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Vitamin B: A review of the Food Sources and their Deficiencies

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ABSTRACT

Vitamins play a significant role in improving and maintaining the health of an individuals. Though every vitamin has its own importance, Vitamin B is a vitamin of a very diverse nature. The B vitamins are identified as follows: thiamine (B1), riboflavin (B2), niacin (B3), pantothenic acid (B5), pyridoxine (B6), biotin (B7), folate (B9), and cobalamin (B12). B vitamins act as coenzymes in several enzymatic processes that support every aspect of cellular physiological functioning, including major functions within the brain and nervous system. Numerous studies on the cellular and physiological functions of vitamins and related discussions on their effects on health and the long-term health implications are going on in the scientific domain. The author tries to review Vitamin B in terms of its food sources and deficiencies, addressing which speed of widespread diseases can be curbed.

Keywords: Vitamins, Deficiency, Food Sources, Health

INTRODUCTION

Worldwide, the majority of individuals take a daily multivitamin to treat or prevent chronic illnesses. People consume a high prevalence of vitamins due to unregulated vitamin advertisements and the widespread availability of these substances. The use of multivitamins and minerals supplements is widespread in many industrialized countries, despite the fact that their efficacy is uncertain. In the past several years, there has been a sharp rise in the percentage of adults who use daily vitamin and mineral supplements. Half of the people over 55 years old and one-third of adults say they use at least one supplement daily. Since 1997, there has been a growth in the sales of supplements, which in the US reached $18.8 billion in 2003.

Over the past three decades, antioxidants including carotenoids, ascorbic acid (vitamin C), and α-tocopherol (vitamin E) have received a great deal of attention. Through lipid per oxidation and DNA damage, free radicals can contribute to the development of cancer and cardiovascular disease (CVD). According to basic research, antioxidants prevent cardiovascular disease by neutralizing organic free radicals and excited oxygen molecules. By blocking the oxidation of low-density lipoprotein cholesterol (LDL-C), reducing thrombotic potential, altering platelet activity, and altering vascular responsiveness, antioxidants can stop the development of atherosclerotic plaque. The majority of individuals think that vitamins are at least safe even if they are ineffective. Despite numerous studies on the cellular and physiological functions of vitamins and intriguing discussions over their effects on health, the long-term health implications, the debates are still going on.

B vitamins, also known as B-complex vitamins, play an essential roles in catabolic and anabolic metabolism in the human bodies. These 8 water-soluble vitamins are excreted in urine and require repletion daily. The B vitamins are identified as follows: thiamine (B1), riboflavin (B2), niacin (B3), pantothenic acid (B5), pyridoxine (B6), biotin (B7), folate (B9), and cobalamin (B12). B vitamins act as coenzymes in several enzymatic processes that support every aspect of cellular physiological functioning, including major functions within the brain and nervous system. Any B vitamin deficiency can negatively affect mitochondrial metabolism of amino acids, glucose, and fatty acids through the citric acid cycle and electron transport chain. This article focuses on reviewing the members of the B complex and their associated deficiencies.

Vitamin B1 (Thiamine)

Food Sources:

Thiamine is found in most foods, though whole grains, pork, fish, and yeast are particularly rich sources. Processed foods such as cereals, bread, dairy products, and infant formulas are fortified with thiamine because of the characteristics inherent in it.

THIAMINE DEFICIENCY/TOXICITY

Common symptoms of thiamine deficiency are seen mostly with alcoholism and comprise 2 syndromes: Wernicke-Korsakoff syndrome and beriberi.

Wernicke-Korsakoff syndrome can present with 2 disorders. Wernicke encephalopathy appears at the beginning of the disease course, presenting with a triad of ataxia, ophthalmoplegia, and altered mental status. Korsakoff psychosis may develop if left untreated, consisting of delirium and permanent memory loss. Wernicke-Korsakoff syndrome should be treated emergently to prevent disease progression and permanent brain damage.

Beriberi's early symptoms include nausea, suppressed appetite, constipation, fatigue, mental suppression, peripheral neuropathy, and weight loss. Symptoms can manifest as either wet beriberi or dry beriberi as the disease progresses. Wet beriberi presents with cardiomyopathy, heart failure, edema, warm extremities, pleural effusions, and pulmonary edema. Dry beriberi affects mainly the peripheral nervous system, causing paresthesia, foot drop, muscle wasting, numbness, and absent ankle reflexes

Vitamin B2 (Riboflavin)
Food Sources
Riboflavin is found naturally in eggs, dairy products, green vegetables, meat, mushrooms, and almonds. It is also available as a supplement and added to rice, corn, and flour, to address the deficiencies in the food.

RIBOFLAVIN DEFICIENCY/TOXICITY
Riboflavin toxicity is rare due to its efficient excretion by the kidneys. Deficiency, however, can lead to skin abnormalities, angular stomatitis, cheilosis, depression, fatigue, anemia, sore throat, hair loss, liver toxicity, and nervous system issues.

Vitamin B3 (Niacin)
Food Sources
Niacin is found in animal and plant-based foods, including soy, nuts, seeds, legumes, and grains. Many grains, such as bread and cereals, and infant formulas are fortified with niacin.

NIACIN DEFICIENCY/TOXICITY
Pellagra, caused by niacin deficiency, is rare in developed countries because their diets have the average recommended amount of niacin. Pellagra is characterized by "the 3 Ds": dementia, diarrhea, and dermatitis. Other associated manifestations include memory loss, depression, disorientation, headaches, apathy, fatigue, vomit, a swollen mouth, and a scaly rash on sun-exposed skin. Pellagra may be lethal if not treated timely.

