

Fundamental Aspects of Vitamin B complex in Human Nourishment and Fitness

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Abstract

Vitamins are vital building blocks of the body and help to keep human in good health. This article explains about what vitamins are, what they do and which foods provide each type of vitamin. The vitamin B-complex refers to all of the known essential water-soluble vitamins except for vitamin C. These include eight B vitamins namely thiamine (vitamin B1), riboflavin (vitamin B2), niacin (vitamin B3), pantothenic acid (vitamin B5), pyridoxine (vitamin B6), biotin (Vitamin B7), folic acid (Vitamin B9) and the cobalamins (vitamin B12). Vitamin B complex, play an important role in keeping our bodies running like well-oiled machines and these essential nutrients help to convert food into fuel and thus allowing us to stay energized throughout the day. Each member of the B-complex has a unique structure and performs unique functions in the human body. Vitamins B1, B2, B3 and B7 participate in different aspects of energy production, vitamin B6 is essential for amino acid metabolism, and vitamin B12 and B9 facilitate steps required for cell division. Each of these vitamins has many additional functions; however, no function requires all B-complex vitamins simultaneously. For making of new cells in our body, regulating nervous and digestive systems, and promoting red blood cells to reduce the risk of birth defects, B-complex vitamins enriched foods should be included in our daily diet. Generally, human requirements for members of the B-complex vary considerably from 3 mcg per day for vitamin B12 to 18 mg per day for vitamin B3 in adult males. Therefore, taking equal amounts of each one as provided in many B-complex supplements makes little sense. Furthermore, there is little evidence in supporting the use of mega doses of B-complex vitamins to combat everyday stress, boost energy or control food cravings, unless a person has a deficiency of one or more of these. Again, contrary to popular belief, there is no evidence indicating that people should take all B vitamins to avoid an imbalance when one or more individual B vitamin is taken for a specific health condition. Most multivitamin products contain the B-complex along with the rest of the essential vitamins. Since they are more complete than B-complex vitamins alone, multiple vitamin-mineral supplements are recommended to improve overall micronutrient intake and prevent deficiencies. With so many supplements being advertised, it is hard to figure out which ones work and which ones are right. As a result, seek consultation of medical professional to work out what vitamin is right for someone's health.

Keywords

Vitamin, Vitamins B Complex, Supplements, Multivitamins, Diet

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1. Introduction

Health is a state of complete physical, mental and social well-being and not only the absence of disease or infirmity [1-5]. It means that health is a resource to support an individual's function in wider society, and a healthful lifestyle provides the means to lead a full life with meaning and purpose [6, 7].

Healthcare exists to help people maintain the optimal state of health as well as physical capacities. Essential nutrients are compounds that the body cannot make or cannot make in sufficient quantity, therefore, these nutrients must come from food, and they are vital for disease prevention, growth and good health. Though there are many essential nutrients, macronutrients are eaten in large amounts, whereas vitamins are micronutrients and their small doses go a long way [8, 9].

Among vitamins, vitamin B has been once thought to be a single nutrient that existed in extracts of rice, liver or yeast. But, researchers later discovered that these extracts contained several vitamins, which have been given distinguishing numbers. Vitamins B are a class of water-soluble vitamins that play important roles in cell metabolism. Though these vitamins share similar names, research shows that they are chemically distinct vitamins that often coexist in the same foods. In general, dietary supplements containing all eight vitamins [B vitamins namely thiamine (vitamin B1), riboflavin (vitamin B2), niacin (vitamin B3), pantothenic acid (vitamin B5), pyridoxine (vitamin B6), biotin (Vitamin B7), folic acid (Vitamin B9) and the cobalamins (vitamin B12)] are referred to as a vitamin B complex [10].

Human requirements for members of the B-complex vary considerably from 3 mcg per day for vitamin B12 to 18 mg per day for vitamin B3 in adult males. Therefore, taking equal amounts of each one as provided in many B-complex supplements makes little sense. Furthermore, there is a little evidence in supporting the use of mega doses of B-complex vitamins to combat everyday stress, boost energy or control food cravings, unless a person has a deficiency of one or more of these. Again, contrary to popular belief, there is no evidence indicating that people should take all B vitamins to avoid an imbalance when one or more individual B vitamin is taken for a specific health condition [11, 12].

