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Vitamins

Updated: May 9, 2016.

OVERVIEW

Introduction

Vitamins are defined as essential constituents of the diet that are not synthetized by humans. Some vitamins are synthesized to some extent, but in amounts that are usually inadequate to support health. Most vitamins were discovered during the investigation of severe deficiencies such as scurvy (vitamin C), rickets (vitamin D), megaloblastic anemias (vitamin K and folate), pellagra (niacin) and beriberi (thiamine). Most vitamins are not one specific molecule, but a group of related compounds that are capable of providing the necessarily essential molecular ingredient (thus nicotinic acid and nicotinamide for niacin and phytonadione and menadione for vitamin K). The recommended daily amounts or recommended daily intakes of most vitamins have been established by the Food and Nutrition Board of the Institute of Medicine. These recommendations provide guidance for standard dosing of vitamins in dietary supplements and multivitamin preparations. Approximately one-third of adult Americans take multivitamins and a substantial number take specific vitamin supplements.

Hepatotoxicity

When taken within the range of recommended amounts, vitamins have not been implicated in cases of drug induced liver injury. Even in high doses, most vitamins have few adverse events and do not harm the liver. Many vitamins are normally concentrated in, metabolized by and actually stored in the liver, particularly the fat soluble vitamins. The two exceptions to the lack of harm to the liver by higher doses of vitamins are vitamin A and niacin, both of which can cause distinctive forms of liver injury when taken in high doses.

Specific links to discussions of the risks of liver injury from specific vitamins are given below. The water soluble B vitamins are discussed together, whereas the fat soluble vitamins (A, D, E and K) and niacin, folate, vitamin C and vitamin K are discussed in separate documents. Specific examples of hepatotoxicity are given in the sections on vitamin A and niacin.

- Folic Acid (Folate, Folinic Acid)
- Vitamin A & Retinoids
  - Vitamin A
  - Acitretin, Etretinate, Isotretinoin
  - Bexarotene
- Vitamin B
  - Biotin (B5)
  - Choline
  - Cyanocobalamin (B12)
  - Niacin (B3, Nicotinamide, Nicotinic Acid)

    - Pantothenic Acid (B7)
    - Pyridoxine (B6)
    - Riboflavin (B2)
    - Thiamine (B1)
- Vitamin C (Ascorbic Acid)
- Vitamin D (Cholecalciferol, Ergocalciferol)
- Vitamin E (alpha Tocopherol)
- Vitamin K (Menadione, Phytonadione)

ANNOTATED BIBLIOGRAPHY

References updated: 09 May 2016

Zimmerman HJ. Hepatotoxicity: the adverse effects of drugs and other chemicals on the liver. 2nd ed. Philadelphia: Lippincott, 1999.

(Expert review of hepatotoxicity published in 1999, discussed vitamin A and niacin as causes of liver injury, but not the other B vitamins, vitamin C, D, E or K).

Seeff L, Stickel F, Navarro VJ. Hepatotoxicity of herbals and dietary supplements. In, Kaplowitz N, DeLeve LD, eds. Drug-induced liver disease. 3rd ed. Amsterdam: Elsevier, 2013: pp, 631-57.

(Review of hepatotoxicity of dietary supplements; does not discuss vitamins).

Shils ME, Olson JA, Shike M, Ross AC. Modern nutrition in health and disease. 9th ed. Baltimore: Williams & Wilkins, 1998.

(Textbook of nutrition with individual chapters on each of vitamins).

Food and Nutrition Board, Institute of Medicine. Dietary reference intakes. Washington DC: National Academy Press, 1998.

(Reports from the Food and Nutrition Board of the Institute of Medicine on reference values for vitamin intake; replacing the previously published Recommended Dietary Allowances).

Available at: https://ods.od.nih.gov/factsheets/list-all/

(Fact sheets on dietary supplements including vitamins maintained and regularly updated by the Office of Dietary Supplements, National Institutes of Health).

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