Vitamin E - The Key to Antioxidant Health

What Vitamin E Does

Vitamin E may be the most well known dietary supplement there is. Its increasing popularity is due to an extensive amount of clinical research. Research demonstrates vitamin E may dramatically reduce the risk and incidence of heart disease. According the Journal of the American Medical Association, vitamin E supplements can actually slow the progression of heart disease.

Experts recommend supplementing with vitamin E because it is so difficult to consume the amount necessary to provide protective effects. The typical dosage is between 400 IU and 800 IU per day. To consume this amount from the diet, one would have to eat five cups of almonds or ten cups of wheat germ per day.

Antioxidant Protection

Vitamin E plays a very special role in the body as a "protector". What does it protect the body from? Damage caused by "free radicals". Free radicals are a silent unseen enemy that invades and attacks our bodies, contributing to aging, the risk of cancer, and heart disease. Oxygen molecules with "attitude", free radicals wreak havoc on the body through the negative charge they carry. With the help of antioxidants, this negative charge is neutralized, diminishing the destructive power of free radicals. Vitamin E is the body's primary antioxidant. Others include vitamin C, beta carotene, and selenium.

The Role of Supplements

The average diet usually does not supply adequate vitamin E necessary for maximum prevention, therefore supplements are often warranted. Because there are several different types of vitamin E supplements, it is important to understand the terms used when discussing this nutrient.

Alpha-Tocopherol

The most important consideration to make when choosing a vitamin E supplement is to choose the 100% natural form, d-alpha tocopherol, because our bodies use this form most efficiently. Other varieties such as beta, gamma, and delta tocopherols (often called "mixed" tocopherols) exist in nature along with alpha tocopherol.

d versus dl: Natural versus Synthetic

Unlike many vitamins whose synthetic form is "nature identical", synthetic vitamin E is not the same as natural vitamin E and has lower biological activity. Here's why: vitamin E can be either d-alpha tocopherol or dl-alpha tocopherol. The form that exists in our food and the form that our bodies need is the d form: d-alpha tocopherol.

Synthetic vitamin E is dl-alpha tocopherol and is not as biologically active. In fact, studies have indicated that synthetic vitamin E does not stay in the body nearly as long as natural vitamin E, making it much less effective. Be sure to take only the 100% natural form of vitamin E, d-alpha tocopherol. All of our products contain only the natural form of vitamin E

Acetate & Succinates

Vitamin E in its "raw" state (d-alpha tocopherol) is in oil form. The oil form is "esterified" with acetate to better stabilize the vitamin E, maintaining its potency. In order to put it into tablets and hard gelatin capsules, it can be made into a dry form or esterified, using succinate, a carrier that is a compound naturally found in our bodies. This simply means that a natural "carrier", acetate or succinate, is added onto the vitamin E. When the nutrient is ingested, the carrier is removed and it goes back to d-alpha tocopherol in your body.

Water Dispersible Vitamin E

Water dispersible dry vitamin E is vegetarian, in a vegetable capsule and is esterified using succinate. This form of delivery offers an alternative to vegetarians who would like to supplement with vitamin E.

These esterified forms of vitamin E are written as d-alpha tocopheryl acetate (the oil form) or d-alpha tocopheryl succinate (the dry form). Acetate in the softgel and succinate in dry form hard gel protect the vitamin E from potency loss until it gets into your system where it is then converted back into d-alpha tocopherol. Using a carrier also helps us to meet our best-by date labeling requirements, which ensures that you are getting all the good nutrition that the label states.

Remember, esterified vitamin E is still natural as long as you see the "d" in front of the name versus "dl." It is d versus dl that determines whether it is natural or synthetic, not the carrier.

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A summary of what is known about vitamin E (alpha-tocopherol)

Alpha-tocopherol: The Great Protector

by Hans R. Larsen, MSc ChE

Research carried out in universities, hospitals, and laboratories around the world has now provided conclusive evidence that alpha-tocopherol, better known as vitamin-E, is absolutely crucial to human health. Moreover, it has been clearly established that the amount of vitamin E present in even the most carefully selected diet is totally inadequate to meet the requirement for this vitamin.

The recognition that vitamin-E supplementation is essential is a radical departure from the previous stand of the medical/scientific community that very little, perhaps 10-30 milligram/day, of vitamin E is needed and that this amount can be supplied through the normal diet.

Vitamin E however, is not merely a vitamin. The most active component of the vitamin E complex is alpha-tocopherol and this organic substance is the most powerful antioxidant in the lipid (fat) phase of the human body (1,2). So alpha-tocopherol has two functions: it acts as a vitamin (vitamin E) and it acts as an essential antioxidant. It is this function as an antioxidant and its crucial importance which the mainstream scientific community has so belatedly come to realize.

Vitamin E can not be synthesized by the body and must therefore be supplied in the diet or through supplementation. It is only stored in the bodyor a relatively short time and must be replenished on a regular basis. Unlike the other fat-soluble vitamins, A,D, and K, which are stored in the liver, vitamin E is stored throughout the body in the lipid phase. This fact is of crucial importance in the utilization of alpha-tocopherol to modify metabolic reactions.

Human metabolism is aerobic, that is, it depends on oxygen for sustenance. This has many advantages, but also creates some problems. One of the very major problems is that oxygen has a pronounced tendency to create free radicals - dangerous and highly reactive molecules which are now recognized as being the culprits in a large array of debilitating and deadly diseases.

Antioxidants have long been used to prevent and break up free-radical induced chain reactions and are used extensively for that purpose in plastics, rubbers, gasoline, motor oils, and indeed in many, many foodstuffs. As a matter of fact, unsaturated fatty acids occuring in nature almost always contains alpha-tocopherol which protects them from going rancid. In the body, alpha-tocopherol acts very effectively to deactivate free radicals and stops chain reactions before they can run away (1). In contrast to the action of alpha-tocopherol as a vitamin it is actually consumed, sometimes quite extensively, in its role as antioxidant.

The extremely critical role of alpha-tocopherol in protecting against free- radical reactions becomes apparent when considering the vast number of diseases and conditions thought to be caused by these reactions (3,4). Among them are:

- Aging
- Many types of cancer
- Atherosclerosis and other circulatory diseases
- Arthritis
- Cataract formation
- Senile dementia (Alzheimer type)
- Respiratory diseases induced by pollution

Free-radical diseases are almost all diseases with a very long "incubation period". It is not uncommon for these diseases to show up only after 20 or more years of accumulated free-radical damage. This of course makes it very difficult and in many cases unethical, to perform experiments on humans in order to establish the benefits of alpha-tocopherol in combatting these diseases. Nevertheless, recent medical literature provides a wealth of examples of the efficacy of alpha-tocopherol in preventing or arresting free- radical induced diseases.

Aging is thought to be caused by a decline in the functioning of the immune system as well as by lipid peroxidation leading to undesirable crosslinking and damage to DNA (3). Daily supplementation with vitamins E and C has been shown to lower lipid peroxide concentration in humans (5). Daily supplementation with vitamin E (400 IU/day) was also shown to increase the T-cell mediated immune responses in healthy, elderly people (6).

Recent studies have shown that a low vitamin E concentration in human blood is associated with an overall increased risk for many **cancers** including breast and lung cancer (7,8,9). There is definite proof that alpha-tocopherol prevents the formation of cancer-promoting nitrosamines in the stomach (5,8). There is also some indication that an increased intake of vitamin E by smokers (experimental dosage: 1000 mg/day of alpha-tocopheryl acetate) can decrease their risk of developing cancer and heart disease (10).

