Evidence-based Vitamin E Usage

Name(s): Tocopherol

Warnings: Vitamin E may cause glycaemic control tests, as represented by glycosylated haemoglobin, to appear better than actual values. That is, a lower than actual reading may be obtained while using vitamin E. Also, iron should not be taken at the same time as antioxidants.

Description: Vitamin E is a fat-soluble vitamin notorious as an antioxidant. An advantage of this vitamin is that it oxidises slowly. Oxidation is when an electron is removed from a compound by an oxidiser. Muscles of the cardiac and skeletal systems are able to function with less oxygen with the use of this vitamin. This enhances cellular respiration causing an increase in endurance and stamina. Vitamin E is found in soaps. Fat is an ingredient of soap and the soap would smell rancid without vitamin E.[1]

Absorption/Storage: For vitamin E to be absorbed, bile salts and fat must be present. Once absorbed into the lymphatic system, tocopherol is transported to the liver via the bloodstream and is then stored. Other places of storage include fatty tissues, heart, muscles, testes, uterus, and blood. Vitamin E is commonly found in ointments. When ointments are used, vitamin E is absorbed through the skin and mucous membranes. When vitamin E is taken concurrently with the inorganic form of iron, the absorption of both of these is impaired.[1]

Recommended Dietary Allowance/Dietary Reference Intake: [2]

Persons	U.S.	
	mg alpha-TE	Units
Birth to 3 years of age	4-6	6-9
4 to 8 years of age	7	11.5
9 to 13 years of age	11	16.5
Adolescent and adult males	15	22.5
Adolescent and adult females	15	22.5
Pregnant females	15	22.5
Breast-feeding females	19	28.5

Optimum Daily Allowance (Adult): 400-600 IU.[3]

Tolerable Upper Intake Levels:[2]

Persons	mg alpha-TE
Birth to 3 years of age	ND-200
4 to 8 years of age	300
9 to 13 years of age	600
Adolescent and adult males	800-1000
Adolescent and adult females	800-1000
Pregnant females	1800-2000
Breast-feeding females	1800-2000

Principal Uses: Antioxidant protection against heart disease and stokes,[4-12] osteoarthritis and rheumatoid arthritis,[13-20] diabetes,[21-33] epilepsy in children,[34-36] immune support in elderly people,[37,38] intermittent claudication.[39-41] sunburn (oral form when taken with vitamin C or topical form used before sun exposure),[42-48] tardive dyskenesia,[49-52] and yellow nail syndrome.[53-56]

Proposed Uses: Alzheimer's disease, angina, atherosclerosis, athletic performance (for exercise recovery and high-altitude exercise performance only), bronchitis, cold sores, dermatitis herpetiformis, heart attack, leukoplakia, lung cancer (reduces risk), pancreatic insufficiency, preeclampsia (in combination with vitamin C; for high risk only), premenstrual syndrome, prostate cancer (reduces risk), retinopathy (diabetic retinopathy and retrolental fibroplasia), skin ulcers (oral vitamin E), and wound healing.[57]

Traditional Uses: Abnormal pap smear, age-related cognitive decline (ARCD), alcohol withdrawal support, burns (minor) (topical), cataracts, colon cancer (reduces risk), cystic fibrosis, Dupuytren's contracture, epilepsy (for adults), fibrocystic breast disease, fibromyalgia, hepatitis, high cholesterol, HIV support, hypoglycaemia, infertility (female), infertility (male), insulin resistance syndrome (Syndrome X), kidney stones (prevention), liver cirrhosis, lupus, macular degeneration, menopause, menorrhagia (heavy menstruation), Osgood-Schlatter disease, Parkinson's disease (in combination with vitamin C), photosensitivity, pre- and post-surgery health, restless legs syndrome, retinopathy (abetalipoproteinemia), retinopathy (in combination with selenium, vitamin A and vitamin C), shingles, sickle cell anaemia, skin ulcers (topical vitamin E), sprains and strains (for exercise-related muscle strain) and vaginitis.[57]

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Healthy Sources:
High (40%+ US RDA): So-fortified ready-to-eat cereals, hazelnuts, and sunflower seeds,[58] almond paste, unblanched toasted or unroasted almonds, dried agar, dried spirulina, tomato paste and tomato puree.[59]

Medium (25-39% US RDA): Peanuts, plain wheat germ,[58] almond butter, frozen loganberries, raw papaya, canned peaches in juice, peanut butter and boiled soybeans.[59]

Contraindications: If you are taking this dietary supplement without a prescription, carefully read and follow any precautions on the label. For vitamin E, the following should be considered:

Allergies--Tell your health care professional if you have ever had any unusual or allergic reaction to vitamin E. Also, tell your health care professional if you are allergic to any other substances, such as foods, preservatives, or dyes.