Eight individual B vitamins (thiamine, riboflavin, niacin, pantothenic acid, pyridoxine, biotin, folic acid, and cobalamins) make up this family of nutrients that help to convert the human's food eaten into cellular energy that fuels to our bodies for many chemical reactions. B vitamins are also important for the normal functioning of the nervous system. B-complex vitamins are organic compounds that must be consumed in our diet because humans cannot

synthesize them in adequate quantities [13]. Therefore, this article takes a detailed look at the health effects of B-complex vitamins, their role, what they do, which foods provide each type of vitamin, various vitamin deficiencies and factors for preventing the occurrence or progression of certain vitamins deficient diseases.

2. Benefits of Vitamin B Complex

Vitamin B complex has recently received attention within the world of beauty, with a number of studies demonstrating how the inclusion of Vitamin B in face creams can help to prevent ageing. In particular, nicotinamide, a derivative of vitamin B3 (niacin), has been shown to improve the ability of epidermis, upper-most layer of skin, retain moisture by leading to softer and smoother skin with less dryness and flakiness, and a reduction of fine lines. B-complex vitamins enhance beauty by promoting of healthy hair, skin and nails, by counteracting damage caused by free-radicals molecules that breakdown healthy cells and contribute to ageing and disease. Nicotinamide can also serve as an effective skin-lightening agent when added to moisturizers.

B vitamins help us to metabolize food sources, providing nutrients to the whole body including the hair and hair follicles. Deficiencies of vitamins B1, B2 and B3, can result in poorly-nourished hair follicle cells. Not getting of enough vitamin B9 or folic acid can slow down cell division within the hair follicles, which also slows down hair growth [14, 15].

Vitamin B7 (biotin) is also essential for maintaining the texture, tone and strength of our locks, and its deficiency can lead to hair loss. This vitamin can also be used to treat cradle cap; a scalp condition which affects infants. If anyone is suffering with chronic skin issues or even just sick of dealing with a dull and unhealthy complexion, the cause may be a vitamin B deficiency. Vitamin B12 helps to regulate our skin's pigment production and location, and preventing of hyperpigmentation- darkening of skin in certain parts of body. A study by Bisset *et al.* [16], demonstrates that a topical form of vitamin B has shown to dramatically reduce the effects of ageing in human skin.

Vitamin B3 is used to improve the appearance or severity of some skin conditions, whereas both topical and oral supplements of nicotinamide, a form of vitamin B3, can help to minimize acne by helping the body to breakdown oils in the form of triglycerides and cholesterol. Research reported shows that supplementation of vitamin B5 can also help to lower triglyceride and cholesterol levels, indirectly by promoting of healthy skin. Vitamin B5 also helps to promote

faster healing of skin wounds and is most effective when combined with vitamin C. Our nails require a well-balanced, nutrient-rich diet in order to grow and live healthy. A number of B vitamins are important for nail health. Vitamin B12 (riboflavin) helps the body to absorb the essential mineral iron, which is necessary for healthy and strong nails. Without enough access to usable iron, the fingernails can turn white, brittle, thin and grow abnormally [17, 18].

Vitamin B12 in addition to nail health also plays an important role in the formation of red blood cells. A deficiency of B12 can lead to the development of anaemia. One of the symptoms of anaemia is pale, unhealthy or unsightly nails. Vitamin B9 (folate) is also important for the health and growth of nails, as this helps with the development of new cells. Thiamine (vitamin B1), pantothenic acid (vitamin B5) and other B vitamins have all been shown to play a role in wound healing. For this reason, some healthcare practitioners recommend a high-potency B vitamin supplement to promote wound healing [19].

People with recurrent canker sores may have a B vitamin deficiency. Supplementing with vitamins B1, B2 and B6 has been reported to provide relief. The relationship between B vitamins and rosacea is unclear, however, one study found it caused rosacea like symptoms, and other preliminary reports have found benefits. Research suggests that heavy Drinkers have an increased need for B vitamins and it is possible that successful treatment of B-complex vitamin deficiencies may actually reduce alcohol desires. Double-blind research suggests that supplementing with vitamin B-complex multivitamin may reduce feelings of anxiety, perceived stress and tiredness [20, 21].

