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# Deficiency of Vitamin B-Complex and Its Relation with Body Disorders

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## Abstract

Vitamins B denote to some diverse kinds of vitamins which collectively, are recognized as B-complex vitamin. At hand are eight types of vitamins in vitamin B complex; thiamine (B1), riboflavin (B2), niacin (B3), pantothenic acid (B5), pyridoxine (B6), biotin (B7), folate (B9) also known as folic acid and cobalamin (B12). B vitamins have a direct impact on body energy levels, brain function and cell metabolism. There is a roundup of four top causes of vitamin B deficiency; a non-balanced diet, excessive alcohol consumption, various medications and gut malabsorption conditions. Deficiencies in these B vitamins can lead to a number of different symptoms like paresthesias, peripheral neuropathy, psychosis and heart attack and stroke over time if the deficiency is not reversed. Vitamins are found in highest abundance in meat, eggs and dairy or milk products such as butter, yogurt and cheese produced from milk of mammals usually buffaloes, cattle, goats, sheep and camels. Most people can get many nutrients they need, including B vitamins, by eating a varied diet of lean meats, grains, fruits and vegetables. This chapter provides an affluent of the most common types of vitamins B, including why body needs these, their deficiency symptoms and which foods contain them.

**Keywords:** B vitamins, B-complex vitamin, disorder, neuropathy, biochemical action

## 1. Introduction

Within little earnings nations, insufficient quantities of foodstuff (resulting situations like kid malnourishment and undersized development) and limited variety of foodstuff (resulting deficiency of vigorous micronutrients like vitamins, minerals or trace elements) remain to be urgency healthiness complications. Undernourishment entirely in its practices rises the threat of illness and premature expiry. Almost millions of persons in the biosphere do not have sufficient diet to consume. Undernourishment disturbs entirely age crowds, however it is particularly common amongst poor persons and those with insufficient entrance to fitness teaching, good sanitation and clean water. Maximum of the malnutrition-related nervous complaints are escapable [1–3].

The body requires nutrients such as protein, fats and sugars to build tissues and fuel biological processes, but even when calories are plentiful, there are some vital nutrients that when missing, would cause catastrophic illness and death. One of the

first of these deficiency syndromes to be identified is scurvy, due to a deficiency of vitamin C that led to the discovery of the B vitamins, which is a group of water-soluble chemicals working with enzymes to support a wide range of functions in the body [4].

The B vitamins are a group of eight nutrients, each with unique roles in keeping the body healthy. Though these vitamins share similar names (B1, B2, B3, etc.), they are chemically distinct compounds that often coexist in the same foods. Generally, dietary supplements containing all eight are referred to as a vitamin B complex. Each B vitamin is either a cofactor (normally a coenzyme) for key metabolic processes otherwise a precursor needed to make one. They are especially important for maintaining cell health and keeping energized with a unique function in the body. There are eight kinds of vitamins in the vitamin B complex: thiamine (B1), riboflavin (B2), niacin (B3), pantothenic acid (B5), pyridoxine (B6), biotin (B7), folate (B9, also known as folic acid) and cobalamin (B12) [5].

All B vitamins play crucial roles as coenzymes for enzymatic reactions in different biological systems. The eight B vitamins form a group of chemically very heterogeneous essential substances, which have a wide variety of functions in the human body. Further substances once thought to be vitamins have been given numbers (B4, B8, B10, B11 and others) in B-vitamin numbering scheme, however are subsequently discovered to be either not essential for life or manufactured by the body, thus not meeting the two essential qualifiers for a vitamin [6].

Individually, these eight B vitamins play key parts in the body desired to initiate the chemical reactions that upkeep body's lots of tasks. For instance, cells usage B vitamins to create energy from fatty acids, sugar and other nutrients. Thus, deprived of B-complex vitamins, the human body may possibly not function fine of any kind. B vitamins are water-soluble or they can dissolve in water, thus excess B vitamins in body does not use are washed out through urination. The body cannot easily store B vitamins for long periods of time, thus it is especially important to regularly consume B vitamins from diet or supplements to avoid deficiency. Entirely, B vitamins aid to transform the fats, carbohydrates and proteins consumed into energy. B vitamins are likewise required for strong hair, eyes and skin; right working of the liver and nervous system; fit gastrointestinal expanse; creating red blood cells that transport oxygen all over the body; and constructing sex and stress-related hormones in adrenal glands [7].

Each member of the B-complex has a unique structure and performs unique functions in the human body. Their supplement has been used in connection with the subsequent health conditions. Thiamine (vitamin B1), pantothenic acid (vitamin B5) and other B vitamins have all been shown to play a role in wound healing. Supplementing with vitamins B1, B2 and B6 has been reported to provide relief from canker sores. Preliminary reports have claimed that acne rosacea improved; treatment of B-complex vitamin deficiencies may actually reduce alcohol cravings (desires); may reduce feelings of anxiety, perceived stress and tiredness; athletic performance can suffer if these slightly increased requirement needs are not met; helpful to treat people with hives; can prevent the development of tardive dyskinesia; women may benefit from supplementing with B-complex vitamins for premenstrual syndrome symptom relief; postmenopausal women increase their bone density against osteoporosis remarkably; and may depigment skin affected by vitiligo. Human requirements for each B vitamin vary considerably from 3 mcg per day for vitamin B12 to 18 mg per day for vitamin B3 in adult males [8].

The symptoms of a vitamin B deficiency vary depending on which B vitamin a person is deficient resulting in different symptoms. Certain conditions, such as crohn's disease, celiac disease, HIV (human immunodeficiency virus) and alcohol use disorder can prevent the body from absorbing B vitamins effectively, thus

increasing the risk for deficiencies. They can range from fatigue and confusion to anemia or a compromised immune system, while skin rashes can also occur. Most people can get all nutrients they need, including B vitamins, by eating a varied diet of lean meats, grains, fruits and vegetables. Some foods are high in several B vitamins and certain foods are particularly high in specific B vitamins. So, eating of a balanced diet is the key to get all nutrients the body needs. Older adults, pregnant women and people with certain health conditions are more likely to have vitamin B deficiencies [9]. To treat a B vitamin deficiency, physician will likely recommend that a person should take supplements or increase intake of certain foods that contain the target vitamin.