Pregnancy--It is especially important that you are receiving enough vitamins when you become pregnant and that you continue to receive the right amount of vitamins throughout your pregnancy. The healthy growth and development of the foetus depend on a steady supply of nutrients from the mother. However, taking large amounts of a dietary supplement during pregnancy may be harmful and should be avoided.

Breast-feeding--It is especially important that you receive the right amounts of vitamins so that your baby will also get the vitamins needed to grow properly. You should also check with your health care professional if you are giving your baby an unfortified formula. In that case, the baby must get the vitamins needed some other way. However, taking large amounts of a dietary supplement while breast-feeding may be harmful to the mother and/or baby and should be avoided.

Children--Problems in children have not been reported with intake of normal daily-recommended amounts. You should check with your health care professional if you are giving your baby an unfortified formula. In that case, the baby must get the vitamins needed some other way. Some studies have shown that premature infants may have low levels of vitamin E. Your health care professional may recommend a vitamin E supplement.

Older adults--Problems in older adults have not been reported with intake of normal daily-recommended amounts.

Medicines or other dietary supplements--Although certain medicines or dietary supplements should not be used together at all, in other cases they may be used together even if an interaction might occur. In these cases, your health care professional may want to change the dose, or other precautions may be necessary. Tell your health care professional if you are taking any other prescription or non-prescription (over-the-counter [OTC]) medicine.

Other medical problems--The presence of other medical problems may affect the use of vitamin E. Make sure you tell your health care professional if you have any other medical problems, especially:

- Bleeding problems--Vitamin E, when taken in doses greater than 800 Units a day for long periods of time, may make this condition worse.[60]

Interactions:

Decreases Vitamin Availability:	Orlistat,[57] bile acid sequestrants, isoniazid, mineral oil, [57,61] alcohol, anticonvulsants, beta carotene (long term supplementation), charcoal, clofibrate, oestrogens, omega 3 essential fatty acids, fibre supplementation, probucol, sucralfate, and stomach acid-lowering drugs.[61]
Increases Vitamin Availability:	Essential fatty acids, manganese, selenium, inositol, vitamins A, B1, C,[3] and coenzyme Q10.[61]
Is Decreased By Vitamin Availability:	Side effects from anthralin, benzamycin, chemotherapy, dapsone, (topical supplement), fenofibrate, haloperidol, isotretinoin, lindane lovastatin, risperidone,[57] amiodarone,[57,61] side effects of adriamycin, blenoxane, bleomycin, vitamin K (high dose supplementation) and iron therapy (in children).[62,63]

Is Increased By Vitamin Availability:	Aspirin, AZT effectiveness, glyburide, griseofulvin, insulin, pentoxifylline, simvastatin, sodium fluoride,[57] anticoagulants (large doses of supplement), glutathione, magnesium, selenium, vitamin A, vitamin D and zinc.[61]
Adverse Reactions:	Aspirin,[57] iron and warfarin (high dose supplementation).[61]

Deficiency: The first sign of a deficiency a rupturing of red blood cells. This is caused by the free-radical oxidation of polyunsaturated fats in the membranes. Most people experience gastrointestinal complications such as blockage of bile ducts and chronic inflammation of the pancreas with insufficient amounts of vitamin E. Nephritis may also result from a deficiency. This disease is caused by dead cells plugging up the kidney tubules enabling urine to pass. Lack of vitamin E is common in the American diets due to the milling process. It has been found that approximately 90% of vitamin E is lost from wheat germ through the milling process.[1] Lack of vitamin E is extremely rare, except in people who have a disease in which it is not absorbed into the body.[60]

Toxicity/Side Effects: Along with its needed effects, a dietary supplement may cause some unwanted effects. When used for short periods of time at recommended doses, vitamin E usually does not cause any side effects. However, check with your health care professional as soon as possible if any of the following side effects occur:

With doses greater than 400 Units a day and long-term use

- Blurred vision; diarrhoea; dizziness; headache; nausea or stomach cramps; unusual tiredness or weakness

Other side effects not listed above may also occur in some individuals. If you notice any other effects, check with your health care professional.[60]

Treatment For Overdose: Induce vomiting if recently taken. Take activated charcoal and a laxative.[64]

Storage: To store this dietary supplement:

- Keep out of the reach of children.
- Store away from heat and direct light.
- Do not store in the bathroom, near the kitchen sink, or in other damp places. Heat or moisture may cause the dietary supplement to break down.
- Keep the oral liquid form of this dietary supplement from freezing.
- Do not keep outdated dietary supplements or those no longer needed. Be sure that any discarded dietary supplement is out of the reach of children.[60]