Atherosclerosis is a common form of **heart disease**. It is characterized by fatty deposits on the walls of the arteries. Cholesterol and low density lipoproteins (LDP) are known to be heavily implicated in the build-up of the fatty deposits. Recent research has confirmed that high blood levels of LDP's accelerate atherosclerosis. It has also been shown that the LDP's are oxidized before they attach to the artery wall and that this oxidation can be slowed down by the use of antioxidants (11,12).

Alpha-tocopherol has been shown to improve the capacity of the blood to carry oxygen, to prevent and dissolve blood clots and is effective in preventing scar formation (13,14). Other research confirmed that daily supplementation with 400 IU of vitamin E results in a significant reduction in blood platelet adhesion in healthy adults (5). Vitamin E has also been found effective in treating varicose veins and thrombophlebitis (14).

Animal studies have shown that alpha-tocopherol can alleviate **arthritis** symptoms (15). Studies involving humans suffering from osteoarthritis have shown that supplementatiom with vitamin E is effective in relieving pain associated with this disease (15).

Cataracts are a very major health problem in North America. It is estimated that 45% of men and 48% of women over 75 suffer from cataracts. The disease is caused by long term accumulation of free radical damage. A recent study suggests that the risk of getting cataracts may be reduced by more than 50% through supplementation with vitamins C and E (600 and 400 IU/day respectively) (16).

The list of known benefits of alpha-tocopherol in the fight against free- radical induced diseases goes on and on. The evidence is overwhelming that vitamin E is an extremely critical factor in human health. However, it is equally clear that a normal or even carefully selected diet is totally inadequate to provide the needed quantities of the vitamin/antioxidant.

Nutrition-oriented medical doctors are reaching a consensus as to how much alpha-tocopherol is required for a healthy person eating an average diet. The magic number is 400 IU/day which is considered a basic amount (17,18). The optimum intake for an individual depends on many factors including the intake of polyunsaturated fatty acids and the degree of exposure to air pollution and toxic chemicals. Higher dosages may be indicated for women suffering from premenstrual or menopausal problems, for smokers, for people engaging in heavy, out-door exercise, and for people having a family history of cancer (18). Interestingly enough, the intake of fish oils or a large consumption of fish has been shown to increase the requirement for vitamin E quite significantly (19).

Large, well-controlled studies of vitamin E supplementation have shown the vitamin to be non-toxic in intakes as high as 3200 IU/day (20). However, most researchers caution against daily intakes higher than 800-1200 IU/day for extended periods (13,17,18). It is also recommended that the progression to a daily dose of 400 IU be gradual as should any decrease in intake.

There are some cases in which high dosages (more than 30 IU/day) of vitamin E are contraindicated. Medical advice concerning dosage should be sought by individuals having high blood pressure, those taking anticoagulant drugs (Coumadin, warfarin) or having a tendency to prolonged bleeding, those having a vitamin K deficiency and those suffering from rheumatic heart disease, an overactive thyroid, or diabetes (13,18).

Inorganic iron (ferrous sulphate) destroys vitamin E and birth control pills deactivate it to some degree. So vitamin E should be taken with the main meal (to optimize absorption) and at least six hours before or after taking an iron supplement or a multivitamin/mineral tablet or a birth control pill.

Natural vitamin E comes in two forms: d-alpha-tocopherol (100 mg=149 IU) and d-alpha-tocopheryl acetate (100 mg=136 IU). The "d" designation in front of the "alpha" indicates that the products are derived from natural sources such as vegetable oils or wheat germ. A prefix of "dl", such as in dl-alpha- tocopherol, shows that the vitamin has been synthesized from a petroleum base. Recent research has shown d-alpha-tocopherol and d-alpha-tocopheryl acetate to be equally effective on an International Unit basis (21). Synthetic alpha- tocopherol acetate however, has been found to be considerably less effective than its natural equivalent in raising the blood plasma level of vitamin E and in preventing peroxide hemolysis even when ingested at equivalent IU levels (22).

Vitamin E is quite clearly a prime example of a vitamin/antioxidant which is present in the diet in an amount insufficient to sustain health. To obtain a daily dosage of vitamin E equivalent to 400 IU it would be necessary to consume 200 cups of brown rice, 10 cups of almonds, 80 cups of cooked spinach, or 12 tablespoonfuls of unrefined, fresh wheat germ oil - clearly not a viable alternative.

Perhaps the most telling evidence of the metamorphosis of vitamin E from ugly duckling to reigning swan of nutrition can be found in the fact that an eminent scientist who in 1974 supported the contention that an alpha- tocopherol intake of 10-30 mg/day would be adequate for an adult publicly stated in 1991 that he was himself taking 400 IU of vitamin E every second day (22,23). To quote: "... The knowledge that undesirable products of lipid peroxidation in human tissues can be decreased by taking vitamin E have persuaded me to personally take a 269 mg supplement of d-alpha-tocopherol every other day (23)."

REFERENCES

1. Burton, G.W., and Ingold, K.U. (1989) Vitamin E as an in Vitro and in Vivo Antioxidant. Ann. N.Y. Acad. Sci. 570: 7-22
2. Niki, Etsuo, et al. (1989) Inhibition of Oxidation of Biomembranes by Tocopherol. Ann. N.Y. Acad. Sci. 570: 23-31
3. Ames, B.N. (1983) Dietary Carcinogens and Anticarcinogens. Science 221:1256-64

4. Cross, C.E. et al. (1987) Oxygen Radicals and Human Disease. Ann. Intern. Med. 107:526-45
5. Packer, L. (1991) Protective Role of vitamin E in biological systems. Am. J. Clin. Nutr. 53:1050S-55S
6. Meydani, S.N., et al. (1989) Effect of Vitamin E Supplementation on Immune Immune Responsiveness of the Aged. Ann. N.Y. Acad. Sci. 570: 283- 90
7. Wang, Yeu-Ming, et al. (1989) Vitamin E and Cancer Prevention in an Animal Model. Ann. N.Y. Acad. Sci. 570: 383-91
8. Stahelin, H.B, et al. (1989) Cancer Mortality and Vitamin E Status. Ann. N.Y. Acad. Sci. 570: 391-99
9. Menkes, M.S., et al. (1986) Serum Beta-carotene, Vitamins A and E, Selenium, and the Risk of Lung Cancer. N. Engl. J. Med. 315: 1250-54
10. Duthie, G.G., et al. (1989) Antioxidant Status of Smokers and Nonsmokers. Ann. N.Y. Acad. Sci. 570: 435-38
11. Steinberg, Daniel, et al. (1989) Beyond Cholesterol. N. Engl. J. Med. 320: 915-24
12. Sevanian, Alex and McLeod, L.L. (1987) Cholesterol Autooxidation in Phospholipid Membrane Bilayers. LIPIDS 22: 627-36
13. Mindell, Earl (1981) Earl Mindell's Vitamin Bible, pp. 73-75. Warner Books, New York, NY
14. Shute, Evan (1959) The Current Status of Alpha Tocopherol in Cardiovascular Disease. In Vitamin E - Your Key to a Healthy Heart by Herbert Bailey. ARC Books, New York, NY
15. Packer, L. and Landvik S. (1989) Vitamin E: Introduction to Biochemistry and Health Benefits. Ann. N.Y. Acad. Sci. 570: 1-6
16. Robertson, J.M. et al. (1989) Vitamin E Intake and Risk of Cataracts in Humans. Ann. N.Y. Acad. Sci. 570: 372-82
17. Berger, S.M. (1988) How To Be Your Own Nutritionist, page 192. Avon Books, New York.,NY
18. Giller, M.G. and Matthews, K. (1986) Medical Makeover, page 162. Beech Tree Books (William Morrow) New York, NY
19. Horwitt, M.K. (1986) Interpretations of requirements for thiamin, riboflavin, niacin-tryptophan, and vitamin E plus comments on balance studies and vitamin B-6. Am. J. Clin. Nutr. 44:973-85
20. Bendich, A. and Machlin, L.J. (1988) Safety of oral intake of vitamin E. Am. J. Clin. Nutr. 48: 612-19
21. Burton, G.W. et al. (1988) Comparison of Free Alpha-tocopherol and Alpha- tocopheryl Acetate as Sources of Vitamin E in Rats and Humans. LIPIDS 23: 834-40
22. Horwitt, M.K. (1974) Status of human requirements for vitamin E. Am. J. Clin. Nutr. 27: 1182-93
23. Horwitt, M.K. (1991) Data Supporting Supplementation of Humans With Vitamin E. The Journal of Nutrition 121: 424-29