B-complex vitamins are needed to produce energy from carbohydrates. Exercisers may have slightly increased requirements for some of the B vitamins, including vitamins B2, B6 and B5. An athletic performance can suffer if these slightly increased needs are not met. B vitamins have been used for attention deficit hyperactivity disorder. High amounts of B vitamins have shown mixed results in relieving of attention deficit hyperactivity disorder. In one study, treatment with a hydrochloric acid supplement and a vitamin B-complex supplement has helped to treat people with hives. For people who have inadequate absorption of vitamin B12 due to low stomach acid, supplementing with vitamin B complex can help to correct a deficiency [22].

In one trial postmenopausal women who combined hormone replacement therapy with B vitamins and other nutrients, and dietary changes increased their bone density by a remarkable 11%. Research has linked B vitamin deficiencies to premenstrual syndrome, so some women may benefit from supplementing with B-complex vitamins for symptom relief.

In some studies, taking of vitamin B-complex along with other nutrients appeared to prevent the development of tardive dyskinesia. Para-aminobenzoic acid, a compound commonly found in B-complex vitamins, has been shown to re-pigment skin affected by vitiligo [23, 24].

3. Role, Source, Deficiency and Dosage of Vitamin B Complex

Worthy sources for B vitamins are legumes including pulses or beans, whole grains, potatoes, bananas, chilli peppers, tempeh, nutritional yeast, brewer's yeast and molasses. Even though the yeast used to make beer results in beers being a source of B vitamins, yet their bioavailability ranges from poor to negative as drinking of ethanol inhibits absorption of thiamine (B1), riboflavin (B2), niacin (B3), biotin (B7) and folic acid (B9). In addition, each of the preceding studies further emphasizes that an elevated consumption of beer and other alcoholic beverages results in a net deficit of those B vitamins and the health risks are associated with such deficiencies [25].

Several of the following substances have been referred to as B complex vitamins as they are believed to be vitamins.

3.1. Vitamin B1 (Thiamine)

Vitamin B1 is also called thiamine and this vitamin helps to convert food into energy and has neurological benefits. It helps with energy production in our body. Thiamine is responsible for turning carbs into energy, as well as improving brain, muscle and nervous system health and function. B1 helps the body to make healthy new cells. It is often called an anti-stress vitamin because of its ability to protect the immune system. The carbo-loading (either to prepare for a big race or just because pizza tastes that is good), studies say that this vitamin is necessary to help break down those simple carbohydrates [26].

Deficiency of vitamin B1 can cause numbness, tingling and loss of sensation. People who do not consume enough thiamine may experience poor appetite, weight loss, confusion, memory loss, muscle weakness or cardiovascular symptoms. Deficiencies of thiamine generally do not pose a problem. This is due to the fact that many foods, such as milk and whole-grain cereals, are fortified with the vitamins. It can become an issue with people who misuse alcohol, however, presenting symptoms such as confusion and cracks along the sides of the mouth [27].

Most people get thiamine from breakfast cereals and whole grains. It can be found in whole grain, bread and cereals. Thiamine is found in high concentrations in fortified cereals,

whole grains, enriched whole grain products (like brown rice), peanuts, spinach, kale, blackstrap molasses and wheat germ, black beans, trout, mussels, and tuna (a saltwater fish). The heating of foods may reduce their thiamine content. Its non-vegetarians sources are found in liver and eggs [28].

An adult man should aim for 1.2 mg of thiamine, while adult woman needs 1.1 mg and pregnant or lactating women need 1.4 mg daily dosage. The intake of 0.8 to 1 mg per day is sufficient.

3.2. Vitamin B2 (Riboflavin)

Vitamin B2 is also called riboflavin and this vitamin helps to maintain proper eyesight. Riboflavin helps the body to use other B vitamins, converts food into fuel, and assists with red blood cell production and growth. This B vitamin works as an antioxidant to help fight free radicals (particles in the body that damage cells). It may also prevent early aging and the development of heart disease. And, riboflavin is important for red blood cell production, which is necessary for transporting of oxygen throughout the body. Several studies suggest that B2 can help to stave off migraines, but more research is needed to be sure. And be careful, while sunlight does to the body good, ultraviolet light reduces the riboflavin content in food sources. Consumers should purchase milk, for instance, in opaque containers in order to keep this vitamin from breaking down [29].

