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MEGADOSES OF VITAMINS C, D, AND E

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INTRODUCTION

After the vitamins were discovered during 1915-1948 and their chemical and physical properties as well as physiological roles were learned, the importance of vitamins became accepted. However, there has been a great deal of controversy about the amounts of vitamins that should be consumed daily to support optimal health. Also there has been confusion about the difference between the terms "physiologic" and "pharmacologic" as applied to doses of vitamins (1). Different orders of magnitude of intake of vitamins C, D, and E are compared in Table 1. "Physiologic doses" represent the amounts of these vitamins recommended in 1974 by the Food and Nutrition Board of the National Research Council (NRC-RDA) (2) to meet the known nutritional needs of practically all healthy young male adults. A "pharmacologic dose" is generally in the range of ten times the physiological dose; it may be used to treat an illness or a condition quite unrelated to the generally recognized manifestations of a vitamin deficiency. A "toxic dose" of 100 times or more the physiologic dose may induce undesirable or toxic signs and symptoms.

Supplementation with vitamins has value for persons in certain situations: the elderly, those on low-calorie reducing diets, those taking certain medications (such as oral contraceptives and anti-epilepsy drugs), pregnant women, and infants who are not breast-fed. Some persons say they feel better and have more energy when taking vitamin supplements, even when no deficiency can be demonstrated. However, a common approach to vitamins has been: "If a little bit is good, a lot will be better, and enormous quantities still better". When excessive vitamins are taken into the body, they function as chemicals instead of vitamins. The body must

TABLE 1

Effects of varying doses of vitamins C, D, and E (1)

Substance	Physiologic Dose	Pharmacologic Dose	Toxic Dose and Manifestations of Toxicity
Vitamin C	45 mg	100-2000 mg	2000-4000 mg Reproductive failure Interferes with tests for glycosuria Reverses effects of anticoagulants May induce nephrolithiasis Inactivates vitamin B ₁₂ Induction of vitamin C dependent ayndrome
Vitamin D	400 IU	50,000- 100,000 IU Hypophosphatemic rickets	1000-3000 IU-(children)-Hypercalcemia 15,000 IU-(adult)-renal failure
Tocopherol	15 mg	300-1200 mg Cardiovascular disorder	1000 mg / kg (experimental animals) Increase deposition of cholesterol in aorta Decrease hepatic tolerance to ethanol

excrete excess chemicals which may interact with other substances and cause toxicity. However, according to a recent concept, some vitamins can be used in pharmacological dosages to prevent and treat certain diseases such as some forms of cancer. The purpose of this report is to review and discuss the uses and effects of megadoses of vitamin C, D, and E by animal and human beings.

VITAMIN C

Human requirements

Ascorbic acid is necessary for the hydroxylation of proline and lysine in the amino acid chain of collagen (3). The function of ascorbic acid in collagen formation makes it indispensable for the growth of fibroblasts, osteoblasts, and odontoblasts (4). The primary defect in scurvy, ascorbic acid deficiency disease, is the failure of collagen formation in the fibroblast in connective tissue (4).

Results of numerous studies have indicated that a daily intake of 10 mg of ascorbic acid is sufficient to alleviate and cure the clinical signs of scurvy in human subjects (5). This amount, however, may not be satisfactory for the maintenance of optimal health over a long period of time. Anderson (6) stated that the vitamin C level of blood can be increased only to a certain point by increasing the daily intake of vitamin C. Maximum blood concentrations are reached with intakes of 60 to 120 mg ascorbic acid per day. Tissue levels also appear to reach a plateau---referred to as "saturation of tissues". In this state, body stores of the average adult (estimated at approximately 4000 mg) decline at a constant rate of about 3 % per day. The 1974 NRC-RDA of 45 mg will maintain a body pool of 1500 mg which is 300 mg above the level that symptoms of scurvy begin to appear. Recently, there have been many claims for benefits of pharmacological doses of ascorbic acid. However, there are doubts about the safety of taking large amounts for long periods of times.

Vitamin C and the common cold

In his 1970 controversial book, "Vitamin C and the Common Cold",