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REPORT

What Makes Gamma Tocopherol Superior to Alpha Tocopherol

By Lyle MacWilliam, MSc, FP

While the alpha tocopherol form of vitamin E has long been valued as a potent antioxidant, its little-known cousin, gamma tocopherol, may be equally important in promoting health and protecting against disease. Found in nuts, seeds, and vegetable oils, gamma tocopherol accounts for about 70% of the vitamin E in the North American diet, (#but in its processed oxidised form which makes them unavailable).

Unlike alpha tocopherol, (#natural) gamma tocopherol is a potent defender against disease-provoking compounds in the body known as reactive nitrogen oxides. Furthermore, gamma tocopherol has been found to reduce inflammation,[1] regulate factors that guard against certain cancers,[2-5] and activate genes involved in protecting against Alzheimer's disease.[6,7]

The latest research should compel all health-conscious adults to take a closer look at gamma tocopherol, a previously underestimated member of the vitamin E family.

BEYOND ALPHA TOCOPHEROL

Regular consumption of natural vitamin E has long been purported to lower the risk of degenerative disease. Laboratory evidence and data from epidemiological and retrospective studies show that abundant dietary intake of vitamin E can help ward off heart disease[8-11] and keep several cancers at bay.[12-14] While many published studies examine the effects of the alpha tocopherol form of vitamin E, scientists increasingly are turning their attention to gamma tocopherol.

Gamma tocopherol has distinctive chemical properties that differentiate it from alpha tocopherol and may explain the observed differences in the biological effects of these two forms of vitamin E. One of these differences makes gamma tocopherol a more effective trap for reactive nitrogen oxides,[15,16] toxic compounds that must be removed from the body. As recent studies have shown, the accumulation of reactive nitrogen oxides in body tissues undoubtedly plays a central role in the etiology of several degenerative diseases.[1]

TRAPPING REACTIVE NITROGEN OXIDES

Two particularly damaging free radicals are nitrogen dioxide and peroxynitrite. Nitrogen dioxide is a mutagenic metabolite and a major constituent of vehicle exhaust and cigarette smoke.[17-19] Peroxynitrite is a dangerous oxidant created in activated phagocytes, which are a type of white blood cell.[16,20,21] The formation of these toxic compounds is an integral part of the inflammation process, and their stable end products have been detected in both animals and humans with chronic inflammation.[22] Inflammation induced by activated phagocytes is a major contributor to the development of cancer, cardiovascular disease, and several neurodegenerative disorders.[23,24]

Gamma tocopherol plays a pivotal role in quenching this type of inflammation.[22] In a landmark study at the University of California, Berkeley, researchers established that alpha tocopherol and gamma tocopherol exhibit dramatically different anti-inflammatory activities.[16] Despite alpha tocopherol's superior antioxidant abilities, gamma tocopherol is required to remove peroxynitrite and other nitrogen- containing toxins that are responsible for initiating the inflammatory response. Acting through a mechanism unavailable to alpha tocopherol, gamma tocopherol reacts with and removes these harmful reactive nitrogen oxides, thereby helping to subdue the inflammatory cascade.

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The Berkeley findings support previous studies that demonstrate gamma tocopherol's superior ability to neutralize reactive nitrogen oxides.[25,26] This has led researchers to conclude that gamma tocopherol plays a vital complementary and synergistic role to its alpha counterpart in the prevention of inflammatory diseases.[22] These findings also explain why studies using only high doses of alpha tocopherol often fail to produce significant clinical benefits.

INHIBITING OTHER INFLAMMATORY EVENTS

Gamma tocopherol and its major metabolite can also reduce inflammation by inhibiting the cyclooxygenase-2 enzyme. Cyclo-oxygenase-2 is central to inflammatory processes and associated diseases such as cancer and vascular disease. Gamma tocopherol's ability to block the production of this inflammatory mediator is not shared by alpha tocopherol.[27,28]

Preliminary evidence shows that gamma tocopherol may help protect against the onset of type I diabetes. Gamma tocopherol is more effective than its alpha analog in protecting pancreatic cells from the damaging effects of interleukin 1-beta. This inflammation-signaling protein is secreted by macrophages (specialized white blood cells responsible for the destruction of pathogens) activated by exposure to reactive nitrogen oxides.[29]

In a study of mammals, administration of gamma tocopherol reduced several powerful inflammatory mediators, including leukotriene B4 and tumor necrosis factor-alpha. The study investigators noted that this provides evidence that gamma tocopherol exerts anti-inflammatory activity in vivo (within the body) that may have important implications for human disease prevention and treatment.[30]

COMPLEMENTARY ANTIOXIDANT EFFECTS

According to conventional wisdom concerning vitamin E, alpha tocopherol is the premier antioxidant in the tocopherol family. Recently, however, several investigators have reported that the relative antioxidant potentials of alpha and gamma tocopherol vary considerably.[1,31]

Both forms of vitamin E are known to inhibit the formation of destructive superoxide radicals and reduce the oxidation of fats and low-density lipoproteins in the blood—all risk factors for cardiovascular disease. Surprisingly, researchers at the University of Uppsala in Sweden found that gamma tocopherol was even more effective than alpha tocopherol in reducing several pro-thrombotic (contributing to clot formation) events associated with such forms of oxidative stress.[32]

THE EIGHT FORMS OF VITAMIN E

Discovered in 1922, vitamin E is not a single compound, but rather an entire family of compounds with eight structurally related forms, or isomers. The eight isomers are made up of four tocopherols (alpha, beta, gamma, and delta tocopherol) and four tocotrienols, also known by their alpha, beta, gamma, and delta forms. The distinct structures of these tocopherols and tocotrienols confer unique chemical characteristics to each of the eight forms of vitamin E. While all forms of vitamin E are potent membrane-soluble antioxidants, only two—alpha tocopherol and gamma tocopherol—are predominant in nature.

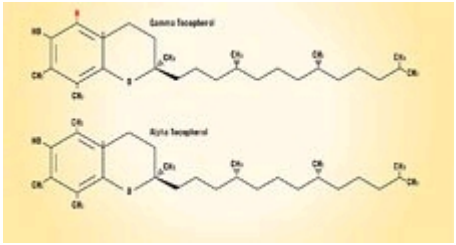
Humans and other animal species cannot synthesize their own vitamin E and therefore must acquire this nutrient from plants, which are the only organisms capable of manufacturing it.

Similarly, supplementation studies show that the combination of gamma tocopherol and alpha tocopherol can afford better protection against DNA damage than alpha tocopherol alone.[33] Moreover, University of Arkansas researchers discovered that a mixture of tocopherols is superior to alpha tocopherol in reducing oxidative damage in cultured muscle tissue. The authors propose that the lack of efficacy of commercial vitamin E supplements reported in clinical trials may reflect an absence of the gamma and delta tocopherol forms.[34]

Finally, a European study reveals that both gamma tocopherol and the ratio of gamma tocopherol to alpha tocopherol are important nutritional markers related to the antioxidant and protective benefits of the traditional Mediterranean diet.[13] The Mediterranean diet has been associated with greater longevity and a lower prevalence of many age-related diseases.