Vitamin B5 (Pantothenic Acid)
Food Sources
Small amounts of pantothenic acid are typically found in nearly all food, with more substantial quantities in fortified cereals, infant formulas, dried foods, mushrooms, eggs, fish, avocados, chicken, beef, pork, sunflower seeds, sweet potatoes, and lentils

PANTOTHENIC DEFICIENCY/TOXICITY
Although rare in developed countries, deficiency symptoms may include increased arthritic pain, fatigue, irritability, headaches, and gastrointestinal issues. Nearly all symptoms resolve after resuming intake of pantothenic acid.

Vitamin B6 (Pyridoxine)
Food Sources
Pyridoxine is found in beef, poultry, starchy vegetables, non-citrus fruits, and fortified cereals

PYRIDOXINE DEFICIENCY/TOXICITY
Pyridoxine deficiency is commonly associated with other B vitamin deficiencies, such as folic acid and vitamin B12, and is rare in isolation. Deficiency of active pyridoxine is found in chronic alcohol dependence, chronic renal failure or autoimmune disorders, obesity, pregnancy, preeclampsia, eclampsia, and malabsorptive states such as celiac disease, inflammatory bowel disease, and bariatric surgery. Pyridoxine deficiency is associated with microcytic-anemia, electroencephalographic abnormalities, dermatitis with cheilosis, glossitis, depression, confusion, and weakened immune

function. Individuals with mild deficiency might show no symptoms or signs for months or years. Pyridoxine deficiency in infants causes irritability, abnormally acute hearing, and convulsive seizures.

Vitamin B7 (Biotin)
Food Sources
Biotin is found naturally in organ meats, eggs, fish, seeds, soybeans, and nuts but is also available through supplementation

BIOTIN DEFICIENCY/TOXICITY
Biotin deficiency is rare outside of high-risk populations, such as those who experience biotinidase deficiency, alcoholism, chronic use of epileptic medications, and pregnant or breastfeeding women. Excessive biotin levels have no known toxic effects. Biotin deficiency is associated with hair thinning, a scaly rash around the eyes, nose, mouth, and perineum, nail changes, skin infections, and neurologic symptoms such as ataxia, seizures, depression and lethargy

Vitamin B9 (Folate)
Food Sources
Folate is present in plenty of foods, with the highest levels in dark green leafy vegetables, nuts, beans, dairy products, meat, poultry, grains, and sprouts.

FOLATE DEFICIENCY/TOXICITY
Deficiency is associated with poor diet, alcoholism, and malabsorptive disorders. Folate deficiency can lead to megaloblastic anemia, characterized by large erythrocytes with abnormal nuclei. Patients may report weakness, fatigue, poor concentration, irritability, headaches, and palpitations. Deficiency can also cause oral ulcerations and changes in skin, hair, and fingernails. Maternal low folate levels during pregnancy increase the chance of congenital birth defects, including fetal neural tube defects, and congenital heart defects, in addition to low birth weight, preterm labor, and delayed fetal growth. Concurrent B12 deficiency should be ruled out before repletion of folate to reverse the megaloblastic anemia. Repletion of folic acid will correct the macrocytic anemia but will not prevent the neuropathy related to cobalamin deficiency and its toxic neurologic effects because of elevated methylmalonic acid levels.

Vitamin B12 (Cobalamin, Cyanocobalamin, Methylcobalamin)
Food Sources
Cobalamin is found in animal products and fortified foods

COBALAMIN DEFICIENCY/TOXICITY
Deficiency may be present as megaloblastic anemia, fatigue, low appetite, and neuropsychiatric symptoms. If not treated, neuropsychiatric illness and irreversible neurologic damage occur. The most affected groups are older adults, patients with pernicious anemia, pregnant and lactating women, and those with gastrointestinal disorders. Individuals on a vegetarian diet should consider supplementation in addition to the geriatric population. High doses of cobalamin are unlikely to cause toxicity

Vitamin B	Bioactive Enzyme	Deficiency Symptom
Thiamine (B1)	TPP	Mild: fatigue, anorexia, and impaired reaction to stress Deficiency: Beriberi, endocarditis, arrhythmia, and sudden death
Riboflavin (B2)	Flavoproteins: flavin adenine dinucleotide or flavin mononucleotide (redox reactions)	Stomatitis, cheilitis, glossitis, dermatitis, eye irritation, cataracts, and anemia
Niacin (B3)	Nicotinamide adenine dinucleotide and nicotinamide adenine dinucleotide phosphate	Pellagra: dermatitis, photodermatitis, burning and twitching in extremities, and diarrhea
Pantothenic acid (B5)	Coenzyme A	Diarrhea, numbness, burning sensations, and dermatitis
Pyridoxine, pyridoxal, pyridoxamine (B6)	Pyridoxal 5′-phosphate	Anemia
Biotin (B7)	Biotin	Dermatitis and tingling in extremities

Folic acid, folate (B9)	Methyltetrahydrofolate	Megaloblastic anemia, peripheral neuropathy, and spinal cord lesion
Cobalamins (B12)	Methylcobalamin and 5'-deoxyadenosylcobalamin	Same as folic acid deficiency

CONCLUSION

'Good Health and Well Being' one of the 17 goals of the Sustainable Development Goals designed by the United Nations. To maintain the good health, vitamins play an effective role in the human body. The article has tried to review the Food Sources and the deficiencies related to Vitamin B: thiamine (B1), riboflavin (B2), niacin (B3), pantothenic acid (B5), pyridoxine (B6), biotin (B7), folate (B9), and cobalamin (B12). The author has tabulated Vitamin B, its bioactive enzymes, and the symptoms related to its deficiencies.

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