Short Communication

Multivitamins : Use or Misuse?

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Introduction

It has been more than a century since an Englishman, William Fletcher in 1905 while researching the cause of the disease Beriberi, discovered that it could be prevented by eating unpolished rice. He concluded that the husk of rice must have special nutrients, which we know today as vitamins. The term vitamin originated from "vitamine," a word first used in 1911 by the Polish scientist Casimir Funk to designate a group of compounds considered vital for life; each was thought to have a nitrogen-containing component known as an amine. The final "e" of vitamine was dropped when it was discovered that not all of the vitamins contain nitrogen and, therefore not all are amines.

Role of Vitamins

The thirteen essential vitamins are either fat soluble (A,D,E,K) or water soluble vitamins viz. C, B_1 (thiamine), B_2 (riboflavin), B_3 (niacin), B_6, B_{12}, pantothenic acid, biotin and folate (folic acid). Fat soluble vitamins are stored in the body for prolonged periods and as a class deal with the regulation of protein synthesis. Vitamin C and B-complex vitamins are stored to a limited extent (except B_{12}) and frequent consumption is necessary.

B-complex vitamins generally form coenzymes and catalyse the oxidation of small molecules in the production of energy. Vitamin C is an anti-oxidant and plays a specific role in the hydroxylation of specific compounds [1,2]. A well balanced Indian diet is able to provide most vitamins and micronutrients except B_{12} in strict vegetarians (Table 1).

Vitamins in therapeutic amounts (normally 5-10 times, the recommended daily allowance) are indicated for the treatment of deficiency states or pathologic conditions in which absorption and utilisation of vitamins is reduced or when requirements are increased [3]. In addition, they are also recommended for the treatment of non-nutritional disease in which a large dose has a unique effect independent of nutritive activity e.g. alcoholic neuritis and Wernicke's syndrome (thiamine), hyperlipoproteinaemias (niacin), to prevent neuropathy in those on isoniazid (pyridoxine), sideroblastic anemia (pyridoxine), infantile seborrhea (biotin) and acute promyelocytic leukaemia (all-trans-retinoic acid) [4-7].

The term multivitamin came into vogue sixty years

Table 1

Vitamin content of common Indian food items

Vitamin	Thiamine	Riboflavine	Nicotinic Acid	Vitamin C	Vitamin A	CaroteneIU[b]	Vitamin D
(Recommended daily allowance)	(1500) µg	(1700) µg	(19) mg	(60) mg	(1000) IU		(200) IU
Rice, milled, boiled 1 cup	27	11	1.0	-	-	-	-
Wheat chapatti 15g	45	45	0.9	-	-	-	-
Egg medium, boiled 48gms	40	130	1.6	-	550	-	27
Milk, cow, 1 cup	100	360	2.3	4	300	-	8
Bengal gram (chana dal) 1 cup	87	127	1.1	-	-	-	-
Black gram (urad dal) 1 cup	76	92	1.5	-	-	-	-
Lentil (masur dal) 1 cup	81	125	1.0	-	-	-	-
Cabbage, cooked, ½ cup	40	40	-	58	-	-	-
Carrot,raw 1 large	60	60	-	-	-	12000	-
Roast chicken 100 gms	80	180	13	-	-	-	-
Mutton, lean 30 gms	70	95	4.2	-	-	-	-
Ghee 1 teaspoon	-	-	-	-	165	-	5
Butter 1 teaspoon	-	-	-	-	165	-	2

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ago when Miles Laboratory, United States marketed a combination of Vit A, Vit D, β-carotene, B-vitamins and micronutrients (iron, calcium etc). Since then a number of combinations have been marketed as multivitamins [8]. The National Health and Nutrition Examination Survey (NHANES) USA, defines multivitamin as a formulation containing three or more vitamins with or without minerals [9]. These may be marketed as specialised products such as multivitamin for men, senior women, menopausal women, persons with diabetes, for energy, for hair growth and so on. The content of each multivitamin is determined by the manufacturer, e.g. a brand of multivitamin available in the Armed Forces contains 26 vitamins and micro nutrients (Table 2). The bioavailability of the individual vitamin or micronutrient in a multivitamin depends on the homeostatic mechanism which regulates absorption and excretion depending on level of nutrient in the host. It also depends on the dose of each vitamin/micronutrient in a preparation of multivitamin and the interaction of the various components, for instance vitamin C increases the bioavailability of iron.