References:

1. Dr. Morrow's Library of Vitamins, Minerals, Amino Acids, and Herbs: Vitamin D. [Online] http://www.nutritiondynamics.com/cgi-bin/process.asp?product=Vitamin+E
2. National Academy of Sciences Food and Nutrition Board. (2000). Dietary reference intakes: Applications in dietary assessment. Washington, DC: National Academy Press.
3. Balch, P.A. & Balch, J.F. (2000). Prescription for nutritional healing (third edition). Garden City Park: Avery Publishing.
4. Gey, K.F. et al. (1991). Inverse correlation between plasma vitamin E and mortality from heart disease in cross-cultural epidemiology. American Journal of Clinical Nutrition, 53: 326S-334S.
5. Stampfer, M.J. et al. (1993). Vitamin E consumption and the risk of coronary heart disease in women. New England Journal of Medicine, 328: 1444-1449.
6. Rimm, E.B. et al. (1993). Vitamin E consumption and the risk of coronary heart disease in men. New England Journal of Medicine, 328: 1450-1456.
7. Princen, H.M.G. (1992). Supplementation with low doses of vitamin E protects LDL from lipid peroxidation in men and women. Arteriosclerotic, Thrombotic and Vascular Biology, 15: 325-333.
8. Hodis, H.N., et al. (1995). Serial coronary angiographic evidence that antioxidant vitamin intake reduces progression of coronary artery athrosclerosis. JAMA, 273: 1849-1854.
9. Stephens, N.G., Parsons, A., Schofield, P.M. et al. (1996). Randomised controlled trial of vitamin E in patients with coronary disease: Cambridge Heart Antioxidant Study (CHAOS). Lancet, 347: 781–786.
10. Boaz, M., Smetana, S., Weinstein, T. et al. (2000). Secondary prevention with antioxidants of cardiovascular disease in endstage renal disease (SPACE): randomised placebo-controlled trial. Lancet, 356: 1213–1218.
11. Fang, J.C., Kinlay, S., Beltrame, J., Hikiti, H., Wainstein, M., Behrendt, D., Suh, J., Frei, B., Mudge,