PROTECTING AGAINST CARDIOVASCULAR DISEASE

The alpha form of vitamin E decreases oxidative damage to the arterial lining, reduces dangerous aggregation and clumping of blood cells, delays clot formation,[32] and enhances the activity of a known vascular dilator. It also inhibits smooth muscle proliferation (involved in the plaque-forming process),[11] improves the stability of fatty plaques, enhances the function of cells lining the arteries, regulates vascular tone, and fights inflammation.[35] Despite these impressive preliminary findings, however, clinical trials of alpha tocopherol alone have yielded mixed results concerning its cardioprotective effects.



Molecular Structure of Gamma Tocopherol and Alpha Tocopherol

The answer to this mystery may reside in the previously undiscovered benefits of gamma tocopherol and other forms of vitamin E. Since high-dose alpha tocopherol supplementation dramatically reduces gamma tocopherol levels, alpha tocopherol's benefits may be overshadowed by the adverse effects of diminished gamma tocopherol levels.[36-38]

Although less is known about gamma tocopherol than about alpha tocopherol, recent evidence suggests that the gamma form is an important weapon in defending against cardiovascular disease. Several investigations confirm that higher tissue concentrations of gamma tocopherol are associated with lower rates of illness and death due to cardiovascular events.[28]

In fact, several studies show that patients with advanced cardiovascular disease exhibit normal plasma levels of alpha tocopherol but have substantially lower levels of gamma tocopherol.[39-41] In a seven-year follow-up study of more than 334,000 postmenopausal women with no previous heart disease, greater intake of dietary vitamin E—consisting predominantly of gamma tocopherol—was strongly associated with a lower risk of death from cardiovascular disease. The data did not appear to demonstrate a similarly protective role for supplemental alpha tocopherol.[8]

Numerous animal studies likewise suggest that gamma tocopherol may provide powerful protection for the heart. In laboratory rats, supplementation with gamma tocopherol reduced platelet aggregation and clot formation even more effectively than alpha tocopherol.[32] In addition, gamma tocopherol at physiological doses was more effective than alpha tocopherol in enhancing the activity of superoxide dismutase (SOD), an antioxidant enzyme that may help reduce the risk of cardiac events.[42]

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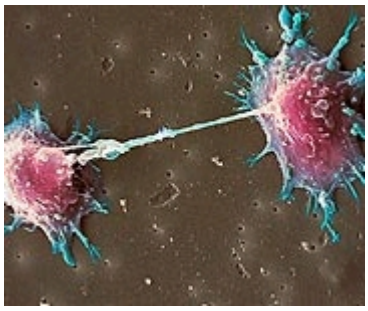
GAMMA'S CANCER-PREVENTIVE PROPERTIES

While human and animal prevention trials are lacking, several studies support gamma tocopherol's potential role in cancer prevention, having demonstrated that it inhibits cancer cell growth even more effectively than alpha tocopherol.[43] Gamma tocopherol's actions appear multifactorial, and include the ability to:

- destroy reactive nitrogen species[1,16]
- prevent the formation of mutagens (DNA-damaging agents) in the colon[2]
- induce apoptosis (programmed cell death) in cancerous cell lines[4,5]
- regulate the expression of genetic factors that can influence cancerous growth.[44-46]

Colorectal cancer. As the second most common cause of cancer death in North America, colorectal cancer is a silent but deadly enemy. Gamma tocopherol may play an important role in arresting its development.



Prostate cancer cell division. Colored scanning electron micrograph of two prostate cancer cells in the final stage of cell division (cytokinesis).

While both gamma and alpha tocopherol appear to act as gene regulators,[44] recent epidemiological and experimental evidence suggests that gamma tocopherol may be a more potent chemopreventive agent than alpha tocopherol against this disease.[45] New evidence from tissue culture studies shows that both tocopherols, and gamma tocopherol in particular, can shield colon cells through a mechanism that enhances the expression of genetic factors that protect against cancerous growth. Scientists suggest that these findings hold relevance not only for cancer prevention, but also for the management of diabetes, inflammatory disorders, and cardiovascular disease.[46]

The ratio of gamma tocopherol to alpha tocopherol appears higher in the bowel than in the blood,[47,48] which may explain gamma tocopherol's protective effect against colorectal cancer. Gamma tocopherol may help prevent colon cancer by inhibiting the formation of mutagens arising from the oxidation of fecal lipids, as well as by diminishing oxidative stress in the cells lining the colon.[24,45,49]

Prostate cancer. Both alpha tocopherol and gamma tocopherol may guard against prostate cancer.[3-5] Gamma tocopherol effectively inhibits cell proliferation and DNA synthesis in colon and prostate cancer cells.[50] In one study, researchers found that gamma tocopherol—but not alpha tocopherol—induced apoptosis (programmed cell death) in both prostate and lung cancer cells.[50] Similar effects have been observed with gamma-tocopheryl quinone, a metabolite of gamma tocopherol that demonstrates powerful chemotherapeutic and cell-killing properties in human leukemia cells.[51]

One study revealed an intriguing association between prostate cancer and plasma and toenail concentrations of alpha tocopherol, gamma tocopherol, and selenium. Men with the highest concentrations of gamma tocopherol had a fivefold lower risk of developing prostate cancer than men with the lowest levels. Moreover, the protective effect observed for high levels of selenium and alpha tocopherol was observed only when gamma tocopherol levels were also high, leading the authors to recommend the use of mixed tocopherol supplements in future prevention trials.[52]

Other cancers. Blood levels of both alpha tocopherol and gamma tocopherol appear to be substantially lower in women at risk for cervical cancer.[53] In addition, epidemiological evidence indicates that women who consume the most dietary vitamin E (which consists primarily of gamma tocopherol) have a 60% lower risk of breast cancer than women with low dietary vitamin E intake.[12] Finally, gamma tocopheryl quinine, the gamma tocopherol metabolite, has been found to kill leukemia and breast cancer cells in the laboratory.[51,54]

GAMMA MAY GUARD AGAINST DEMENTIA

Some of the most promising protective benefits of gamma tocopherol involve Alzheimer's disease. Scientists believe that oxidative stress and inflammation are major contributing factors in the development of Alzheimer's, and that reactive nitrogen oxides play a role in the disease process. The results of one study suggest that gamma tocopherol offers greater protection than alpha tocopherol in subduing oxidative stress in the brain related to reactive nitrogen oxides, thus helping to protect the brain against

inflammatory processes related to Alzheimer'disease.[55]

GAMMA TOCOPHEROL EXCLUDED FROM DIETARY REFERENCE INTAKES

Until recently, scant attention has been paid to the biological importance of gamma tocopherol and the other tocopherol forms. In fact, they are not even included in the new dietary reference intakes recently established by the US Food and Nutrition Board.

Under the current dietary reference intake definition for vitamin E activity, the daily intake requirement can be met only with alpha tocopherol. This is not the case in the European Union, where gamma tocopherol is considered an integral component of the nutrient-based recommendations in many EU member countries.

The US Food and Nutrition Board's decision has failed to consider the cumulative results of more than three decades of research, which consistently point to a unique nutritional role for gamma tocopherol. This underestimated nutrient—the most prevalent form of vitamin E in nature—may contribute significantly to human health in ways yet fully recognized.

British researchers recently found that dietary vitamin E, mainly comprising gamma tocopherol, strongly affects the expression of an array of genes involved in the clearance of amyloid beta proteins.[7] The accumulation of amyloid beta plaques is a hallmark of the oxidation and inflammation that occurs in the brains of Alzheimer's sufferers. Fighting beta amyloid tangles is believed to be essential in slowing the progression of this incapacitating disease.