Inadequate intake of riboflavin may lead to skin conditions, mouth sores, cracked and swollen lips, hair loss, sore throat, liver disorders, problems with the reproductive and nervous systems, and, in severe cases, anaemia or cataracts. Cracks at the corners of the mouth, light sensitivity and a sore or red tongue are the problems a human can face if do not have vitamin B2. Riboflavin is present naturally in eggs, organ meat, lean meats, milk and green vegetables. It is also found in fortified cereals and enriched whole grain products. Dark green vegetables, spinach, brussels sprouts, legumes, whole and enriched grain products, almonds, wild rice, yogurt, and soybeans and milk, along with liver and eggs should be eaten. Getting 1.1 to 1.3 mg per day of this vitamin helps to release energy from foods, promotes good vision and healthy skin [30].

3.3. Vitamin B3 (Niacin)

Niacin is essential to healthy digestive system function. It also aids in the production of hormones, as well as skin and nerve functioning, and assists with the conversion of food to energy. Vitamin B3 (niacin) also helps to convert food into energy. It aids in proper digestion and healthy appetite as well. One of the primary uses for niacin is to boost High-density lipoproteins (HDL) cholesterol (i.e., the good cholesterol). And the higher a person's HDL, the less bad cholesterol he or she will have in their blood. Vitamin B3

deficiency is very rare in developed countries, though alcoholism has been shown to lower B3 levels in some individuals. Niacin, used topically and ingested, has also been found to treat acne [31].

A lack of niacin can cause digestive issues, such as nausea and abdominal cramps. Severe deficiency may also cause mental confusion. The chicken tacos with peanut sauce are a great way to get niacin in our diet. Niacin deficiency may show up in the form of confusion and mental impairment, digestive problems, inflamed mucous membranes, and scaly skin sores.

It is recommended that men may consume 16 mg of niacin, while women should aim for 14 mg daily dosage. Pregnant women need 18 mg and those who are lactating need 17 mg. Just be sure not to go over 35 mg per day, as large doses can cause increased blood sugar, liver damage, peptic ulcers and skin rashes. The best bet for boosting of niacin intake is to eat foods such as eggs, fish, lean meats, poultry, peanuts, dairy products, rice, fortified cereals, yeast, red meat, milk, eggs, beans and green vegetables, and enriched bread. Niacin is also found in chicken, fish, liver, red meat, whole grains such as wheat and barley, and peanuts [32].

3.4. Vitamin B4 (Adenine)

Vitamin B4 also known as Adenine is the member of the Vitamin B complex family and also one of the water-soluble vitamins. Vitamin B4 is actually a former designation given to several distinct chemical compounds, none of which is currently considered a true vitamin, for instance, adenine, carnitine and choline. Choline is synthesized by the human body, but not sufficiently to maintain good health and now considered an essential dietary nutrient. Adenine is a nucleobase synthesized by the human body. Adenine is a compound that acts as a co-enzyme with other compounds such as vitamins and helpful in producing of energy. Adenine is the one of the nitrogenous bases of DNA also helpful in making of code for DNA and very important component of the DNA. It is a purine and forms a bond with thiamine in the DNA as well as also reduces cholesterol levels. Carnitine is involved in metabolism and can be synthesized by most of humans. This vitamin B4 also forms a part of adenosine triphosphate (ATP), which is important in the transport of energy between many reactions and also forms adenosine that plays an important role in various biochemical processes. It enables the change of phosphate group, which then provides energy that is very necessary for various cellular reactions and cells' life [33].

Since, vitamin B4 acts as a co-enzyme with other vitamins, so it therefore, enhances metabolism. It increases formation of antibodies, which are helpful in counteracting of various

infections. It plays a role as a precursor of assimilation of other B vitamins. It helps to remove fatigue, weakness and debility, and causes promotion of cell formation as well as normal growth. It increases the transit time of the intestinal tract of the body. It also helps to maintain balance of blood sugar levels in our body, and strengthens immune system and its response. It causes prevention of cellular mutation and formation of free radical. This vitamin B4 has been found useful in the treatment of various diseases such as ulcer, constipation and dyspepsia. It may be useful in treating of bile obstruction, alopecia, sinusitis and dandruff. It is helpful in curing of atria tachycardia. Adenine forms several tautomers (structural isomers) compounds that can be rapidly interconverted and are often considered equivalent [34].

