

ABC's of E

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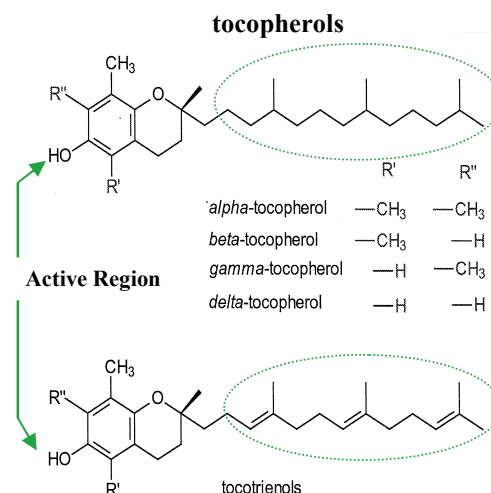
Understanding Vitamin E Chemistry & Physiology

Vitamin E may be the most difficult of all nutrients to understand. The difficulty arises from the vague biochemical role of vitamin E as well as the confusion resulting from many similar substances that are considered different forms of vitamin E.

Types of Natural Vitamin E

Scientists define vitamin E as any tocol with vitamin E activity. For supplement labeling, however, only alpha tocopherol (or tocopheryl) can be labeled vitamin E. Therefore, only one of the 8 naturally occurring vitamin E's (4 tocopherols and 4 tocotrienols as shown on the right) may be labeled as vitamin E. There are many more forms of synthetic vitamin E, commonly referred to as dl-alpha, which is a non-scientific terminology used to identify synthetic vitamin E. Natural alpha tocopherol is identified as d-alpha. The most natural form of commercially available vitamin E is the mixed tocopherols. However, all of the vitamin E content listed on the label of a mixed tocopherol product is from d-alpha tocopherol with an additional amount of beta, delta, and gamma tocopherols. The additional tocopherols do have some vitamin E activity, though less than alpha tocopherol. However, the vitamin E activity from those tocopherols are in addition to the vitamin E activity listed on the label. This is confusing, because the label does not really reflect the total vitamin E activity, but, by law, only the alpha tocopherol may be considered vitamin E for labeling purposes. In products containing tocotrienols, none of the tocotrienol content can contribute to the vitamin E listed on the label. The figure below shows the amount of biological vitamin E activity for various forms of vitamin E per mg.

Natural Vitamin E: The structural representations show the 8 forms of natural vitamin E. The circled region represents the difference between tocopherols and tocotrienols. "R" represents the common variable region on tocopherols and tocotrienols. For instance when both R groups are CH₃, the top molecule is alpha-tocopherol and the bottom molecule is alpha-tocotrienol.



Tocopherols in Vitamin E Supplements

Using the chart to the left, it can be calculated that a 1000 IU capsule of either d-alpha tocopherol or mixed tocopherol contains 671.14 mg of d-alpha tocopherol. However, mixed tocopherols contain additional d-beta, d-gamma, and d-delta tocopherols. The additional mixed tocopherols, above the d-alpha tocopherol, typically amount to about 5 mg in a 1000 mg capsule. Therefore the mixed tocopherol capsules and d-alpha tocopherol capsules have exactly the same d-alpha tocopherol content, but the mixed tocopherol products have a small amount of additional tocopherols. As can be seen in the chart on the following page, the tocopherols are the most common forms of vitamin E in the diet and gamma tocopherol is the most prevalent of the four tocopherols in most diets.

Despite the fact that most diets contain twice the amount of gamma as alpha tocopherol, there is a much greater concentration of alpha tocopherol in most tissues. The higher alpha concentration is the result of alpha tocopherol binding proteins that help conserve it while the gamma tocopherol is excreted.

Nevertheless, there are valuable functions for gamma tocopherol and it has been reported to be important for reducing the risk of several cancers as well as

Biological Activity of Various forms of Natural Vitamin E

Form of Vitamin E	Biological Activity Int. Units per mg.
d-alpha tocopherol	1.49
d-alpha tocopheryl acetate	1.36
d-alpha tocopheryl acid succinate	1.21
d-beta tocopherol	0.75*
d-gamma tocopherol	0.15*
d-delta tocopherol	0.05*

*Although these tocopherols have vitamin E activity, none can be listed on product labels.

Vitamin E Content of Common Food Oils (Mg of Vitamin E Per Kg of Oil)

Oil Type	Alpha-T	Beta -T	Gamma-T	Delta-T	Alpha-TT	Beta-TT	Gamma-TT	Delta-TT
Palm	89	—	18	—	128	323	72	630
Soy	100	8	1021	421	—	—	—	—
Corn	282	54	1034	54	49	8	161	6
Sunflower	670	27	11	1	—	—	—	—
Rapeseed	202	65	11	1	—	—	—	—
Wheat Germ	1179	398	493	118	24	165	—	—

* T represents tocopherol and TT represents tocotrienol.

working as a cyclooxygenase-2 (COX-2) inhibitor, an important anti-inflammatory property.

Despite the presence of some beneficial effects of gamma tocopherol, a high ratio of gamma to alpha tocopherol is associated with an increased risk of arthritis, according to some preliminary research from the University of North Carolina. Fortunately, even mixed tocopherol supplements have about a hundred fold higher concentration of alpha to gamma tocopherol. Therefore, obtaining most of the dietary vitamin E from supplements greatly favors a high alpha to gamma tocopherol intake whereas obtaining vitamin E from a typical Western diet favors a high gamma tocopherol intake. Based on current knowledge, the high percentage of alpha tocopherol as found in supplements is ideal.

The tocopheryl form of vitamin E is encountered in dry as opposed to oil based supplements. If you look at the pictures of vitamin E on the first page you will notice the OH— on the left side that is identified as the active region. In order to make a dry form of E, it is often esterified with a natural substance such as succinic acid. The OH group that was an alcohol (thus the ol on the end of tocopherol) becomes an ester and is designated as yl in the chemical nomenclature. The correct name after this has been done is d-alpha tocopheryl acid succinate. In the digestive tract the ester is hydrolyzed back to tocopherol and succinic acid, so that it is absorbed as a tocopherol. The esterification process has the advantage of making a vitamin E that does not need to be in a oil base, it can be in a vegetarian two piece capsule, and does not oxidize as rapidly. On the other hand, it does require extra processing and is not quite as natural, although it is obtained from natural sources.

All of the forms of vitamin E mentioned above are natural vitamin E, as opposed to the dl-alpha form which is chemically synthesized vitamin E.

Vitamin E is one of a few fat soluble anti-oxidants and is very important for that reason. Vitamin C is water soluble and may be found freely circulating in the blood. Vitamin E, on the other hand, is found circulating only as part of the lipoprotein molecules (LDL, HDL etc.). It is also incorporated into the lipid membranes of cells where it protects them from oxidative damage. Vitamin E is believed to be very important for protecting the heart and arteries from oxidation that can lead to coronary artery disease. It is also an important part of the cellular defense to protect against chemical and radiation induced mutations that lead to cancer. High quality natural vitamin E, as offered by Daily Manufacturing, is a vital part of any health program and is safe and effective for everyone.



**Daily Vitamin E Products
The Very Best!**

Functions of Vitamin E

- ⇒ Antioxidant
- ⇒ Immune Enhancer
- ⇒ Heart protector
- ⇒ Protects against bone loss
- ⇒ Reduces “bad cholesterol”
- ⇒ Protects the skin from sun and age related damage
- ⇒ Reduces arthritis symptoms
- ⇒ Protects eyes from sun or oxidative damage
- ⇒ May slow the progression of age-related dementia
- ⇒ Protects against heavy metal toxicity