G.H., Selwyn, A.P. & Ganz, P. (2002). Effect of vitamins C and E on progression of transplant-associated arteriosclerosis: a randomised trial. Lancet, 359(9312): 1108-1113.
12. Singhal, S., Gupta, R. & Goyle, A. (2001). Comparison of antioxidant efficacy of vitamin E, vitamin C, vitamin A and fruits in coronary heart disease: a controlled trial. Journal of the Association of Physicians in India, 49: 327-331.
13. Machtey, I. & Ouaknine, L. (1978). Tocopherol in osteoarthritis: A controlled pilot study. Journal of the American Geriatric Society, 25(7): 328–330.
14. Blankenhorn, G. (1986). Klinische Wirtsamkeit von Spondyvit (vitamin E) bei aktiverten arthronsen. Z Orthop, 124: 340-343.
15. Scherak, O., Kolarz, G., Schödl, Ch. & Blankenhorn, G. (1990). Hochdosierte Vitamin -E-Therapie bei Patienten mit aktivierter Arthrose. Z Rheumatol, 49: 369–373.
16. Helmy, M., Shohayeb, M., Helmy, M.H. & el-Bassiouni, E.A. (2001). Antioxidants as adjuvant therapy in rheumatoid disease. A preliminary study. Arzneimittelforschung, 51(4): 293-298.
17. Hanninen, Kaartinen K., Rauma, A.L., Nenonen, M., Torronen, R., Hakkinen, A.S., Adlercreutz, H., Laakso, J. (2000). Antioxidants in vegan diet and rheumatic disorders. Toxicology, 155(1-3): 45-53.
18. Scherak, O. & Kolarz, G. (1991). Vitamin E and rheumatoid arthritis. Arthritis & Rheumatology, 34: 1205–1206 [letter].
19. Wittenborg, A., Petersen, G., Lorkowski, G. & Brabant, T. (1998). Effectiveness of vitamin E in comparison with diclofenac sodium in treatment of patients with chronic polyarthritis. Z Rheumatol, 57: 215–221 [in German].
20. Kolarz, G., Scherak, O., El Shohoumi, M. & Blankenhorn, G. (1990). High dose vitamin E for chronic arthritis. Akt Rheumatol, 15: 233–237 [in German].
21. Salonen, J.T., Nyssonen, K., Tuomainen, T-P. et al. (1995). Increased risk of non-insulin dependent diabetes mellitus at low plasma vitamin E concentrations: a four year follow up study in men. British Medical Journal, 311: 1124–1127.
22. Bierenbaum, M.L., Noonan, F.É., Michelin, L.K. et al. (1985). The effect of supplemental vitamin E on serum parameters in diabetics, post coronary and normal subjects. Nutrition Report International, 31: 1171–1180.
23. Paolisso, G., D'Amore, A., Giugliano, D. et al. (1993). Pharmacologic doses of vitamin E improve insulin action in healthy subjects and non-insulin dependent diabetic patients. American Journal of Clinical Nutrition, 57: 650–656.
24. Paolisso, G., D'Amore, A., Galzerano, D. et al. (1993). Daily vitamin E supplements improve metabolic control but not insulin secretion in elderly type II diabetic patients. Diabetes Care, 16: 1433–1437.
25. Paolisso, G., Di Maro, G., Galzerano, D. et al. (1994). Pharmacological doses of vitamin E and insulin action in elderly subjects. American Journal of Clinical Nutrition, 59: 1291–1296.
26. Paolisso, G., Gambardella, A., Galzerano, D. et al. (1994). Antioxidants in adipose tissue and risk of myocardial infarction. Lancet, 343: 596 [letter].
27. Tütüncü, N.B., Bayraktar, M. & Varli, K. (1998). Reversal of defective nerve condition with vitamin E supplementation in type 2 diabetes. Diabetes Care, 21: 1915–1918.
28. Colette, C., Pares-Herbute, N., Monnier, L.H. & Cartry E. Platelet function in type I diabetes: effects of supplementation with large doses of vitamin E. American Journal of Clinical Nutrition, 47: 256–261.
29. Ceriello, A., Giugliano, D., Quatraro, A. et al. (1991). Vitamin E reduction of protein glycosylation in diabetes. Diabetes Care, 14: 68–72.
30. Duntas, L., Kemmer, T.P., Vorberg, B., Scherbaum, W. (1996). Administration of d-alpha-tocopherol in patients with insulin-dependent diabetes mellitus. Current Therapy & Research, 57: 682–690.
31. Jain, S.K., McVie, R., Jaramillo, J.J. et al. (1996). Effect of modest vitamin E supplementation on blood glycated hemoglobin and triglyceride levels and red cell indices in type I diabetic patients. Journal of the American College of Nutrition, 15: 458–461.
32. Jain, S.K., McVie, R. & Smith, T. (2000). Vitamin E supplementation restores glutathione and malondialdehyde to normal concentrations in erythrocytes of type 1 diabetic children. Diabetes Care, 23: 1389–1394.
33. Gisnger, C., Jeremy, J., Speiser, P. et al. (1988). Effect of vitamin E supplementation on platelet thromboxane A2 production in type I diabetic patients: Double-blind crossover trial. Diabetes, 37: 1260–1264.
34. Ogunmekan, A.O. & Hwang, P.A. (1989). A randomized, double-blind, placebo-controlled, clinical

