of exercise-induced muscle injury.<sup>36-39</sup>
- Eyes: Helps the body protect the eyes against cataracts and diabetic retinopathy, although again, research restricted to alpha-tocopherol and not mixed tocopherols produced no beneficial results.<sup>35</sup>

**Dose:**

DRI\* 15 I.U. daily

ODA\*\* 50 – 1000 I.U. daily

Tocotrienols 140-360 mg daily

\* The Dietary Reference Intakes (DRI) are the most recent set of dietary recommendations established by the Food and Nutrition Board of the Institute of Medicine, 1997-2001. They replace previous RDAs, and may be the basis for eventually updating the RDIs.

\*\*The Optimum Daily Allowance (ODA) represents a reference level beyond the RDI, and is often many times higher than the RDI to prevent diseases such as aging or cancer. These numbers are based on clinical use.

### **Standardization:**

### **Cautions & Side Effects:**

- Vitamin E is destroyed by heat and oxidation during cooking or food processing. Therefore, reliance on processed foods and/or fast foods can contribute to depletion. Low levels of selenium and high intake of polyunsaturated fatty acids both contribute to vitamin E depletion. Symptoms of vitamin E deficiency include: dry skin, dull dry hair, rupturing of red blood cells resulting in anemia, easy bruising, PMS, fibrocystic breasts, hot flashes, eczema, psoriasis, cataracts, benign prostatic hyperplasia, poor wound healing, muscle weakness, and sterility.
- Although there are some reports that vitamin E supplementation may increase the incidence of prostate cancer and all-cause mortality in some individuals a meta-analysis in 2011 found that there was no relationship between vitamin E supplementation and all-cause mortality. It is especially important to use a mixed tocopherol ( $\gamma$ - and  $\delta$ -tocopherols) and tocotrienols to get the full clinical effects of vitamin E.
- Vitamin E may increase the chances of bleeding in sensitive individuals. Use with caution if a bleeding disorder exists or if the individual is taking anticoagulant medications, including aspirin. Two clinical trials have reported an increased risk of hemorrhagic stroke in participants taking alpha-tocopherol.

### **Symptoms of Deficiency:**

- Vitamin E is destroyed by heat and oxidation during cooking or food processing. Therefore, reliance on processed foods and/or fast foods can contribute to depletion. Low levels of selenium and high intake of polyunsaturated fatty acids both contribute to vitamin E depletion. Symptoms of vitamin E deficiency include: dry skin, dull dry hair, rupturing of red blood cells resulting in anemia, easy bruising, PMS, fibrocystic breasts, hot flashes, eczema, psoriasis, cataracts, benign prostatic hyperplasia, poor wound healing, muscle weakness, and sterility.
- Those with an increased need for vitamin E include:
  - o Alzheimer's Disease
  - o Atherosclerosis
  - o Cancer
  - o Cataracts
  - o Cervical Dysplasia

- o Diabetes
- o Heart Attack Prevention
- o Osteoarthritis
- o PMS
- o Respiratory Tract Infections
- o Rheumatoid Arthritis

The following drugs can cause a depletion of vitamin E, which may increase an individual's need for vitamin E:

- o Cholestyramine
- o Clofibrate and fenofibrate
- o Colestipol
- o Gemfibrozil
- o Haloperidol
- o Mineral oil

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### **General Comments**

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