Deficiency of vitamin B-4 leads to growth retardation blood disorders, skin disorders and gastrointestinal disturbances, such as constipation, vomiting or nausea. It causes muscle weakness, sensitivity to insulin and low blood glucose level. There may arise physical as well as mental depression, fatigue, anaemia vertigo, dizziness and allergies, and increase susceptibility to infections occurs due to poor immune system. It mostly occurs in the plants, some vegetables, Brewer's yeast, propolis, fresh fruits, whole grains containing breads and cereals, bee pollen, raw unadulterated honey, and royal jelly. It is also found in complex carbohydrates. Adenine is also found in the various herbs such as blue cohosh, blessed thistle, ginger, burdock, cascara sagrada, capsicum (cayenne), caraway, catnip, cloves and couch grass [35].

This vitamin is available as nicotinamide adenine dinucleotide (NAD) and usually taken 25-75 mg a day in an empty stomach. But, sometimes it is combined with 200 mg of ribose.

3.5. Vitamin B5 (Pantothenic Acid)

Pantothenic acid is a vitamin also known as vitamin B5, and a water-soluble vitamin that is found in all living cells within the body. Pantothenic acid is responsible for breaking down of fats and carbs for energy, as well as producing red blood cells and cholesterol. It also assists to the body in using of other vitamins, such as riboflavin. Studies have shown that there are plenty of important B5 vitamin roles within the body, such as converting of nutrients from food into energy, balancing blood sugar, reducing bad cholesterol, lowering high blood pressure, preventing nerve damage and pain, and preventing heart failure [36].

In addition to breaking down of fats and carbs for energy, it is responsible for the production of sex and stress-related hormones including testosterone. Studies show that B5 also promotes healthy skin with the ability to reduce signs of skin aging such as redness and skin spots. Like the other B

vitamins, vitamin B5 plays a role in energy metabolism, acting as a coenzyme to energy-producing chemical reactions. It plays a role in the synthesis of fat, hormones and carbohydrates, which is taken from the foods eaten, turning them into usable energy that the body uses in many ways. Pantothenic meaning "from everywhere", so vitamin B5, can be in small amounts within just about every food group. Pantothenic acid is important for our bodies to properly use carbohydrates, proteins, and lipids and for healthy skin. Pantothenic acid can be got from Avocados, yogurt, eggs, meat and legumes. It is widely found in both plants and animals including meat, vegetables, cereal grains, legumes, eggs and milk [37].

People take pantothenic acid for treating of dietary deficiencies, acne, alcoholism, allergies, baldness, asthma, attention deficit-hyperactivity disorder (ADHD), autism, burning feet syndrome, yeast infections, heart failure, carpal tunnel syndrome, respiratory disorders, celiac disease, colitis, conjunctivitis, convulsions and cystitis. It is also taken by mouth for dandruff, depression, diabetic nerve pain, enhancing immune function, improving athletic performance, tongue infections, grey hair, headache, hyperactivity, low blood sugar, trouble sleeping (insomnia), irritability, low blood pressure, multiple sclerosis, muscular dystrophy, muscular cramps in the legs associated with pregnancy or alcoholism, neuralgia, and obesity. Pantothenic acid is also used orally for osteoarthritis, rheumatoid arthritis, Parkinson's disease, nerve pain, premenstrual syndrome (PMS), enlarged prostate, protection against mental and physical stress and anxiety, reducing adverse effects of thyroid therapy in congenital hypothyroidism, reducing signs of aging, reducing susceptibility to colds and other infections, retarded growth, shingles, skin disorders, stimulating adrenal glands, chronic fatigue syndrome, salicylate toxicity, streptomycin neurotoxicity, dizziness, and wound healing. People apply dexpanthenol, which is made from pantothenic acid, to the skin for itching, promoting healing of mild eczemas and other skin conditions, insect stings and bites, poison ivy, diaper rash, and acne. It is also applied topically for preventing and treating of skin reactions to radiation therapy [38, 39].