Moreover, vitamin E appears to help regulate other genes associated with nerve growth, the transmission of nerve signals, and the clearance of advanced glycation end products, which are pro-inflammatory sugar-protein complexes that result from oxidative damage to biological molecules.[7] Such evidence of vitamin E's role as a gene regulator indicates an important protective role for dietary vitamin E against the progression of Alzheimer's disease.

Alpha tocopherol, more so than gamma tocopherol, suppresses the degeneration of neurons caused by oxidative stress.[56] This has led some researchers to dismiss gamma tocopherol's importance in protecting against neurodegenerative decline. However, research conducted in 2005 provides strong evidence that gamma tocopherol may play just such a protective role. The study authors found that increased consumption of a mixture of tocopherols from food, rather than alpha tocopherol alone, was associated with a lower risk of Alzheimer's-related cognitive decline.6 Their findings are consistent with several other recent studies that validate vitamin E's importance in preventing the onset of Alzheimer's disease.[7,57-59]

THE FUTURE OF VITAMIN E SUPPLEMENTATION

As recent investigations show, gamma tocopherol is quickly gaining recognition within the medical research community and is emerging as an important partner to alpha tocopherol in the science of preventive health.

While both forms of vitamin E have disease-preventive actions that reflect their individual chemistries, it is their combination that likely accounts for the powerful preventive effects observed in epidemiological, retrospective, and laboratory studies. Consequently, to highlight one form and exclude the other is to sell both forms short. We may soon find that the other tocopherol forms of vitamin E pack even more preventive punch in ways not yet revealed.

STUDY FLAWS FUEL VITAMIN E CONTROVERSY

Life Extension members and other health-conscious adults have expressed concern about recent headlines that question the safety and effectiveness of vitamin E supplements. In fact, findings from several clinical trials of alpha tocopherol have been ambiguous, failing to show consistent results due to the way the trials were structured and conducted.[60-64]

For example, a recent meta-analysis of seven clinical trials of antioxidant vitamins concluded that the data do not support the use of vitamin E supplements for preventing heart disease.[65] Likewise, a number of large prospective studies examining vitamin E's cancer-preventive effects have produced inconsistent results.[14]

Several plausible explanations may account for this ambiguity. At a recent conference on vitamin E and health sponsored by the New York Academy of Sciences, researchers noted that the various clinical trials of vitamin E differed markedly in ways that contribute to the inconsistent findings.[14] For one thing, many of the studies focused on supplementation with vitamin E alone rather than with a broad spectrum of antioxidants. It is well known that nutrients work best when they work synergistically; consequently, the inconsistent findings may simply reflect the fact that no single nutrient is a "magic bullet."

In addition, many of the clinical studies involved elderly adults who were seriously ill, rather than healthy individuals. The results

of such studies would not, therefore, reflect the preventive nature of nutritional supplementation. Moreover, virtually all of the clinical trials used alpha tocopherol, the primary form of vitamin E in dietary supplements, and most used synthetic vitamin E—which is known to cause adverse effects at high dosage—rather than the mixed tocopherols found in natural dietary sources.[46] According to researchers at Johns Hopkins, the benefits of alpha tocopherol may in fact be compromised by a decrease in the levels of gamma and other tocopherols that is known to occur with high-dose alpha tocopherol supplementation.[36]

To explain these inconsistencies, scientists are now looking beyond alpha tocopherol to other forms of vitamin E, particularly gamma tocopherol. To date, relatively few clinical studies have examined gamma tocopherol's role in the context of prevention. Those few, however, concur that gamma tocopherol may be every bit as important as alpha tocopherol in preventing chronic diseases.[25,39] These findings may prelude a paradigm shift in scientific thinking on vitamin E.

Nevertheless, it is important to keep in mind that most research to date consists of laboratory studies and that further human clinical trials are needed to reveal the true powers of gamma tocopherol and other forms of vitamin E. Researchers have called for such trials to employ a mixture of tocopherols that better reflects the ratio found in the diet. Others urge a review of international dietary standards that to date have considered only the alpha tocopherol form.

Given the widespread popularity of vitamin E supplementation, the potential public health implications of using mixed tocopherols are immense. According to Dr. Kenneth Hensley of the Oklahoma Medical Research Foundation, recent findings may signal a major paradigm shift in free radical biology and medicine, and argue for a thorough reappraisal of the role of gamma tocopherol and other tocopherol forms, especially within the context of cardiovascular disease and cancer biology.[66]

Dr. Stephan Christen of the University of California, Berkeley, contends that consumers taking vitamin E supplements containing an imbalance of the two principal forms of vitamin E are depriving themselves of the protective value afforded by a mixture of tocopherols. His views are based on joint investigations by US and Australian researchers that confirm previous findings—namely, that gamma tocopherol possesses distinctive and protective biochemical properties not seen in alpha tocopherol, and plays an equally important but complementary role in limiting cell damage and disarming toxic metabolites.[26] Accordingly, he and other scientists contend that vitamin E supplements should contain a ratio of alpha tocopherol to gamma tocopherol that is closer to what is found in nature.

In the meantime, consumers of dietary supplements committed to optimal nutrition should seriously consider the inclusion of mixed tocopherols in their daily regimens. Johns Hopkins scientists initially recommended that at least 20% of supplemental vitamin E be in the form of gamma tocopherol,[52] while researchers at Berkeley just this year have proposed a 50-50 blend of alpha tocopherol and gamma tocopherol.[67] For optimal supplementation, it would appear logical to consume at least 200 mg of gamma tocopherol each day, in addition to around 400 IU of alpha tocopherol.

Editor's note: *Individuals who use the medication warfarin (Coumadin®) or have a history of bleeding disorder or hemorrhagic stroke should consult a physician before supplementing with vitamin E.*

References

1. Wagner KH, Kamal-Eldin A, Elmadfa I. Gamma-tocopherol—an underestimated vitamin? Ann Nutr Metab. 2004;48(3):169-88.

2. Stone WL, Krishnan K, Campbell SE, et al. Tocopherols and the treatment of colon cancer. Ann NY Acad Sci. 2004 Dec;1031:223-33.

3. Weinstein SJ, Wright ME, Pietinen P, et al. Serum alpha-tocopherol and gamma-tocopherol in relation to prostate cancer risk in a prospective study. J Natl Cancer Inst. 2005 Mar 2;97(5):396-9.

4. Jiang Q, Wong J, Ames BN. Gamma-tocopherol induces apoptosis in androgen-responsive LNCaP prostate cancer cells via caspase-dependent and independent mechanisms. Ann NY Acad Sci. 2004 Dec;1031:399-400.

5. Jiang Q, Wong J, Fyrst H, Saba JD, Ames BN. gamma-Tocopherol or combinations of vitamin E forms induce cell death in human prostate cancer cells by interrupting sphingolipid synthesis. Proc Natl Acad Sci USA. 2004 Dec 21;101(51):17825-30.

6. Morris MC, Evans DA, Tangney CC, et al. Relation of the tocopherol forms to incident Alzheimer disease and to cognitive change. Am J Clin Nutr. 2005 Feb;81(2):508-14.

7. Rota C, Rimbach G, Minihane AM, Stoecklin E, Barella L. Dietary vitamin E modulates differential gene expression in the rat

hippocampus: potential implications for its neuroprotective properties. Nutr Neurosci. 2005 Feb;8(1):21-9.

8. Kushi LH, Folsom AR, Prineas RJ, et al. Dietary antioxidant vitamins and death from coronary heart disease in postmenopausal women. N Engl J Med. 1996 May 2;334(18):1156-62.