2. Indicators of vitamins B scarcities

Neurotropic B vitamins play crucial roles as coenzymes and beyond in the nervous system. Particularly vitamin B1 (thiamine), B6 (pyridoxine), and B12 (cobalamin) contribute essentially to the maintenance of a healthy nervous system. Taking into consideration the present information on the neurotropic vitamins B1, B6 and B12, it is ultimate that a biological interaction come to be obvious in several diverse passageways in nervous system, mainly in the PNS (peripheral nervous system) as illustrated by their collective usage in the management of peripheral neuropathy [10]. This is significant to start bearing in mind about B vitamins as a therapeutic and neuroprotective tactic for peripheral neuropathies and several brain disorders equally, in forthcoming medical studies. **Table 1**, provides an overview on the major implications in overlapping biochemical pathways important for the nervous system, pointing to a synergistic effect as a logical consequence of these overlaps.

The indications of a vitamin B shortage vary depending on which B vitamin a body is deficient. Maximum nutritious syndromes with harmful sound effects on the peripheral and central nervous system are secondary to vitamin insufficiencies, principally those of the B group. Several of these syndromes happen in the site of undernourishment linked with alcoholism. A thorough dialog of whole vitamin B shortages lies inside the space of this chapter. Nevertheless, four of the further common vitamin B deficiencies such as thiamine (B1), cobalamin (B12), niacin (B3) and folate (B9) are specially appraised.

Vitamin	Processes	Coenzyme for	Implication in nervous system
B1 (Thiamine)	Glycolysis Pentose phosphate pathway Krebs cycle (citric acid cycle)	Pyruvate dehydrogenase Transketolase Alpha-ketoglutarate dehydrogenase	Delivers energy to nerve cells that are required for production of nucleic acids, myelin and neurotransmitters
B6 (Pyridoxine)	One-carbon unit metabolism Hcy metabolism Dopamine and serotonin synthesis	Serine-hydroxymethyltransferase Cystathionine-beta-synthase/ lyase Aromatic L-amino acid decarboxylase	Metabolism of DNA/ RNA, amino acids and neurotransmitters
B12 (Cobalamin)	Hcy metabolism Methymalonyl CoA pathway	Methionine synthase Methylmalonyl CoA mutase	Metabolism of amino acids, fatty acids, DNA/ RNA, myelin and neurotransmitters

**Table 1.**  
*Outline on key biochemical mechanisms of action for nerve function by vitamins B1, B6 and B12.*

## 2.1 Beriberi

Amongst the B vitamins, one and only of the initial scarcity disorders to be discovered is beriberi, due to an insufficiency of vitamin B1 (thiamine). The signs of beriberi are numbness and weakness in the legs and feet, inflammation, trouble in inhalation, and heart tragedy. Beriberi is ultimately found to a nutrition of refined white rice consumption and as soon as the rice bran is resumed to the food, the indicators are retreated. There are double types of beriberi; wet beriberi disturbs the cardiac-vascular structure and dry beriberi likewise famous as wernicke korsakoff syndrome, upsets the nervous structure. The signs of dry beriberi comprise; difficulty in speaking, confusion, pain, nystagmus (uncontrolled repetitive eye movements), difficulty in walking, tingling or numbness in feet and hands, muscle paralysis or weakness, and nausea. Wet beriberi may result further signs such as increased heart rate, rapidity of breathing and inflammation in legs [11].

## 2.2 Pellagra

Pellagra is one more illness, which is directed to the finding of a vitamin that is initiated by a shortage of B3 vitamin (niacin). The usual indications of pellagra are; loss of hair, swelling and dermatitis of skin, inflammation of tongue, weakness, insomnia, ataxia, diarrhea, aggression, confusion, dilation of cardiomyopathy and dementia (loss of thinking, remembering or making decisions). A deficiency of niacin in food centrals to reduce of nicotinamide adenine diphosphate production, which is necessary for a several serious metabolic tasks in the body. Uncertainty, if untouched, it may lead to expiry in four to five years. Pellagra is found in populations where the diet is heavily based on corn, and in addition to dietary deficiency, pellagra can be caused by conditions that prevent the absorption of niacin, such as crohn's disease or other inflammatory disorders of the intestine. Alcoholism can also interfere with absorption leading to pellagra [12, 13].

Mammals on their own are not capable to produce B vitamins; for that reason, they might take up these in adequate amounts by way of food. Despite the fact that maximum of these are manufactured by plant life, they may be indirectly consumed by the use of animal derivative diet such as eggs, dairy and meat. Merely, vitamin B12 is not formed by plant life. However, it is produced by means of bacteria, which inhabit colon of humans or foregut of ruminants and as a result only can be set up in animal foodstuffs such as eggs, fish, dairy products or liver. Nevertheless, the vitamin B12 formed in the colon of humans by bacteria is not obtainable for uptake for the reason that adsorption merely further takes place in ileal mucosa through an intrinsic factor-mediated mechanism [14]. The following **Table 2**, provides a synopsis on the particularly common deficiency symptoms of each B vitamin as listed below.