trial of D-alpha-tocopheryl acetate (vitamin E), as add-on therapy, for epilepsy in children. Epilepsia, 30: 84–89.
35. Hom, A.C., Weaver, R.C. & Aldersen, J.J. (1991). Efficacy of D-alpha tocopherol acetate as adjunctive antiepileptic agent in patients with refractory epilepsy and profound developmental disability. A prospective, randomised, double-blind, placebo-controlled trial. Epilepsia, 32(suppl 3): 63 [abstract].
36. Sullivan, C., Capaldi, N., Mack, G. & Buchanan, N. (1990). Seizures and natural vitamin E. Medical Journal of Australia, 152: 613–614 [letter].
37. Meydani, S.N., Barklund, M.P., Liu, S. et al. (1990). Vitamin E supplementation enhances cell-mediated immunity in healthy elderly subjects. American Journal of Clinical Nutrition, 52: 557–563.
38. Meydani, S.N., Meydani, M., Blumberg, J.B. et al. (1997). Vitamin E supplementation and in vivo immune response in healthy elderly subjects: a randomised controlled trial. JAMA, 277: 1380–1386.
39. Haeger, K. (1974). Long-time treatment of intermittent claudication with vitamin E. American Journal of Clinical Nutrition, 27: 1179–1181.
40. Williams, H.T., Fenna, D. & Macbeth, R.A. (1971). Alpha tocopherol in the treatment of intermittent claudication. Surgical Gynecology and Obstetrics, 662–666.
41. Donnan, P.T., Thomson, M., Fowkes, G.R. et al. (1993). Diet as a risk factor for peripheral arterial disease in the general population: the Edinburgh Artery Study. American Journal of Clinical Nutrition, 57: 917–921.
42. Fuchs, J. (1998). Potentials and limitations of the natural antioxidants RRR-alpha-tocopherol, L-ascorbic acid and beta-carotene in cutaneous photoprotection. Free Radical Biological Medicine, 25: 848–873.
43. Fuchs, J., Kern, H. (1998). Modulation of UV-light-induced skin inflammation by D-alpha-tocopherol and L-ascorbic acid: A clinical study using solar simulated radiation. Free Radical Biological Medicine, 25: 1006–1012.
44. Eberlein-Konig, B., Placzek, M., Przybilla. B. (1998). Protective effect against sunburn of combined systemic ascorbic acid (vitamin C) and d-alpha-tocopherol (vitamin E). Journal of the American Academy of Dermatology, 38: 45–48.
45. Werninghaus, K., Meydani, M., Bhawan, J. et al. (1994). Evaluation of the photoprotective effect of oral vitamin E supplementation. Archives of Dermatology, 130: 1257–1261.
46. Fuchs, J. & Kern, H. (1998). Modulation of UV-light-induced skin inflammation by D-alpha-tocopherol and L-ascorbic acid: A clinical study using solar simulated radiation. Free Radical Biology and Medicine, 25(9): 1006-1012.
47. Eberlein-Konig, B., Placzek, M. & Przybilla, B. (1998). Protective effect against sunburn of combined systemic ascorbic acid (vitamin C) and d-alpha-tocopherol (vitamin E). Journal of the American Academy of Dermatology, 38(1): 45-48.
48. Dreher, F., Gabard B., Schwindt, D.A. et al. (1998). Topical melatonin in combination with vitamins E and C protects skin from ultraviolet-induced erythema: a human study in vivo. British Journal of Dermatology, 139:332–339.
49. Adler, L.A., Peselow, E., Rotrosen, J. et al. (1993). Vitamin E treatment of tardive dyskinesia. American Journal of Psychiatry, 150: 1405–1407.
50. Sajjad, S.H.A. (1998). Vitamin E in the treatment of tardive dyskinesia: a preliminary study over 7 months at different doses. International Clinical Psychopharmacology, 13: 147–155.
51. Elkashef, A.M., Ruskin, P.E., Bacher, N. & Barrett, D. (1990). Vitamin E in the treatment of tardive dyskinesia. American Journal of Psychiatry, 147: 505–506.
52. Lohrr, J.B., Cadet, J.L. & Lohr, M.A. (1987). Alpha-tocopherol in tardive dyskinesia. Lancet, 1: 913–914.
53. Norton, L. (1985). Further observations on the yellow nail syndrome with therapeutic effects of oral alpha-tocopherol. Cutis, 36: 457–462.
54. Ayres, S. Jr. & Hihan, R. (1973). Yellow nail syndrome: Response to vitamin E. Archives of Dermatology, 108: 267–268.
55. Ayres, S. Jr. (1986). Yellow nail syndrome controlled by vitamin E therapy. Journal of the American Academy of Dermatology, 15: 714–716 [letter].
56. Williams, H.C., Buffham, R. & du Vivier, A. (1991). Successful use of topical vitamin E solution in the treatment of nail changes in yellow nail syndrome. Archives of Dermatology, 127: 1023–1028.
57. Austin, S., Gaby, A., Appleton, J. et al. (2001). HealthNotes Online. [Online] http://healthnotes.com
58. Ohio State University. (Unknown). Ohio State University Extension Fact Sheet: Vitamin E. [Online]. http://www.ag.ohio-state.edu/~ohioline/hyg-

fact/5000/5554.html.
59. Pennington, J.A. (1998). Boes and Church's food values of portions commonly used (seventeenth edition). Philadelphia, PA: Lippincott.
60. National Library of Medicine. (2000). Vitamin E (Systemic). [Online] http://www.nlm.nih.gov/medlineplus/druginfo/vitaminesystemic202598.html
61. Meletis, C. & Jacobs, T. (1999). Interactions between drugs & natural medicines. Sandy, OR.: Eclectic Medical Publications.
62. Gillis, C. (editor). (1999). Compendium of pharmaceuticals and specialties. Ottawa, Canada: Canadian Pharmacists Association.
63. American Society of Health-System Pharmacists. (2000). AHFS drug information. Bethesda, MD: American Society of Health-System Pharmacists.
64. Leikin, J.B. & Paloucek, F.P. (1995). Poisoning & toxicology handbook (second edition). Hudson, Ohio: Lexi-Comp/American Pharmaceutical Assoc.

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