Multivitamin as Health Promoter: Is it Evidence Based ?

Both observational studies and randomised controlled trials (RCT's) have been conducted for studying effect of single nutrient supplementation or multivitamins in healthy individuals. Antioxidants scavenge free radicals and other reactive oxygen species that damage cellular membranes, organelles and macromolecules. There has been an interest in assessing the role of antioxidants (vitamin C, vitamin E and β carotenes found in vitamin A preparation) in cardiovascular disease and cancer. Several studies have shown that vitamin E in doses higher than recommended daily allowance had cardio protective effect. Low density lipoprotein concentration decreased significantly in blood taken from subjects receiving >200 IU a day but not in those on < 200 IU a day. A double blind placebo controlled trial showed a significant decrease in non-fatal myocardial infarction in high risk subjects consuming either 400 or 800 IU vitamin E/day as supplement. Vitamin E was also shown to be effective in prevention of cancer [1]. However, Lee et al [12], in a randomised controlled trial (Women's Health Study) using vitamin E 600 IU on alternate days in women >45 years, found no overall benefit for prevention of major cardiovascular diseases or cancer. The strength of the study lies in the fact that it involved a large population (39,876) studied over a long duration (10.1 years) of time.

In vitro observation and epidemiologic studies have shown that people with high intake of β carotene or high blood concentration of this nutrient have reduced risk of various diseases including cancer and heart disease. The effect has been attributed to antioxidant properties of β carotene. However when a RCT used β carotene and α tocopherol in Finnish smokers to test this hypothesis, there was an increase rather than decrease in the incidence of lung cancer in the β carotene group [13].

Higher intake of folate has been inversely associated with coronary heart disease (CHD), possibly due to decrease in homocysteine levels. The Nurses Health Study, a prospective cohort study of 1,21,700 nurses in the United States suggested that intake of folate and vitamin B_6 above the recommended dietary allowance may be beneficial for primary prevention of CHD among women. The primary sources of folate in this study were multivitamin and diet [14]. However a recent RCT has come up with contradictory evidence. A combination pill of folic acid (2.5mg), Vit B_6 (50 mg) and Vit B_{12} failed to reduce cardiovascular events among high risk women despite reduction in homocysteine levels [15].

Selenium in doses of 200 µg (thrice the recommended daily intake) was used in a multi centre double blind, placebo controlled trial to determine whether it decreased the incidence of cancer. After a follow up of 6.4 years, there was no decrease in the incidence of squamous or basal cell carcinoma (primary end point). However there was a significant reduction in cancer mortality, incidence of carcinoma of lung, prostate and colorectal carcinoma (secondary end point) [16]. This

Table 2

Nutrient content of "Standard" multivitamin tablet*

1.	Vitamin A	2500 IU	11.	Vitamin K	10 µg	21.	Chromium	25 µg
2.	Thiamine mononitrate	1 mg	12.	Zinc	15 mg	22.	Molybdenum	25 µg
3.	Vitamin B_2	1.5 µg	13.	Potassium iodide	0.15 mg	23.	Selenium	30 µg
4.	Vitamin B_{12}	1 mg	14.	Ferrous fumarate	10 mg	24.	Nickel	5 µg
5.	Vitamin C	50 mg	15.	Magnesium	100 mg	25.	Tin	10 µg
6.	Vitamin D	200 mg	16.	Manganese	2.5 mg	26.	Silicon	2 mg
7.	Alpha tocopherol	7.5 mg	17.	Copper	2 mg	27.	Vanadium	10 µg
8.	Calcium pantothenate	5 mg	18.	Calcium	162 mg	28.	Boron	150 µg
9.	Folic acid	15 mg	19.	Potassium chloride	40 mg			
10.	Nicotinamide	20 mg	20.	Chloride	36.3 mg			

* Branded multivitamin tablet available at service hospital