## 3. Needs, deficiency signs and sources of vitamins B

In the section given underneath, it is looked at each B vitamin in more detail. Vitamin B1 is also called thiamin and vitamin B2 is also called riboflavin, and these vitamins help to convert food into energy. Vitamin B1 has neurological benefits and vitamin B2 helps to maintain proper eyesight. Vitamin B1 deficiency is rare and vitamin B2 deficiency is very rare, which is due to the fact that many foods, such as milk and whole-grain cereals are fortified with these vitamins. Vitamins B1 and B2 deficiencies symptoms include confusion and cracks along the sides of the mouth. It can become an issue with alcoholics people who misuse alcohol,

Vitamin	Name	Deficiency effects
B1	Thiamine	Thiamine deficiency causes beriberi and symptoms of this nervous system disease comprise emotional disturbances, weight loss, weakness and pain in limbs, edema (bodily tissues swelling) periods of irregular heartbeat and wernicke encephalopathy (impaired sensory perception). Heart disaster and passing away could happen in progressive circumstances. Prolonged thiamine shortage may as well cause alcoholic korsakoff syndrome, an irreversible dementia regarded as compensatory confabulation and amnesia.
B2	Riboflavin	Riboflavin insufficiency can cause ariboflavinosis, which might result in great sensitivity to sunlight, cheilosis (cracks in lips), glossitis (swelling of the tongue), angular cheilitis, pharyngitis (sore throat), edema of the pharyngeal and oral mucosa, hyperemia, and pseudo-syphilis or seborrheic dermatitis (predominantly distressing the mouth, and labia majora or scrotum.
B3	Niacin	Niacin shortage, together with a lack of tryptophan, results in pellagra. Signs consist of weakness, dermatitis, aggression, diarrhea, mental confusion and insomnia (sleep disorder). In progressive circumstances, pellagra can lead to dementia and passing away.
B5	Pantothenic acid	Pantothenic acid scarcity may give rise to acne and paresthesia, even though it is rare.
B6	Pyridoxine, pyridoxamine	Vitamin B6 deficiency causes seborrhoeic dermatitis-like eruptions, pink eye and neurological symptoms (epilepsy).
B7	Biotin	Biotin deficit does not normally cause indications in adults other than superficial matters like declined nail and hair development, however can cause reduced development and nervous syndromes in children. Manifold carboxylase scarcity, an innate fault of metabolism, may cause biotin lack even at what time dietetic biotin eating is common.
B9	Folic acid	Folic acid deficit leads to raised stages of homocysteine and macrocytic anemia. Lack in expectant females may cause delivery faults, mainly neural tube defects like anencephaly and spina bifida.
B12	Cobalamins	Vitamin B12 shortage leads to loss of memory and further cognitive insufficiencies, macrocytic anemia, peripheral neuropathy, and elevated methylmalonic acid and homocysteine. It is maximum expected to happen amongst elderly persons, as absorption through gut drops with age and autoimmune disease pernicious anemia is one more common cause. It could likewise result to signs of psychosis and mania. In occasional risky cases, paralysis can take place.

**Table 2.**  
*Delivers each B vitamin deficiency that can cause the symptoms in human.*

however, presenting symptoms such as confusion and cracks along the sides of the mouth [15].

Most people get their B1 and B2 from fortified breakfast cereals and whole grains. Sources of vitamin B1 include organ meats, lean meats, kidney and liver, fish, eggs, low-fat milk, whole grains; fortified bread, cereal, pasta and rice, nuts and seeds, legumes, including black beans and soybeans, green vegetables including broccoli and spinach, and fortified cereals, grains and bread.

### **3.1 Vitamin B1 (thiamine)**

Thiamine or vitamin B1 is an essential nutrient required by the body. It has many health benefits, such as vital for metabolism, supports brain function, boosts the immune system, protects the heart and helps in digestion [16].

Thiamine essential in the conversion of carbohydrates into glucose, is the preferred source of energy that the body runs to keep metabolism running smoothly. It also helps to break down proteins and fats. The percentage of persons by type 1 or type 2 diabetes ranges from 17 to 79%, who have little thiamine. Readings have established that rising vitamin B1 consumption declines the harshness of signs linked to early stage diabetes [17].

Vitamin B1, similar to other B-complex vitamins, is from time to time termed an 'anti-stress' vitamin for the reason that it can build up the immune system and progress the body's capability to survive tense circumstances [18]. Vitamin B1 looks to aid in the growth of the myelin sheath, which is a coat that wraps round nerves to guard these from harm and passing away. Within the brain, it is necessary together by the nerve cells and other supporting cells in the nervous system [19].

Thiamine deficiency causes beriberi, whose signs comprise swelling, tingling or burning in the feet and hands as well as trouble in breathing because of fluid in the lungs. An inadequate thiamine intake can lead to fatigue, muscle weakness, nerve damage, cognitive complications, interfere with the body's defense against oxidative stress and cardiovascular complications. Sources of thiamine are green peas, beans, lentils, seafood seeds and nuts, soy products, white rice, brown rice, wheat germ, whole-wheat bread, egg, milk, spinach, pecans, cantaloupe and orange.

### **3.2 Vitamin B2 (riboflavin)**

Vitamin B2 or riboflavin is one of eight B vitamins that are essential for human health. It can be found in grains, plants and dairy products. It is crucial for breaking down food components, captivating other nutrients and preserving tissues. Riboflavin aids to alter carbohydrates into adenosine triphosphate (ATP). The human body yields ATP from diet and ATP yields vitality as per the body needs it. The compound ATP is vigorous for storage of energy in muscles [20].

Along with vitamin A, vitamin B is crucial for keeping of the eyes, nerves, muscles and skin healthy; hormone production by the adrenal glands; maintaining a healthy liver; maintaining mucous membranes in digestive system; absorbing and activating iron, folic acid and vitamins B1, B3 and B6; preventing the development of cataracts; converting tryptophan into niacin, an amino acid; and fetal development, especially in areas where vitamin deficiency is common. Migraine headaches typically produce intense pulsing or throbbing pain in one area of the head and mitochondrial dysfunction is thought to play a causal role in some types of migraine. Because riboflavin is required for mitochondrial function, there is potential use of riboflavin to prevent or treat migraine headache [21].