9. Yochum LA, Folsom AR, Kushi LH. Intake of antioxidant vitamins and risk of death from stroke in postmenopausal women. Am J Clin Nutr. 2000 Aug;72(2):476-83.

10. Stampfer MJ, Hennekens CH, Manson JE, et al. Vitamin E consumption and the risk of coronary disease in women. N Engl J Med. 1993 May 20;328(20):1444-9.

11. Keaney JF, Jr., Simon DI, Freedman JE. Vitamin E and vascular homeostasis: implications for atherosclerosis. FASEB J. 1999 Jun;13(9):965-75.

12. Greenwell I. Newly discovered benefits of gamma tocopherol. Life Extension. Collector's Edition; 2003:61-4.

13. Olmedilla B, Granado F, Southon S, et al. Serum concentrations of carotenoids and vitamins A, E, and C in control subjects from five European countries. Br J Nutr. 2001 Feb;85(2):227-38.

14. Friedrich MJ. To "E" or not to "E," vitamin E's role in health and disease is the question. JAMA. 2004 Aug 11;292(6):671-3.

15. Kamal-Eldin A, Appelqvist LA. The chemistry and antioxidant properties of tocopherols and tocotrienols. Lipids. 1996 Jul;31 (7):671-701.

16. Christen S, Woodall AA, Shigenaga MK, et al. gamma-tocopherol traps mutagenic electrophiles such as NO(X) and complements alpha-tocopherol: physiological implications. Proc Natl Acad Sci USA. 1997 Apr 1;94(7):3217-22.

17. Christen S, Gee P, Ames BN. Mutagenicity of nitric oxide in base pair-specific Salmonella tester strains: TA7000 series. Methods Enzymol. 1996;269:267-78.

18. Vinzents PS, Moller P, Sorensen M, et al. Personal exposure to ultrafine particles and oxidative DNA damage. Environ Health Perspect. 2005 Nov;113(11):1485-90.

19. Ohshima H, Tatemichi M, Sawa T. Chemical basis of inflammation-induced carcinogenesis. Arch Biochem Biophys. 2003 Sep 1;417(1):3-11.

20. Pryor WA, Squadrito GL. The chemistry of peroxynitrite: a product from the reaction of nitric oxide with superoxide. Am J Physiol. 1995 May;268(5 Pt 1):L699-L722.

21. Bose M, Farnia P. Proinflammatory cytokines can significantly induce human mononuclear phagocytes to produce nitric oxide by a cell maturation-dependent process. Immunol Lett. 1995 Nov;48(1):59-64.

22. Christen S, Jiang Q, Shigenaga MK, Ames BN. Analysis of plasma tocopherols alpha, gamma, and 5-nitro-gamma in rats with inflammation by HPLC coulometric detection. J Lipid Res. 2002 Nov;43(11):1978-85.

23. Ames BN, Shigenaga MK, Hagen TM. Oxidants, antioxidants, and the degenerative diseases of aging. Proc Natl Acad Sci USA. 1993 Sep 1;90(17):7915-22.

24. Christen S, Hagen TM, Shigenaga MK, Ames BN. Chronic inflammation, mutation, and cancer. In: Parsonnet J, ed. Microbes and Malignancy. New York: Oxford University Press; 1999:35–88.

25. Cooney RV, Franke AA, Harwood PJ, et al. Gamma-tocopherol detoxification of nitrogen dioxide: superiority to alpha-tocopherol. Proc Natl Acad Sci USA. 1993 Mar 1;90(5):1771-5.

26. Cooney RV, Harwood PJ, Franke AA, et al. Products of gamma-tocopherol reaction with NO2 and their formation in rat insulinoma (RINm5F) cells. Free Radic Biol Med. 1995 Sep;19(3):259-69.

27. iang Q, Elson-Schwab I, Courtemanche C, Ames BN. gamma-tocopherol and its major metabolite, in contrast to alpha-tocopherol, inhibit cyclooxygenase activity in macrophages and epithelial cells. Proc Natl Acad Sci USA. 2000 Oct 10;97 (21):11494-9.

28. Jiang Q, Christen S, Shigenaga MK, Ames BN. gamma-tocopherol, the major form of vitamin E in the US diet, deserves more attention. Am J Clin Nutr. 2001 Dec;74(6):714-22.

29. Sjoholm A, Berggren PO, Cooney RV. gamma-tocopherol partially protects insulin-secreting cells against functional inhibition by nitric oxide. Biochem Biophys Res Commun. 2000 Oct 22;277(2):334-40.

30. Jiang Q, Ames BN. Gamma-tocopherol, but not alpha-tocopherol, decreases proinflammatory eicosanoids and inflammation damage in rats. FASEB J. 2003 May;17(8):816-22.

31. Tomasch R, Wagner KH, Elmadfa I. Antioxidative power of plant oils in humans: the influence of alpha- and gamma-tocopherol. Ann Nutr Metab. 2001;45(3):110-5.

32. Saldeen T, Li D, Mehta JL. Differential effects of alpha- and gamma-tocopherol on low-density lipoprotein oxidation, superoxide activity, platelet aggregation and arterial thrombogenesis. J Am Coll Cardiol. 1999 Oct;34(4):1208-15.

33. Elmadfa I, Park E. Impact of diets with corn oil or olive/sunflower oils on DNA damage in healthy young men. Eur J Nutr. 1999 Dec;38(6):286-92.

34. Chen H, Li D, Saldeen T, Romeo F, Mehta JL. Mixed tocopherol preparation is superior to alpha-tocopherol alone against hypoxia-reoxygenation injury. Biochem Biophys Res Commun. 2002 Feb 22;291(2):349-53.

35. Kaul N, Devaraj S, Jialal I. Alpha-tocopherol and atherosclerosis. Exp Biol Med (Maywood.). 2001 Jan;226(1):5-12.

36. Huang HY, Appel LJ. Supplementation of diets with alpha-tocopherol reduces serum concentrations of gamma- and delta-tocopherol in humans. J Nutr. 2003 Oct;133(10):3137-40.

37. Farwer SR, der Boer BC, Haddeman E, et al. The vitamin E nutritional status of rats fed on diets high in fish oil, linseed oil or sunflower seed oil. Br J Nutr. 1994 Jul;72(1):127-45.

38. Handelman GJ, Machlin LJ, Fitch K, Weiter JJ, Dratz EA. Oral alpha-tocopherol supplements decrease plasma gamma-tocopherol levels in humans. J Nutr. 1985 Jun;115(6):807-13.

39. Ohrvall M, Sundlof G, Vessby B. Gamma, but not alpha, tocopherol levels in serum are reduced in coronary heart disease patients. J Intern Med. 1996 Feb;239(2):111-7.

40. Kontush A, Spranger T, Reich A, Baum K, Beisiegel U. Lipophilic antioxidants in blood plasma as markers of atherosclerosis: the role of alpha-carotene and gamma-tocopherol. Atherosclerosis. 1999 May;144(1):117-22.

41.Ohrvall M, Tengblad S, Vessby B. Tocopherol concentrations in adipose tissue. Relationships of tocopherol concentrations and fatty acid composition in serum in a reference population of Swedish men and women. Eur J Clin Nutr. 1994 Mar;48(3):212-8.

42.Li D, Saldeen T, Romeo F, Mehta JL. Relative effects of alpha- and gamma-tocopherol on low-density lipoprotein oxidation and superoxide dismutase and nitric oxide synthase activity and protein expression in rats. J Cardiovasc Pharmacol Ther. 1999 Oct;4 (4):219-26.

43.Moyad MA, Brumfield SK, Pienta KJ. Vitamin E, alpha- and gamma-tocopherol, and prostate cancer. Semin Urol Oncol. 1999 May;17(2):85-90.