Fortunately, pantothenic acid deficiency is rare and those who do suffer from it may experience numb or burning hands and feet, extreme fatigue, headache, irritability, restlessness, sleeping problems, digestive problems, and loss of appetite [40].

Adults should consume 5 mg of pantothenic acid, though pregnant women need 6 mg and lactating women should aim for 7 mg daily dosage. The best dietary sources of pantothenic acid include beef, poultry, seafood, organ meats, eggs, milk, shiitake mushrooms, avocados, potatoes, broccoli, whole grains (brown rice, oats), peanuts, sunflower

seeds and chickpeas.

3.6. Vitamin B6 (Pyridoxine)

Pyridoxine (more commonly referred to as vitamin B6), is critical for over 100 enzyme reactions required for metabolism. It is also necessary for healthy brain development during pregnancy and infancy, and it plays a role in immune function and helping to use and store energy. Along with fellow B vitamins 12 and 9, B6 helps to regulate levels of the amino acid homocysteine (associated with heart disease). Pyridoxine is a major player in mood and sleep patterns because it helps the body to produce serotonin, melatonin and norepinephrine, a stress hormone. Some studies suggest that vitamin B6 can reduce inflammation for people with conditions like rheumatoid arthritis. Vitamin B6 (pyridoxine) helps the body to turn food into energy. It can also help the body to fight infections. Pregnant and breastfeeding women need it to help their babies' brains develop normally [41, 42].

Vitamin B6 deficiency is uncommon, but symptoms such as anaemia, skin rashes and scaly skin around the lips, cracks at the corner of the mouth, swollen tongue, depression, confusion, and weak immune system may be indicative of it. Insufficient amounts of B6 can result in anaemia as well as skin disorders, such as a rash or cracks around the mouth. A lack of B6 also can cause depression, confusion, nausea, anaemia, susceptibility to infections and skin rashes (dermatitis).

If a person is an adult under 50 years, an RDA of 1.3 mg of vitamin B6 is recommended daily. Men over 50 should bump it up to 1.7 mg and women in the same age group should aim for 1.5 mg. Pregnant women should consume 1.9 mg and lactating women need the most, at 2 mg. Although it would be hard to exceed 100 mg per day, avoid doing so in the long term as it is associated with severe nerve damage, painful skin patches, sensitivity to sunlight, nausea and heartburn. Vitamin B6 is found in fruits (other than citrus), starchy vegetables like potatoes, poultry, fish, organ meats and fortified cereals. Also get it from chicken, turkey, tuna, salmon, lentils, sunflower seeds, cheese, brown rice and carrots. B6 can be found in chickpeas, whole grains and cereals (a portion is the size of our fist), beef liver, ground beef, chicken breast, watermelon (a serving of fruit is also no larger than a fist), and spinach (a serving size is equivalent to a rounded handful) [43, 44].

3.7. Vitamin B7 (Biotin)

Biotin or vitamin B7, also called vitamin H (for hair and skin), is involved in a wide range of metabolic processes, both in humans and other organisms, primarily related to the utilization of fats, carbohydrates, and amino acids. Biotin assists in various metabolic reactions involving the transfer

of carbon dioxide. It may also be helpful in maintaining a steady blood sugar level. Because of its association with healthy hair, skin and nails, this B vitamin biotin is also best known 'the beauty vitamin'. It may help to people with diabetes control and high blood glucose levels, too. This B vitamin is especially important during pregnancy because of its vital for normal growth of the baby, but it is also used by the body to metabolize food for energy. Biotin deficiency is super rare, but symptoms include hair loss, brittle nails, skin rashes or infections, pinkeye, high acid levels in the blood and urine, seizures and nervous system disorders. Other deficiency symptoms include dermatitis (itchiness, red skin and rash) in the form of scaly, red rash around the eyes, nose, mouth and genital area. Neurological symptoms in adults occur such as depression, lethargy, hallucination, and numbness and tingling of the extremities [45, 46]

The best dietary sources of biotin include beef, organ meat, egg yolks, wheat germ, sunflower seeds, sweet potatoes, almonds, whole grains, sardines, spinach and broccoli. Foods high in biotin are barley, liver, yeast, chicken, fish, potatoes, cauliflower, egg yolks and nuts. Adults should aim to consume 30 mcg of biotin daily, but if a woman is lactating then increase dosage intake to 35 mcg.