The riboflavin might help to prevent the DNA damage caused by many carcinogens by acting as a coenzyme. The total intakes of riboflavin from both foods and

supplements are associated with a lower risk of colorectal cancer, and a significant inverse association between dietary riboflavin intake and lung cancer risk [22].

Pregnant or lactating women who rarely consume meats or dairy products are at risk of riboflavin deficiency, which can have adverse effects on the health of both mothers and their infants, moreover, people who drink excessive amounts of alcohol are at greater risk of vitamin B deficiency. Symptoms and signs of deficiency include dry skin, cracked lips, angular cheilitis or cracks at the corners of the mouth, inflammation of tongue and lining of mouth, red lips, mouth ulcers, sore throat, fluid in mucous membranes, scrotal dermatitis, and Iron-deficiency anemia. Eyes may be sensitive to bright light and they may be watery, itchy or bloodshot [23].

Sources of B2 include fish; chicken; poultry such as turkey, meat such as beef, liver and kidneys; dairy products; eggs; cayenne; asparagus; artichokes; currants; avocados; kelp; fortified cereals; lima beans, peas; navy beans; mushrooms; molasses; parsley; pumpkins; nuts; sweet potatoes; sage; rosehips; cruciferous vegetables such as Brussels sprouts, spinach, broccoli, watercress and dandelion greens; wheat bran; whole-grain breads; enriched breads; and yeast extract.

### **3.3 Vitamin B3 (nicotinic acid)**

Vitamin B3, also called niacin, nicotinamide or nicotinic acid, helps to convert food eaten into energy. It helps the body to use proteins and fats, and keeps the skin, hair and nervous system healthy. It also aids in proper digestion and healthy appetite, and is important for cell development. Other possible benefits of vitamin B3 stem from its potential cholesterol-lowering trusted source, antioxidative and anti-inflammatory properties [24]. A lack of niacin can cause digestive issues, such as nausea and abdominal cramps. Severe deficiency may also cause mental confusion and can result in a condition called pellagra, which causes many symptoms, but the most common are diarrhea, dermatitis and dementia [25].

A person who lacks vitamin B3 may experience symptoms such as headache; depression; memory loss; circulatory problems; a pigmented rash on skin; bright red tongue; rough skin that turns red or brown in the sun; constipation or diarrhea; vomiting; aggressive, paranoid or suicidal behavior; fatigue and hallucinations [26].

A healthful diet can provide all of a person's vitamin B3 needs, and food sources of vitamin B3 include meat including beef, fish and poultry; some legumes, grains and nuts; fortified breads and cereals; sunflower seed; and almond. The foods cooked brown rice, beef liver, grilled chicken breast, turkey breast, dry roasted peanuts, sockeye salmon and enriched breakfast cereal are good sources of vitamin B3. The chicken tacos with peanut sauce are a great way to get niacin in diet.

### **3.4 Vitamin B5 (pantothenic acid)**

Vitamin B5, also called pantothenic acid, is one of the most important vitamins for human life. Vitamin B5 is a medication used in the management and treatment of patients with nutritional deficiencies and related conditions. It is necessary for making blood cells, synthesizing cholesterol, converting the food eaten into energy, and forming sex and stress-related hormones.

The usage of vitamin B5 is prevalent within the field of dermatology to compare efficiency of dexpanthenol (an alcoholic correspondent of D-pantothenic acid) as a substitute usage to atopic dermatitis therapy in contrast to a normal dealing of hydrocortisone. Generally, the reading set up reveals that dexpanthenol is able to possibly deal minor to modest infant atopic dermatitis [27]. Further investigation proposes that dexpanthenol cream may be beneficial in treatment of

mucocutaneous sideways special effects, which take place in isotretinoin healing. Isotretinoin treatment is used as per a management for acne, and its mucocutaneous side effects comprise xerosis (abnormally dry skin), cheilitis (inflammation of lips) and dry of mucous membranes. The small clinical drug as a pastille trials is used and or spray to heal wounds in postoperative endotracheal intubation, endoscopic sinus surgery, and tonsillectomy [28].

Vitamin B5 deficiency is associated with the symptoms such as personality changes, fatigue, headache, irritability, nausea, stomach pains, malaise, numbness, muscle cramps, paresthesia, muscle or abdominal cramps, impaired muscle coordination, numbness, sleep disorders, upper respiratory infections, burning feet and an increased sensitivity to insulin [29].

Vitamin B5 is an easy vitamin to incorporate into a good diet and it is found in most vegetables, including members of the cabbage family, white and sweet potatoes, broccoli and whole-grain cereals. Other healthy sources of B5 include organ meats (liver, kidney), eggs, poultry, dairy products, mushrooms, peas, beans, lentils, seeds, nuts, brown rice and oats. It can also be applied to the skin to relieve itchiness and promote healing from skin conditions, such as eczema, diaper rash, poison ivy and insect bites. Dexpanthenol has also been used to prevent and treat skin reactions from radiation therapy [30].

### **3.5 Vitamin B6 (pyridoxine)**

Vitamin B6, also called pyridoxine, helps the body to turn food into energy. It can also help the body to fight infections by supporting the immune system. Pregnant and breastfeeding women need it to help their babies' brains develop normally. Vitamin B6 deficiency is not common, however insufficient amounts of B6 can result in anemia as well as skin disorders, such as an itchy cracks or rash around the mouth. A lack of B6 can also cause confusion, depression, anemia, nausea skin rashes or dermatitis and susceptibility to infections [31].

