Biolab Medical Unit

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Tocopherol update (2009)

Biolab offers a chromatographic assay of serum tocopherol isomers which separates and quantifies the vitamers alpha, gamma and delta tocopherol.

Natural sources of tocopherols

Vitamin E is the generic term that refers to all the substances having the biological activity of d-α-tocopherol. There are eight substances in nature having vitamin E activity. These are:

d-α, d-β, d-γ and d-δ-tocopherol; and
d-α, d-β, d-γ and d-δ-tocotrienol.

These vitamers are not inter-convertible in humans and do not follow the same pathways of metabolism. It is reasonable to suppose that they do not all share the same protective functions. Alpha-tocopherol has the highest scavenging activity against lipid peroxyl radicals, but is not a scavenger of peroxynitrite, which can be formed by the interaction of nitric oxide and superoxide in the damaged vascular endothelium. Gamma-tocopherol is, however, an effective peroxynitrite scavenger [1].

The best natural sources of vitamin E are vegetable oils, with wheat germ oil as the richest source. Note that olive oil is not a significant dietary source of vitamin E. As can be seen from the data below, foods of animal origin are generally low in vitamin E. The typical vitamin E content of various foods, calculated from published data [2] is:

Food (100 gm portion	**IU vitamin E**
Oils and fats	
Wheat germ oil	177.97
Sunflower oil	72.56
Peanut oil	28.13
Margarine (soft)	20.66
Butter	3.22
Grains and grain products	
Wheat germ	17.36
Oatmeal	2.02
Boiled brown rice	2.01
Bread (wholewheat)	0.80
Bread (white)	0.21
Nuts	
Sunflower seeds (raw)	73.76
Almonds	40.53
Peanut butter	9.24
Cashews	0.28

Meat, fish, eggs, milk	
Liver (cooked)	0.94
Shrimps	0.89
Chicken	0.86
Eggs	0.69
Haddock	0.64
Steak	0.45
Whole milk	0.06
Fruit and vegetables	
Asparagus	2.68
Spinach	2.67
Peas	0.82
Broccoli	0.69
Apples	0.46
Bananas	0.33

Vitamin E deficiency
Vitamin E deficiency is quite widespread among both the US [3] and UK [4] populations and is not confined to low income groups. Between 20 and 30% of the population is reported as being affected by tocopherol deficiency, depending on the cut-off points used. In recent years headline drug trials have concluded that vitamin E administration is not effective at reducing cardiovascular events, but this has largely been based on giving synthetic alpha tocopherol to subjects with no measurable vitamin E deficiency – a scenario in which the vitamin is unlikely to have any beneficial effect.

Vitamin E supplementation
Prudent nutritional advice would be to encourage the consumption of a diet rich in all the tocopherols and tocotrienols. With regard to the new supplemental Vitamin E preparations which are now available, many are unfortunately mixed tocopherol extracts of soya, which are not universally suitable, especially for subjects with multiple allergies. In such cases, synthetic alpha tocopherol supplementation may still be more appropriate.

Patient preparation
No special preparation is required for the measurement of the tocopherol profile, but the patient should discontinue nutritional supplements for three days before the collection of the sample (so that the measured value better reflects endogenous vitamin E levels rather than a post-absorptive peak after taking supplements).

Specimen requirements
Serum separator tubes (gold top plain gel tubes - available from Biolab on request). If posted, samples must reach Biolab within 24 hours.

Price: £23.00

Methodology
High pressure liquid chromatography (HPLC).

Quality Control
Internal precision control is maintained by repeated analysis of commercial lyophilised samples with assigned values. External quality assurance is carried out via our participation in the UK NEQAS Quality Assurance Scheme in which we have been consistent good performers for the past eight years.

Turn around time
3-5 working days.

Interpretation

The serum concentration of alpha-tocopherol should be maintained between 25 and 60 micromoles per litre. Desirable levels of gamma-tocopherol are between 2.0 and 8.5 micromoles per litre (or 10% of the level of alpha-tocopherol). The reference interval for delta-tocopherol is between 120 and 350 nanomoles per litre. The typical Japanese diet, for example, contains higher levels of gamma and delta tocopherols, as well as the tocotrienols.

References

1. Brigelius-Flohe R, Kelly FJ, Salonen JT et al. The European perspective on vitamin E. Am J Clin Nutr 2002;76:703-716.

2. Bauernfeind J, Tocopherols in Foods. In: Vitamin E; a comprehensive treatise, 1980:133-155.

3. Ford ES, Sowell A. Serum alpha-tocopherol status in the US population; findings from the Third National Health and Nutrition Examination Survey. Am J Epidemiol 1999;1:290-300.

4. Finch S, Doyle W, Lowe C, Bates CJ et al. National Diet and Nutrition Survey: People Aged 65 Years or Over. Volume 1: report of the Diet and Nutrition Survey. The Stationary Office, London.