44.Azzi A, Gysin R, Kempna P, et al. The role of alpha-tocopherol in preventing disease: from epidemiology to molecular events. Mol Aspects Med. 2003 Dec;24(6):325-36.

45.Campbell S, Stone W, Whaley S, Krishnan K. Development of gamma (gamma)-tocopherol as a colorectal cancer chemopreventive agent. Crit Rev Oncol Hematol. 2003 Sep;47(3):249-59.

46. Campbell SE, Stone WL, Whaley SG, Qui M, Krishnan K. Gamma (gamma) tocopherol upregulates peroxisome proliferator activated receptor (PPAR) gamma (gamma) expression in SW 480 human colon cancer cell lines. BMC Cancer. 2003 Oct 1;325.

47. Traber MG, Kayden HJ. Preferential incorporation of alpha-tocopherol vs gamma-tocopherol in human lipoproteins. Am J Clin Nutr. 1989 Mar;49(3):517-26.

48. Yamashita K, Takeda N, Ikeda S. Effects of various tocopherol-containing diets on tocopherol secretion into bile. Lipids. 2000 Feb;35(2):163-70.

49. Stone WL, Papas AM. Tocopherols and the etiology of colon cancer. J Natl Cancer Inst. 1997 Jul 16;89(14):1006-14.

50. Gysin R, Azzi A, Visarius T. Gamma-tocopherol inhibits human cancer cell cycle progression and cell proliferation by down-regulation of cyclins. FASEB J. 2002 Dec;16(14):1952-4.

51. Calviello G, Di NF, Piccioni E, et al. gamma-Tocopheryl quinone induces apoptosis in cancer cells via caspase-9 activation and cytochrome c release. Carcinogenesis. 2003 Mar;24(3):427-33.

52. Helzlsouer KJ, Huang HY, Alberg AJ, et al. Association between alpha-tocopherol, gamma-tocopherol, selenium, and subsequent prostate cancer. J Natl Cancer Inst. 2000 Dec 20;92(24):2018-23.

53. Giuliano AR, Papenfuss M, Nour M, et al. Antioxidant nutrients: associations with persistent human papillomavirus infection. Cancer Epidemiol Biomarkers Prev. 1997 Nov;6(11):917-23.

54. Jones KH, Liu JJ, Roehm JS, et al. Gamma-tocopheryl quinone stimulates apoptosis in drug-sensitive and multidrug-resistant cancer cells. Lipids. 2002 Feb;37(2):173-84.

55. Williamson KS, Gabbita SP, Mou S et al. The nitration product 5-nitro-gamma-tocopherol is increased in the Alzheimer brain. Nitric Oxide. 2002 Mar;6(2):221-7.

56. Milatovic D, Zaja-Milatovic S, Montine KS, Horner PJ, Montine TJ. Pharmacologic suppression of neuronal oxidative damage and dendritic degeneration following direct activation of glial innate immunity in mouse cerebrum. J Neurochem. 2003 Dec;87 (6):1518-26.

57. Salerno-Kennedy R, Cashman KD. Relationship between dementia and nutrition-related factors and disorders: an overview. Int J Vitam Nutr Res. 2005 Mar;75(2):83-95.

58. Tucker JM, Townsend DM. Alpha-tocopherol: roles in prevention and therapy of human disease. Biomed Pharmacother. 2005 Aug;59(7):380-7.

59. Kontush K, Schekatolina S. Vitamin E in neurodegenerative disorders: Alzheimer's disease. Ann NY Acad Sci. 2004 Dec;1031:249-62.

60. Anon. Dietary supplementation with n-3 polyunsaturated fatty acids and vitamin E after myocardial infarction: results of the GISSI-Prevenzione trial. Gruppo Italiano per lo Studio della Sopravvivenza nell'Infarto miocardico. Lancet. 1999 Aug 7;354 (9177):447-55.

61. Yusuf S, Dagenais G, Pogue J, Bosch J, Sleight P. Vitamin E supplementation and cardiovascular events in high-risk patients. The Heart Outcomes Prevention Evaluation Study Investigators. N Engl J Med. 2000 Jan 20;342(3):154-60.

62. Lonn E, Bosch J, Yusuf S, et al. Effects of long-term vitamin E supplementation on cardiovascular disease and cancer: a randomized controlled trial. JAMA. 2005 Mar 16;293(11):1338-47.

63. Jha P, Flather M, Lonn E, Farkouh M, Yusuf S. The antioxidant vitamins and cardiovascular disease. A critical review of epidemiologic and clinical trial data. Ann Intern Med. 1995 Dec 1;123(11):860-72.

64. Anon. The effect of vitamin E and beta carotene on the incidence of lung cancer and other cancers in male smokers. The Alpha-Tocopherol, Beta Carotene Cancer Prevention Study Group. N Engl J Med. 1994 Apr 14;330(15):1029-35.

65. Vivekananthan DP, Penn MS, Sapp SK, Hsu A, Topol EJ. Use of antioxidant vitamins for the prevention of cardiovascular disease: meta-analysis of randomized trials. Lancet. 2003 Jun 14;361(9374):2017-23.

66. Hensley K, Benaksas EJ, Bolli R, et al. New perspectives on vitamin E: gamma-tocopherol and carboxyelthylhydroxychroman metabolites in biology and medicine. Free Radic Biol Med. 2004 Jan 1;36(1):1-15.

67. Available at: http://www.berkeley.edu/news/media/releases/97legacy/christen.html. Accessed January 17, 2006.

The Star Online > Health

Sunday October 1, 2006

Different kinds of E

SCIENTISTS have unanimously concluded that free radicals damage cells and contribute to the common diseases associated with ageing. As people age, they produce more free radicals that inflict greater damage to cellular DNA, mitochondria and cell membranes. The result is illness and premature death.

Health conscious people today consume antioxidant supplements such as vitamin E to help neutralise these free radicals.

When vitamin E was discovered in 1922, scientists mistakenly concluded that out of the four tocopherol family members (alpha-, beta-, delta- and gamma tocopherol), only alpha tocopherol provided some measurable benefit.

So for the next 70 to 80 years, vitamin E supplements contained only the alpha tocopherol.

Vitamin E has since become synonymous with alpha tocopherol. It is not surprising that earlier clinical trials designed to examine vitamin E's ability to prevent disease have been carried out using only alpha-tocopherol.

When scientists started examining other members of vitamin E family, one in particular – gamma tocopherol – was found to possess several unique properties.

Although gamma tocopherol is not as powerful an antioxidant as alpha tocopherol, it was found that gamma tocopherol was the only member of the tocopherol family capable of neutralising reactive nitrogen free radicals such as peroxynitrite and nitrogen dioxide.

Generated by inflammation, these nitrogen free radicals are implicated in a host of degenerative diseases including atherosclerosis, Alzheimer's disease, multiple sclerosis and Parkinson's disease1. Research as also discovered that gamma tocopherol reduces inflammation by inhibiting prostaglandin E22.

In addition to inhibiting chronic inflammation, gamma tocopherol exerts additional non-antioxidant effects to prevent cancer3. Gamma tocopherol is believed to prevent colon cancer by inhibiting the formation of mutagens produced by oxidised foecal fats while decreasing oxidative damage to the epithelial cells of the colon4.

In another study involving 10,456 males5, it was found that gamma tocopherol concentration strongly and inversely associated with subsequent risk of prostate cancer. The blood levels of gamma tocopherol were lower among men with prostate cancer.

Cigarette smoke contains very high amounts of damaging nitrogen free radicals which are carcinogenic6. Gamma tocopherol and not alpha tocopherol is able to effectively neutralise the reactive nitrogen free radicals. This explains why smokers have notoriously low levels of gamma tocopherol as their body store of gamma tocopherol is used to neutralise these free radicals.