Symptoms of B6 scarcity comprise receiving sickening from contaminations more frequently for the reason that B6 aids to looking after immune system. Attainment of sores or cracks on skin round the junctions of mouth or a sensitive and swollen tongue, feeling of tingling or numbness on feet and hands termed as paresthesias, fatigue, irritability or anxiety and depression. A red, irritated rash commonly flaky or oily generally looks on face or upper body. Slight parts of skin may swell as well causing in white areas, reduced attention and convulsions [32]. Foods high in vitamin B6 comprise organ meats, fish, poultry, and potatoes and other starchy vegetables and fruits except citrus fruits.

### **3.6 Vitamin B7 (biotin)**

Biotin, also known as vitamin H or B7, is a vitamin that helps the body to metabolize fats, carbohydrates and protein. Vitamin B7 may not be manufactured by means of human cells, however, it is formed by bacteria in the body and exists in various diets. Biotin rehabilitation can help to give round about curative settings and several persons receipt complements to make stronger their hair and nails, however, there is a shortage of indication in supportive to this usage.

Biotin deficiency is rare in humans, because biotin is widely available in foods and the 'good gut bacteria' can normally synthesize more biotin than the body needs. Signs of deficiency include a scaly red rash around the eyes, nose, mouth and genitals; hair loss or alopecia; numbness and tingling in the hands and feet; lethargy; depression; hallucinations; seizures; a loss of bodily movements control

known as ataxia; and impaired immune function resulting increased risk of bacterial and fungal infection [33].

Biotin deficiency is most likely to arise in people who smoke, women during pregnancy, infants who consume breast milk with low amounts of biotin, patients receiving prolonged intravenous nutrition and patients with impaired biotin absorption due to an inflammatory bowel disease or other gastrointestinal tract disorder. It may also affect those with some kinds of liver disease and those who use medications for epilepsy, such as phenytoin, phenobarbital or carbamazepine [34].

Foods that are rich in biotin include organ meats, cooked whole eggs, baker's yeast, wheat bran and oysters. Raw eggs contain a protein called avidin that inhibits the absorption of biotin. Eating two or more raw egg whites a day for several months has been linked to biotin deficiency. Many foods, such as fruits and vegetables, contain a small amount of biotin [35].

### **3.7 Vitamin B9 (folate or folic acid)**

Vitamin B9, also called folate or folic acid, is the synthetic form of B9, found in supplements and fortified foods, while folate occurs naturally in foods. Folic acid is crucial for proper brain function and plays an important role in mental and emotional health. It is an important vitamin that works with other B vitamins to metabolize proteins, and aids in the production of DNA and RNA, body's genetic material, and is especially important when cells and tissues are growing rapidly, such as in infancy, adolescence and pregnancy [36].

Meats and organ meats, grains, legumes and green leafy vegetables are elevation in folate. The vitamin is not stockpiled in the body, therefore intensities of folate in the body may become little just afterward a small number of weeks of intake a folate scarce food. As per with other shortage disorders, syndromes of the intestinal structure and alcoholism may add to folate insufficiency. Moreover, kidney dialysis, hemolytic anemia and certain medications may lead to folate scarcity [37].

Indicators of folate insufficiency contain fatigue, poor growth, diarrhea, irritability and a tender or smooth tongue. For women with pregnancy, a lack of folate may likewise rise the danger of neural tube faults in the emerging fetus. Low levels of vitamin B9 can result in the symptoms such as irritability, fatigue, megaloblastic anemia that causes weakness, trouble concentrating, headache, shortness of breath, heart palpitations, swollen tongue, open sores in the mouth and changes in skin, hair or fingernail color.

Pregnant women with a folate deficiency could result in their babies being born with neural tube defects, such as spina bifida including cleft palate, spina bifida and brain damage. Neural tube defects are birth defects caused by abnormal development of the neural tube, a structure that eventually gives rise to the brain and spinal cord. Most people (except pregnant women should be able to get enough folic acid from their diets. Supplementing with high-enough levels of B9 before pregnancy as well as during pregnancy) significantly lowers the risk of giving birth to a baby with neural tube defects [38, 39].

Folate occurs naturally in foods and folic acid is the synthetic form, often found in fortified, processed foods. Food sources of folate contain eggs, beef liver, Brussels sprouts, asparagus dark green leafy vegetables (spinach, turnip greens, lettuce, romaine asparagus, broccoli and Brussels sprouts), oranges and orange juice as well as other fresh fruits and fruit juices, beans including kidney beans, peanuts, and other nuts, sunflower seeds, seafood and peas including black-eyed peas. Foods fortified with folic acid include enriched bread, pasta, flour and rice, corn tortillas and tamales made with fortified flour, fortified breakfast cereals,

whole grains, fortified foods and supplements, and spicy roasted beet as a snack or appetizer [40].

### **3.8 Vitamin B12 (cobalamin)**

Vitamin B12 (cobalamin) is only found in animal food sources and helps to regulate the nervous system. It also plays a role in growth and red blood cell formation. Owing to this, persons commonly at danger of B12 deficit comprise lacto-vegetarians. Individuals who have weightiness loss surgical treatment are as well at a great threat for the reason that the operation disturbs absorption of B12 from diet. Further situations, which disturb absorption such as Crohn's disease or celiac disease, may as well result in B12 dearth. Just about 3.2 percent of adults over the age of 50 have a B12 deficiency, and up to 20 percent may have levels of B12 that are at borderline. A vitamin B12 deficiency can lead to disruption in the nervous system and the circulatory system [41].

Vitamin B12 deficiencies can lead to megaloblastic anemia, a condition where the bone marrow produces large abnormally shaped red blood cells that do not function properly. Psychological conditions such as dementia, paranoia, depression and behavioral changes can result from a vitamin B12 deficiency. Neurological damage sometimes cannot be reversed. The primary symptoms of B12 deficiency are mood changes, numbness or tingling in hands, legs and feet, anemia, loss of breath, pale skin, dizziness, blurry vision, difficulty in walking, a swollen tongue, cognitive changes, jaundice, paranoia, hallucinations, soreness of the mouth or tongue, loss of appetite, constipation, weight loss, poor memory, confusion, fatigue or tiredness, and weakness. In addition to animal-based foods, dietary vitamin B12 can be obtained from breads cereals fortified with B12, or through a supplement [42, 43].