3.8. Vitamin B9 (Folate) Folic Acid

Another name for B9 is folate or also called folic acid, which is the synthetic form, used in supplements and fortified foods like cereal and bread. Like most B vitamins, B9 fosters the growth of red blood cells. Folate may help to keep depression at bay and prevent memory loss. As every pregnant woman knows that folate is a non-negotiable part of her diet when she grows a human, it's essential for DNA synthesis and the production of other genetic material. This vitamin is also especially important for women who are pregnant since it supports the growth of bifida, the baby and prevents neurological risk of birth defects in the nervous system, such as spina [47].

Groups that are vulnerable to folate deficiency include women aged 14-30 years old (especially before and during pregnancy), non-Hispanic black women, people with disorders that lower nutrient absorption (e.g., celiac disease, inflammatory bowel disease), and people with alcoholism. Without enough folate, a person can develop diarrhoea or anaemia. Pregnant women with a folate deficiency could give birth to babies with defects. Excessive supplemental folic acid during pregnancy, however, may also lead to neurological problems in the baby. The recommended dietary allowance is 300 mcg/ day in those over 65 years. A deficiency in folate intake can lead to the development of megaloblastic anaemia and macrocytosis. Dietary sources of folate include vegetables, liver and kidney. Folate is

destroyed by prolonged cooking, as well as poor food choice, i.e., tea and toast diet. Low intakes can also be found in institutionalized or hospitalized older people [48, 49].

Vitamin B9 can be found in meats, whole grains, citrus fruits, fish, fortified cereals, legumes, liver and kidney. Folate occurs naturally in foods such as asparagus, brussels sprouts, dark green leafy vegetables, fruits and fruit juices (especially orange juice), salmon, root vegetables, milk, bulgur wheat nuts, beans, and peas. A form of folate called folic acid is used in dietary supplements and fortified foods, such as cereals, enriched flour products and rice [50].

Adults should aim for 400 mcg of folic acid, while pregnant women should increase to 600 mcg and lactating women should consume 500 mcg. An upper limit of 1,000 mcg per day has been established for folate, as folic acid supplementation exceeding this amount may mask a vitamin B12 deficiency, potentially resulting in permanent nerve damage, and may also increase the risk of certain cancers. There are plenty of scrumptious natural sources of folic acid, including dark leafy greens, asparagus, broccoli, citrus fruits, beans, peas, lentils, seeds, nuts, cauliflower, beets and corn [51].

Folic acid is good for cell renewal and preventing of birth defects in pregnancy. It is important to remember that serum levels of B12 decline with age. Many cases of low serum B12 are associated with malabsorption due to gastric atrophy. Excess supplementation of folic acid in the presence of vitamin B12 deficiency can mask the neurological symptoms of B12 deficiency [52].

3.9. Vitamin B12 (Cobalamins)

This B vitamin is also known as total team player. Cobalamin works with vitamin B9 to produce red blood cells and helps iron do its job to create the oxygen carrying protein, haemoglobin. Because it can be only found in animal products, studies show higher rates of non-meat eaters with a deficiency. But unless peoples are a strict vegetarian, it is not hard to get enough of this vitamin in our diet. For those who are deficient, it may be necessary to supplement the diet with B12. It ensures the health of the nervous system and red blood cells, metabolizes proteins and synthesizes DNA, to name just a few. B12 is important for creating of red blood cells and DNA, and maintaining healthy nerve function. There are several groups that are at increased risk for vitamin B12 deficiency; older adults, people with pernicious anaemia, people who have undergone gastrointestinal surgery or who have digestive disorders, and vegetarians. Signs of an inadequate vitamin B12 intake include weakness, fatigue, tingling in hands and feet, digestive problems, loss of appetite, mouth ulcers, shortness of breath, dizziness, depression, mood swings, decline in cognition and memory,

pale skin, and ringing in the ears [53].

