

The second coming of vitamin E: *The Advent of Isomers*

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Vitamin E is great stuff. Whether you're considering it from a conventional or alternative/complementary medicine perspective, pretty much everyone will agree that this nutrient is vital to human health, and provides premier antioxidant protection against free radicals. Perhaps this explains why nearly one-third of all American adults are taking vitamin E as a dietary supplement.¹ Maybe you're one of them. If so, good for you. But which type are you taking? There are several options, and one of them stands out far above the rest: Vitamin E isomers!

Vitamin E isomers

Vitamin E is legally defined as one specific chemical, alpha-tocopherol. However, there are other tocopherols that do have some vitamin E activity, as well as significant antioxidant contributions. These other tocopherols include the beta, gamma, and delta tocopherols; and are called isomers. In this context, the term isomer refers to compounds with the same structural formula but different spatial arrangements of atoms.²

In addition, there is a family of natural compounds related to vitamin E called tocotrienols, which also have distinct health benefits. These tocotrienols are also found in alpha, beta, delta and gamma isomers.

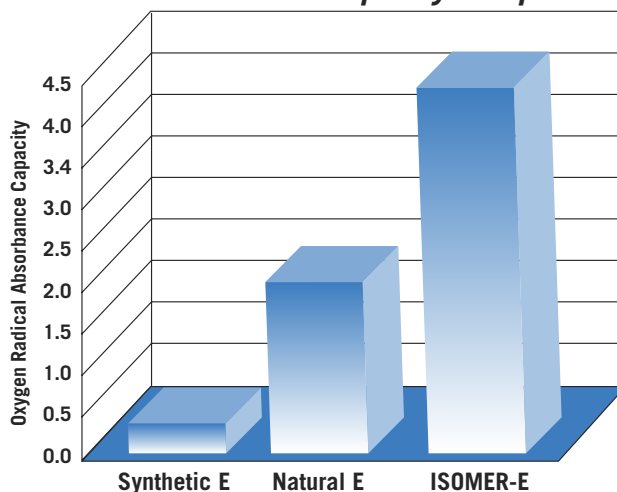
The fact that tocopherols and tocotrienols are available as different isomers may not sound especially significant, but the fact is that their different arrangement of atoms can give each isomer different and valuable properties. As a matter of fact, the combination of these different tocopherol and tocotrienol isomers (vitamin E isomers for short) have been tested, and found to provide 100 times the antioxidant capacity of synthetic vitamin E (dl-alpha-tocopherol), and 100% more than natural vitamin E (d-alpha-tocopherol).¹ This is huge!

ORAC

Of course you often see big numbers like "100 times" and "100%" bandied about by marketers in an attempt to prove that one product has greater activity than another product; and in many instances there is no real scientific proof to back up such claims. In the case of the vitamin E isomers, however, they were subjected to an ORAC

(Oxygen Radical Absorbance Capacity) test, conducted jointly by Brunswick Laboratories and the Jean Mayer USDA Human Nutrition Research Center at Tufts University. ORAC tests are considered to be the definitive measurement of antioxidant capacity, as validated by published scientific research.^{3 4 5 6}

Antioxidant Capacity Comparison



Alpha-, beta- and delta-tocopherol together

Considering the results of the ORAC test on vitamin E isomers, it shouldn't be a big surprise that other research has shown a combination of alpha-, beta- and delta tocopherol together is more effective than alpha-tocopherol alone. For example, in one study, a mixture of these tocopherols was shown to have a stronger effect at inhibiting free radical damage to human blood cells than alpha-tocopherol alone.⁷ The authors of this study also noted that this tocopherol mixture has been found to counteract the development of atherosclerotic cardiovascular disease, whereas intake of large amounts of pure alpha-tocopherol has shown only a slight or no effect in clinical studies.

In another study, the combination of tocopherols were shown to have a synergistic (i.e., enhancing) effect in inhibiting platelet aggregation, or the clumping together of blood cells, above and beyond the effect of the individual tocopherols.⁸ The prevention of platelet clumping is important since such clumping can be a contributory factor toward certain types of cardiovascular disease.

Combining tocopherols and tocotrienols

We know from the previous data presented that combining tocopherols has value over the isolated use of just alpha-tocopherol. But what happens when the tocopherols and the tocotrienols are combined? In one study, a combination of tocopherols and tocotrienols were shown to result in 60% lower cholesterol levels in mice fed high-fat/high-cholesterol diets, than mice given only the combination of tocopherols with the same diet.⁹ Clearly, the full spectrum of vitamin E isomers has greater value for promoting cardiovascular health.

Another consideration is cerebral infarction, where an area of brain tissue dies due to a local lack of oxygen; obviously a bad thing. Although alpha-tocopherol has been shown to be effective

in reducing cerebral ischemia-induced brain damage, the other isomers were not previously studied for this effect. That changed, however, with the results of a recent study showing that alpha-tocopherol, alpha-tocotrienol and gamma-tocopherol significantly decreased the size of the cerebral infarcts, while gamma-tocotrienol, delta-tocopherol and delta-tocotrienol showed no effect.¹⁰ Only a combination of the isomers provides the necessary specific tocopherols and tocotrienols to provide this benefit.