Vitamin B12 is found primarily in meat and dairy products, so people on a vegan diet are at risk for deficiency. However, there are foods options to meet their B12 dietary needs. Vegetarian sources include dairy and eggs. Vegan sources of B12 include fortified foods and nutritional yeast. The top sources of vitamin B12 include; beef liver, meat including fish and poultry eggs, milk, cheese, clams, nutritional yeast, fortified breakfast cereals, and other fortified foods including plants, milk and flours [44].

## **4. Conditions and causes of B vitamins deficiency**

Vitamin B denotes to a number of diverse kinds of vitamins, which are collectively recognized as B-complex vitamins. Vitamin B aids to the cells and nerves inside the body and moreover supports by the manufacture of DNA that is biochemical constituent of which genes are prepared. Each of the eight B vitamins plays vital parts within the body and is desired to motivate the biochemical reactions that upkeep body's several roles. For instance, cells usage B vitamins to create vitality from fatty acids, sugar and other nutrients. Therefore, deprived of B-complex vitamins, the human body might not task fine of any kind. B vitamins are soluble in water, can dissolve in water, excess B vitamins body does not use are washed out through urination, body cannot easily store B vitamins for long time periods, so it is particularly important to commonly consume B vitamins either from diet or from supplements to escape scarcity. Deficiencies in these B vitamins can lead to a number of different symptoms over time if the deficiency is not retreated [45, 46].

When it comes to vitamins needed for both a sound body and mind, B vitamins are not something to be ignored. For instance, if body does not get enough of vitamin B12, energy levels throughout the day might fall with mind constantly perhaps

turning to or thoughts of sleep. Otherwise consider vitamin B9, a deficiency of which may acquire swollen tongue or sores on mouth amongst other probable indications. There is then vitamin B6 and when intensities of this vital B vitamin are excessively little, at that time there might be observed scaly, oleaginous eruptions on face or upper body. However, these are not the lone signs of B vitamin deficit, but there is a further wide-ranging list of vitamin B scarcity signs [47, 48].

People from all age groups are suffered with depression, severe anxiety and psychiatric disorders. These patients are prescribed costly psychotropic drugs, narcotics or benzodiazepines; however, actually the problem is B12 deficiency. The B12 vitamin is a vital micro-nutrient for healthy brain in children, younger and elders. Its deficiency primarily occurs due to insufficient dietary intake resulting neurological disorders including apathy, anorexia, irritability, growth retardation and developmental regression. Some diseases caused by B12 deficiency are myeloneuropathy, demyelination, alzheimer's disease, atrophy or brain shrinkage, sub-acute combined degeneration, vascular complications, neuropsychiatric abnormalities, infantile seizures and poor fetal brain and cognitive development. A timely and proper supplementation is necessary if it is dietary deficiency [49].

#### **4.1 Conditions of vitamin B deficiency diseases**

Vitamin B shortage might upsurge the danger of many syndromes and disorders that may well upset to mental well-being, brain health, heart health and further more. For instance, together B9 and B12 scarcity bases for anemia in many circumstances (a disorder in that body shortages red blood cells, which make it tough for diverse body parts to acquire oxygen they needed). Anemia may too lead to dizziness, fatigue, quickness of inhalation, and even tingling and numbness in several circumstances [50].

Vitamin B shortages are extremely widespread in several emerging nations, particularly wherever foods are little in fruits, vegetables and animal products, and anywhere breakfast cereal are crushed earlier to feeding. Expecting and suckling womenfolk, children and youngsters are greatest at danger of vitamin B deficits [51]. Several B vitamin deficiencies cause homocysteinemia (amino acid produced when proteins are broken down that can contribute to arterial damage and blood clots in blood vessels), notably folic acid, vitamin B12, riboflavin and vitamin B6. Importantly, homocysteinemia is associated with adverse pregnancy outcomes. Severe thiamine (vitamin B1) scarcity may lead to the disorder 'beriberi', possibly lethal heart miscarriage or peripheral neuropathy. Early symptoms of riboflavin (vitamin B2) scarcity may include burning eyes, mouth hurt, itching, fatigue and weakness. Additional progressive shortage may lead to brain dysfunction [52, 53].

Niacin (vitamin B3) insufficiency may lead to 'pellagra, resulting skin eruptions being an indication, along with depression, diarrhea, vomiting, loss of memory and fatigue. Symptoms of severe pyridoxine (vitamin B6) deficiency consist of neural syndromes (epileptic convulsions), skin modifications and probably anemia. Folate (vitamin B9) shows a vital part in cell duplication and tissue development. Insufficiency results to the hazard of neural tube faults and may similarly impair cognitive function in adult persons. This deficit situation is frequently linked to populations, which ingest in their food lots of cereals that are short in folate, and few fruits and leafy greens, those are striking in it. Deficiency of vitamin B12 causes neurological deterioration, megaloblastic anemia and possible impaired immune function. Deficiency can severely delay the development of infants and young children [54, 55]. Other conditions linked with vitamin B deficiency are included in the ensuing section.

#### *4.1.1 Paresthesias*

Paresthesia is an unusual feeling of the skin (pricking, tingling, burning, chilling, numbness) with no physical cause apparently. Paresthesia may be transient (common symptoms of hands, feet, leg and arms) or chronic (problematic with working of neurons or poor circulation) and may have any of dozens of possible underlying causes [56]. Paresthesias are generally painless and can happen anywhere on the body, but most generally occur in the arms and legs. The most familiar kind of paresthesias is the sensation known as ‘pins-and-needle’ after having a limb ‘fall asleep’. A feeling is often experienced around the hands, arms, feet or legs. A lesser familiar and infrequent, but main paresthesias is formication that is like sensation of insects crawling on the skin [57].