Vitamin B12 does not occur naturally in any plant-based foods. It is concentrated in animal products such as beef liver, clams, fish, poultry, eggs and milk. Some cereals and nutritional yeasts are fortified with vitamin B12. Adults should get 2.4 mcg of vitamin B12 per day. Pregnant women should up their dosage to 2.6 mcg and lactating women may further increase to 2.8 mcg. This vitamin can be got from fish, shellfish, dairy, eggs and beef. Getting enough of B12 is a challenge for older people because they cannot absorb it from food as well as younger people. Even if our diet contains enough, someone may be falling its shortage, so eat more foods rich in B12. The richest sources include fish, meat, poultry, eggs, milk and milk products. Talk to a physician about whether anyone should take a B12 supplement. Many people older than 50 years do not get enough vitamin B12. Fortified cereal, lean meat and some fish and seafood are sources of vitamin B12. Ask to physician or a registered dietician nutritionist if someone needs a vitamin B12 supplement [54, 55].

3.10. Correlated Compounds

Several of the succeeding substances have been referred to as vitamins as they have been believed to be vitamins. They are no longer considered as such, and the numbers that have been assigned to them now form the 'gaps' in the true series of B-complex vitamins. Some of these, though not essential to humans, are essential in the diets of other organisms and others may even be toxic under certain conditions. These are Vitamin B₄ (can refer to chemicals choline, adenine or carnitine; choline is synthesized by human body, but not sufficiently; adenine is a nucleobase synthesized by the human body, while carnitine is essential for certain worms, but not for humans), Vitamin B₈ (adenosine monophosphate also known as adenylic acid or inositol), Vitamin B₁₀ (para-aminobenzoic acid, a component of the folate molecule produced by plants and bacteria), Vitamin B₁₁ (pteryl-heptaglutamic acid, a chick growth factor), Vitamin B₁₃ (orotic acid), Vitamin B₁₄ (cell proliferant, anti-anaemia, rat growth), Vitamin B₁₅ (pangamic acid, also known as pangamate promoted in various forms as a dietary supplement and drug, and considered unsafe), Vitamin B₁₆ (dimethylglycine, synthesized by the human body from choline), Vitamin B₁₇ (pseudoscientific name for the poisonous compound amygdalin, also known as nitrilosides), Vitamin B₂₀ (L-carnitine), Vitamin B_f (carnitine), Vitamin B_m (myo-inositol, also called mouse antialopaecia factor), Vitamin B_p (antiperosis factor, which prevents perosis, a leg disorder in chicks and can be replaced by choline and manganese salts), Vitamin B_T (carnitine), Vitamin B_v (a type of B₆ other than pyridoxine), Vitamin B_w (a type of biotin other than d-

biotin), and Vitamin B_x (an alternative name for both para-aminobenzoic acid and pantothenic acid) [56-60].

4. Conclusion

The authors conclude that vitamins have unique functions in the body, are required for our overall wellness and their deficiencies can take a toll on our health. Like any other vitamins, B-complex vitamins help in the smooth functioning of our body. The first thing is that consult a physician if anyone is concerned about the possibility of B vitamin deficiency. A simple blood test will be able to pinpoint exactly, which nutrients anyone is lacking that might help to get the root of the problem as quickly and safely as possible. Again, whole foods are best for many persons, but a physician may recommend supplementing, depending on anybody unique needs.

Armed with that information, anyone can use this guide to learn more about any B vitamins if someone needs to get further body fitness. For most of us, the takeaway message here is that a diet consisting of fruits, vegetables, meat, dairy, rice, beans, nuts, seeds and fortified whole grain products will give the best vitamin B bang to the body. Supplementation might be helpful in some cases, but most people can meet their vitamin B needs through diet alone. Spirulina often referred to as blue-green algae is another B vitamin powerhouse, and if anyone does not eat meat, he or she should also consider these supplements and physicians recommend it for plant-based eaters as a dietary supplement or whole food. After carrying out study of this article, readers might be able to identify risk factors for developing of various vitamin deficiencies, clinical manifestations of various vitamins deficiencies and prevention strategies as well as treatment plans for various vitamins shortages.

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