Supplement Facts

Serving Size: 1 Softgel
Servings Per Container: 60

Amount Per Serving	%Daily value
Vitamin E (d-alpha-tocopherol) 400IU	1333%
Total Tocopherols 391 mg	*
(proprietary Isomer-E™ Blend of d-alpha, d-gamma, d-delta and d-beta tocopherols)	
Toco-Rich 133 mg	*
(proprietary blend of Rice Bran Oil & Concentrate, Palm Oil, Red Raspberry Seed Oil, and Cranberry Seed Oil together containing the Isomer-E ratio d-gamma, d-alpha, d-delta and d-beta tocotrienol as well as d-gamma, d-delta, d-alpha and d-beta tocopherol)	

*%Daily Value has not been established.

Based on a 2000 calorie diet

Understanding labeling and vitamin E activity

Now, let's take a look at an actual supplement facts box from a product that provides a full range of vitamin E isomers. In this case, you'll see that the vitamin E is listed as 400 IU of d-alpha tocopherol, just as it should be (vitamin E activity is measured in international units [IU]). Then, right below it, the total tocopherols are listed as 391 mg. Now don't be confused about the fact that 391 mg does not add up to 400 IU; it's not supposed to. Here's why: 1 mg of d-alpha tocopherol equals 1.49 IU. Therefore, only 268 mg of this specific isomer is necessary to provide the full 400 IU. The remaining 123 mg are comprised of the gamma, delta and beta forms. These isomers cannot be expressed in terms of IU. The law dictates that this must be done with alpha-tocopherol alone.

The tocotrienol blend (Toco-Rich in this formula) provides 133 mg of tocotrienols, which are also not contributing to the 400 IU of vitamin E activity.

Conclusion

Taking a vitamin E supplement is a good idea. Taking a vitamin E supplement composed of a full range of vitamin E isomers is a better idea. Mixed vitamin E isomers have greater value as antioxidants than alpha-tocopherol alone, and greater value for promoting a healthy cardiovascular system as well as for a variety of other potential benefits including anti-inflammatory and anti-cancer effects. ❖

(Footnotes)

¹ The test was conducted on Pinnacle's Isomer-E™, a blend of vitamin E isomers.

(Endnotes)

¹ Use Of Vitamin E Increasing, Survey Shows. January 15, 1998.

http://www.decisionanalyst.com/publ_data/1998/vitamine.asp

² Seager SL, Slabaugh MR. Chemistry for Today: General, Organic, and Biochemistry, Fourth Edition. Pacific Grove, California: Brooks/Cole; 2000:364.

³ Huang D, Ou B, Hampsch-Woodill M, et al. Development and Validation of Oxygen Radical Absorbance

Capacity Assay for Lipophilic Antioxidants Using Randomly Methylated α -Cyclodextrin as the Solubility Enhancer. *J Agric Food Chem* 2002; 50:1815-1821.

⁴ Nabuy YMA. A Fluorometric Method for Measurement of Peroxyl Radical Scavenging Activities of Lipophilic Antioxidants. *Analytical Biochemistry* 1998; 265:290-298.

⁵ Huang D, Ou B, Hampsch-Woodill M, et al. High-Throughput Assay of Oxygen Radical Absorbance

Capacity (ORAC) Using a Multichannel Liquid Handling System Coupled with a Microplate Fluorescence Reader in 96-Well Format. *J Agric Food Chem* 2002; 50:4437-4444.

⁶ Prior RL, Hoang H, Gu L, et al. Assays for hydrophilic and lipophilic antioxidant capacity (oxygen radical absorbance capacity (ORAC_{FL})) of plasma and other biological and food samples. *J Agric Food Chem* 2003; 51:3273-3279.

⁷ Meilin L; Rolf W, Agneta W, Tom S. Mixed tocopherols have a stronger inhibitory effect on lipid peroxidation than alpha-tocopherol alone. *Journal of cardiovascular pharmacology* 2002; 39(5):714-21.

⁸ Li D, Saldeen T, Romeo F, Mehta JL. Different isoforms of tocopherols enhance nitric oxide synthase phosphorylation and inhibit human platelet aggregation and lipid peroxidation: implications in therapy with vitamin E. *Journal of cardiovascular pharmacology and therapeutics* 2001; 6(2):155-61.

⁹ Black TM, Wang P, Maeda N, Coleman RA. Palm tocotrienols protect ApoE +/- mice from diet-induced atheroma formation. *Journal of nutrition* 2000; 130(10):2420-6.

¹⁰ Kenichi M, Takamitsu T, Fengling P, et al. Vitamin E isoforms alpha-tocotrienol and gamma-tocopherol prevent cerebral infarction in mice.

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