#### *4.1.2 Peripheral neuropathy*

Peripheral neuropathy may be acute (with sudden onset, rapid progress) or chronic (symptoms begin subtly and progress slowly) and may be reversible or permanent. It is a nervous system condition that is often felt as a stabbing (sharp) or burning pain. Peripheral neuropathy often describes disease affecting the peripheral nerves beyond the brain and spinal cord. Damage to peripheral nerves may impair sensation, movement and gland or organ function depending on which nerves are affected resulting in different symptoms [58].

Neuropathy could basis of painful cramps (shooting pain), fasciculations (fine muscle contracting), bone deterioration, muscle damage, and alterations in skin, hair and nails. Moreover, motor neuropathy can reason of decreased coordination and balance or best generally, muscle fault; sensory neuropathy might affect lack of feeling to vibration and touch, condensed location common sense resulting lesser balance and coordination, decreased feeling to pain and temperature change, unplanned burning or tingling pain, or skin allodynia (intense pain from usually non-painful stimuli, like touch or light); and autonomic neuropathy could yield varied indications, dependent on the affected organs and glands, however general indicators are abnormal heart rate or blood pressure, poor bladder control and decreased capability to perspire routinely [59].

#### *4.1.3 Psychosis*

Psychosis is a mental condition in which one’s thoughts and perceptions are significantly altered or other symptoms occur. It is a condition of the mind that results in difficulties in determining what is real and what is not real. Psychosis can have serious outcomes, resulting in delusion (unrelenting sense of certainty maintained despite of strong contradictory evidence) and hallucinations (sensory perception in the absence of external stimuli). Other symptoms may include incoherent speech (nonsense speech) and behavior that is inappropriate for the situation. There may also be social withdrawal, sleeping problems, lack of motivation and difficulties in carrying out daily activities [60–62].

#### *4.1.4 Heart attack and stroke*

A deficiency in vitamin B12 may heighten the risk of getting a heart attack or stroke. Myocardial infarction commonly called heart attack, takes place while blood movement stops or decreases to a portion of heart resulting harm to heart muscle. The utmost usual indication is chest discomfort or pain that could move into jaw,

neck, back, shoulder or arm. Habitually it takes place in the middle or leftward sideway of the chest and continues for more than a little minute [63, 64].

A stroke is a health situation in which a reduced blood movement to the mind leads to cell expiry. There are two foremost kinds of stroke; ischemic, for the reason that of shortage of blood movement and hemorrhagic due to blood loss. Both types results portions of the mind to halt working correctly. Symptoms and signs of a stroke could comprise dizziness, an incapability to move or touch on one sideway of the body, difficulties in speaking or understanding, or damage of visualization to one sideway [65].

## 4.2 Causes of vitamin B deficiency

Here is a roundup of the four top causes of vitamin B deficiency that are somewhat not to be ignored.

### 4.2.1 A non-balanced diet

Human body cannot accurately create B vitamins contrasting to proteins that the body constructs by mean of several minor building blocks. However, this is generally not a problematic for the reason that body develops B vitamins from the diet eaten. If any person follows a well-proportioned food that offers to body through the correct level of nutrients, these may aid to escape signs of vitamin B insufficiencies. On the other hand, for a range of causes, from time to time people do not consume the correct equilibrium of diet essential to acquire sufficient of vitamins needed. For instance, if a vegetarian or vegan food is followed, then an individual may not acquire sufficient vitamin B12 as vitamin B12 is set up practically wholly in dairy products and animal-created diets [66].

As such, dietary inadequacies are one of the key causes of vitamin B deficiency. So, whatever diets comprise several B vitamins that rest which B vitamin is in concern (vitamins B6, B9 or B12). A rapid prosperous diets that may be eaten to increase stages of each of these B vitamins is vitamin B6 (fish, legumes, nuts, potatoes, bananas, meat); vitamin B9 (leafy vegetables, citrus fruits, legumes); and vitamin B12 (fish, meat, dairy and animal foodstuffs) [67].

### 4.2.2 Excessive alcohol consumption

An excessive alcohol consumption whether beer or spirit might have its disadvantages and single of which is vitamin B insufficiency. In a nutshell, alcohol creates kidneys to flush B vitamins out of system greatly further rapidly than normal. This means body does not have whole the period it desires to create usage of these B vitamins, hence they somewhat accurately go to discarded [68].

### 4.2.3 Various medications

More than a few types of recommended medications are able to knock up the likelihood of a vitamin B scarcity. An improved possibility of vitamin B6 scarcity is marked from penicillamine (Cuprimine), corticosteroids, hydralazine, isoniazid and anticonvulsants. An augmented probability of vitamin B9 shortage comes by sulfasalazine (Azulfidine), methotrexate (Rheumatrex, Trexall), trimethoprim-sulfamethoxazole and phenytoin (Dilantin). An enlarged chance of vitamin B12 shortage rises by long-term antidepressants and antibiotics, antacids, proton pump inhibitors and metformin [69].

#### *4.2.4 Gut malabsorption conditions*

In well circumstances, B vitamins are absorbed into bloodstream through the gut. The bloodstream at that moment vehicles these greatly-required vitamins all over body. Hence, if B vitamins do not create way into the bloodstream, straightforwardly they may not be placed into upright usage by the body. Then these correctly can drive erroneous if someone have a gut malabsorption situation like ulcerative colitis, celiac disease or crohn's, disease. These situations check to B vitamins for arriving the bloodstream, considerably reducing blood's vitamin B intensities and possibly damaging safety [70].