Population studies have found that the gamma tocopherol appears to protect against the development of lung disease in smokers.

High levels of gamma tocopherol have been correlated with a lower incidence and reduced risk of death from cardiovascular (coronary heart) disease. In one study involving 34,486 postmenopausal women, increased intake of dietary vitamin E, primarily gamma tocopherol, was associated with a reduced risk of death from coronary heart disease7. This association was not observed in women who took vitamin E supplements with alpha tocopherol.

In Malaysia, most of the vitamin E supplements contain only alpha tocopherol. Growing evidence indicate that it may not be good to health to consume alpha tocopherol alone without also consuming gamma tocopherol.

The latest studies have found that consuming alpha tocopherol alone decreases gamma tocopherol level in the tissues. This is definitely not helpful (or may even be detrimental to health) if one considers that by taking alpha tocopherol alone, you lose out on the main health benefits provided by gamma tocopherol that were already present in the tissues.

The best way is to consume both alpha tocopherol and gamma tocopherol together.

The studies also found that taking gamma tocopherol with alpha tocopherol also increases tissue levels of both gamma tocopherol and alpha tocopherol. This finding may explain why vitamin E from food sources have been found to be more effective than alpha tocopherol supplements in reducing death from cardiovascular disease.

In nature, vitamin E is found to contain all four members of the tocopherol family: alpha-, beta-, delta- and gamma tocopherol.

References:

1. Atherosclerosis. 1999 Jun;144(1):117-22. Front Biosci. 2004 Feb 1;9:763-76

2. Proc Natl Acad Sci USA. 2000 Nov 10;97(21):11494-9

3. FASEB J. 2002;16(14):1952-4

4. Crit Rev Oncol Hematol. 2003 Oct;47(3):249-59

5. Am J Epidemiol. 2003;157; 335-344

6. Free Rad Biol Med. 1996, 21:669-681

7. N Engl J Med. 1996 Jun 2;334(18):1156-62

SUMMARY :-

The Powerful AntiOxidant....Natural Vitamin E Complex has two important functions in the body:-

1.) Alpha Tocopherol serves as Anti-Thrombic:- prevents platelet aggregation, internal clotting of blood, and thickening of the blood.

2.) Gamma Tocopherol serves as Anti-Oxidant:- neutralizes harmful free radicals and strongly inhibits peroxynitrite which is very damaging to cells.

3.) Beta and Delta Tocopherols have some Anti-Oxidant value.

The 4 part complex consisting of alpha, gamma, beta and delta tocopherols work together in a synergistic fashion making up the substance known as vitamin E.

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The Star Online > Health

Sunday October 19, 2008

The E musketeers

To gain the benefits attributed to vitamin E, you need all four vitamin E members.

CHECK your vitamin E supplement label and you will very likely find only alpha tocopherol on it.

Food naturally contains all four members €“ alpha, -beta, -delta and gamma tocopherol (also known as mixed tocopherols) of the vitamin E (tocopherol) family.

However when vitamin E was first discovered in 1922, scientists mistakenly concluded that vitamin E was a single compound €“ d-alpha tocopherol. So for the next 70 to 80 years, vitamin E supplements contained only d-alpha tocopherol.

Only in the last decade have scientists discovered the important health benefits of the long-ignored members: d-gamma, d-delta and d-beta tocopherol, which have anti-inflammatory [1] and heart protective [2,3,4] activity.

While d-alpha tocopherol alone does provide certain benefits, it has been found that the best benefits of vitamin E supplements come when it contains all four (alpha-, beta-, gamma-, delta-) tocopherol members of the vitamin E family.

The team of 4 tocopherol members works better together than d-alpha tocopherol alone [4]. Therefore if you are taking d-alpha tocopherol alone, you may be missing out on the synergistic benefits offered by the whole tocopherol family.

Vitamin E helps protect against oxidation of LDL cholesterol and raise “good” HDL cholesterol. It’s been shown to reduce the risk of heart attack [2,3,4], revs up the immune system, fights cancer and lowers risk of developing cataract. The surprising development is that while high levels of dietary

vitamin E have consistently show these effects, typical vitamin E supplements have not. And there is a reason.

The latest research places particular importance on the recently discovered benefits of gamma tocopherol as found in mixed tocopherol vitamin E supplements. Since taking large doses of alpha tocopherol depletes plasma levels of gamma-tocopherol, the health conscious consumer who takes only alpha tocopherol supplements may need to reconsider this practice. Likewise, most vitamin E supplements provide only alpha tocopherol. New evidence suggests that this may be inadequate supplementation [5].

A review by Qing Jiang, Bruce N. Ames and their colleagues at the University of California, Berkeley on the recent findings of gamma tocopherol as found in mixed tocopherol supplements was recently published in the *American Journal of Clinical Nutrition* [5]. After reviewing numerous studies, the authors concluded that it was time to abandon the outdated review that only alpha tocopherol is important, and to conduct more research on gamma tocopherol.

A few studies have shown immense benefits of vitamin E in reducing cardiovascular disease and death from heart attack, while others have been unsuccessful in showing similar results. This discrepancy may well be due to the fact that only alpha tocopherol was studied in isolation, while mixed tocopherols (especially gamma) were not considered.

This may also explain why vitamin E found in food is more effective than the conventional vitamin E supplements containing only alpha tocopherol in reducing death from cardiovascular disease.

Free radicals can stimulate and intensify inflammation by turning on genes that promote inflammation. Many serious degenerative conditions, including atherosclerosis, various types of cancer and Alzheimer’s disease, appear to be promoted by chronic inflammation.

Research scientists at Children’s Hospital Oakland Research Institute found that gamma tocopherol plays a superior role in suppressing inflammation than alpha tocopherol. (Journal €“ *Proceedings of the National Academy of Science* [Oct 2000])

Studies have shown that smokers have very low levels of vitamin E, particularly when it comes to gamma tocopherol. This is because cigarette smoking depletes gamma tocopherol. Hence, it is vital that smokers choose a vitamin E which comprises of gamma (mixed) tocopherol rather than the conventional single compound, alpha tocopherol as it helps smokers maintain better health.

Studies have suggested that alpha tocopherol may not yield the alleged health benefits unless it's combined with the gamma tocopherol form.

Furthermore, some research has demonstrated that too much alpha tocopherol opposes the antioxidant effects of gamma tocopherol.

If you are currently taking the conventional vitamin E (only alpha tocopherol), you should consider balancing your alpha tocopherol supplement with a supplement containing mixed tocopherols.

References:

1. Jiang Q, Elson-Schwab I, Courtemanche C, Ames BN. Gamma -Tocopherol and its major metabolite, in contrast to Alpha-tocopherol, inhibit cyclooxygenase activity in macrophages and epithelial cells. Proc Natl Acad Sci U S A 2000;97:11494€“9.

2. Ohrvall M, Sundlof G, Vessby B. Gamma, but not alpha, tocopherol levels in serum are reduced in coronary heart disease patients. J Intern Med 1996;239:111€“7.

3. Kontush A, Spranger T, Reich A, Baum K, Beisiegel U. Lipophilic antioxidants in blood plasma as markers of atherosclerosis: the role of alpha-carotene and gamma-tocopherol. Atherosclerosis 1999;144: 117€“22.

4. Kristenson M, Zieden B, Kucinskiene Z, et al. Antioxidant state and mortality from coronary heart disease in Lithuanian and Swedish men: concomitant cross sectional study of men aged 50. BMJ 1997; 314:629€“33

5. Qing Jiang, et al. - Gamma tocopherol, the major form of vitamin E in the US diet, deserves more attention. €“ Am J Clin Nutr 2001; 74:714- 22