For first course, study inspection of vitamin B levels with B vitamins assessment. At that point, if persons are definitely lacking, they may access to healthcare worker on the afterward stages. It is suggested that elder adult persons who have lacking levels of vitamin B should consult to their healthcare supplier as early as probable to get a cure strategy. If there are seen vitamin B scarcity signs, it might be for the reason that peoples do not have sufficient vitamin B in their food. If there are shown symptoms of fatigue, quickness of inhalation, lightheadedness or other shortage signs, then think through scrutiny of B12 level [71].

### **5. Preventing of B vitamins deficiency**

For maximum persons, some fit foods riched by means of a diversity of fruits, meats, vegetables and grains, are sufficient to check a scarcity of B complex vitamins. Ladies who are supposed to get into pregnancy are guided to takings folate complements. Elder persons or those with health situations that rise the danger of B vitamin insufficiency might as well advantage from taking an everyday complement. In the direction of staying healthy, most people do not need to take a supplement in order to get enough B vitamins. There are plenty of delicious foods available to get all the nutrients the body needs naturally. Try to eat a complete diet of meats, grains, fruits and vegetables. If any person does not eat meat, eggs or dairy, he or she can still get vitamin B12 from fortified foods or nutritional yeast to help prevent its deficiency [72, 73].

Supplementation is only a last resort if a person cannot obtain B vitamins through diet nor have certain health conditions that require using of supplements. Over the counter supplements can often treat or prevent deficiency. It is best to check with a physician before taking vitamin supplements. However, supplements may still cause side effects, long-term health effects and interactions with medications a person is taking. If any person suspects to be vitamin B deficient, he or she can contact to physician who might perform a physical examination as well as instruct blood testing. If a woman is pregnant or any person is over 50 years old, they are more likely to need supplements. The risk of overdose is lower than other nutrients because B vitamins are water soluble [74, 75]. For maintaining a good health, healthcare professionals mention that people should acquire a sure quantity of each vitamin per day as given in the ensuing **Table 3**.

It needs to be stressed that vitamin B1, B6 and B12 most likely hold synergistic biochemical roles in the nervous system that is neither of these can replace one of the others. Because of the potential for side effects and interactions with medications, people should take dietary supplements only under the supervision of a knowledgeable health care provider [76].

Vitamin B1 helps body to make main energy-carrying molecule ATP, and prevents complications in the nervous system, brain, muscles, heart, stomach and intestines. It is also involved in the flow of electrolytes into and out of muscle

Vitamins	Intake for adults and children ages 4+	Intake for pregnant or breastfeeding
Thiamin (B1)	1.2 mg	1.4 mg
Riboflavin (B2)	1.3 mg	1.6 mg
Niacin (B3)	16 mg or equivalent	18 mg or equivalent
Pantothenic acid (B5)	5 mg	7 mg
Pyridoxine (B6)	1.7 mg	2 mg
Biotin (B7)	30 mcg	35 mcg
Folate (B9)	400 mcg or equivalent	600 mcg or equivalent
Cobalamin (B12)	2.4 mcg	2.8 mcg

**Table 3.**  
*Offering daily intake values of each B vitamin in microgram (mcg) or milligram (mg).*

and nerve cells. Vitamin B6 helps the body to build neurotransmitters (like dopamine) that are special chemicals the brain needs to functions; makes red blood cells, aids immune system antibodies to work correctly and lowers the risk of lung cancer. Vitamin B12 helps the body to make and repair genetic material DNA, make red blood cells as well as nerve cells, and supports healthy hair, skin and nails [77–79]. If someone’s vitamins B status is not at a normal level, it may be useful to get vitamins level checked and their healthcare provider may recommend a high-dosage supplement or even in some cases injections.

Each B vitamins have their particular distinctive utilities, however they depend upon one another for suitable absorption and the best fitness welfares. Consumption of an advantageous, diverse food can usually offer altogether the B vitamins somebody require. Persons can prevent and treat B vitamin insufficiencies through enhancing their food ingestion of high-vitamin diets or taking vitamin complements. Consult to a physician earlier to take any complements to make certain that they will act together with medicines.

6. Conclusions

B vitamins play vital roles in maintaining of good health and well-being. As the building blocks of a healthy body, vitamin B benefits to the nerves and cells within the body and also helps with the production of DNA (chemical substance that genes are made). B vitamins are important exclusively for womenfolk who are expectant and breastfeeding, and help in fetal’s mind growth along with decrease the danger of delivery faults. For pregnant mammies, B vitamins can enhance energy intensities, easiness vomiting and lessen the risk of rising preeclampsia (high blood pressure and possibly protein in urine during pregnancy or after delivery or lower platelets in blood). In men, B vitamins are thought to increase testosterone levels, which decrease with age naturally and may also help men to build muscle and increase strength. For infants of vegan mothers, starting of vitamin supplements immediately after birth helps to prevent vitamin deficiency. For people with nerve damage, vitamin is given by injection into muscle unless the disorder causing the deficiency can be corrected. Blood tests are done periodically to make sure that vitamins level return to and remain normal or sometimes endoscopy diagnosis is done. Treatment of vitamins deficiency consists of high doses of vitamin supplements. If people have the deficiency, but no symptoms, the vitamin may be taken by mouth. Older people with vitamin deficiency can benefit from taking of vitamin

supplements because the deficiency usually results from difficulty in absorbing vitamin from meat. They can absorb the vitamin more easily from supplements than from meat. Maximum of multivitamin-mineral foodstuffs comprise the B-complex together with the rest of the vital minerals and vitamins. As these are further wide-ranging than B-complex vitamins only, various vitamin-mineral additions are suggested to mend whole micronutrient eating and avoid insufficiencies. There is a link between fruit and vegetable intake, and stress levels of persons. People who have higher fruit and veggie intakes are less stressed than those with lower intakes, which suggest that diet plays a key role in mental wellbeing (eating at least 400 grams of fruits and vegetables per day). A practitioner knowledgeable in nutrition must be consulted when using of vitamins and always follow label directions before use.

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