

Neurological Issues Resulting from Vitamin B - Complex Deficiencies

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ABSTRACT

The field of medicine known as neurology focuses on diagnosis of nervous system problems. The human nervous system is an intricate system that controls and coordinates bodily functions it is split into two main sections:

- Central nervous system: the spinal cord and brain
- Eyes, hearing, skin, and other “sensory receptors” are examples of various neurological components that make up the peripheral nervous system.

A neurologist is a medical professional with a focus on neurology. A neurologist addresses conditions affecting the nerves, brain, and spinal cord, including: neurological conditions like stroke, disorders of the central nervous system that cause demyelinating, such multiple sclerosis, problems of headaches, infections in the peripheral nerve system and brain, abnormalities of movement, like Parkinson’s disease and neurodegenerative conditions, including Parkinson’s and Alzheimer’s. The B-complex vitamins are a group of several different types of vitamins that are together referred to as vitamins B. Eight different vitamin types make up the vitamin B complex: cobalamin (B12), pyridoxine (B6), and biotin (B7) commonly referred to as folic acid. The energy levels of the body, brain activity, and cell metabolism are all directly impacted by B vitamins. The following four factors are the main causes of vitamin B deficiency: an unbalanced diet, excessive alcohol use, certain drugs, and disorders causing malabsorption of the stomach.

Keywords: Neurological Issues; Vitamin B-Complex; Abnormalities; Peripheral Nervous System; Human Health; Neuro Muscular Junction; Cobalamin

Introduction

Vitamins are necessary nutrients that come from a variety of food sources and are necessary for the nervous system to operate properly. A common public health issue is vitamin insufficiency, to which children and pregnant women are especially vulnerable. Neurological dysfunction is linked to deficiencies in a wide range of vitamin forms, including the B-complex vitamins (B1, B3, B6, B9, B12), vitamin A (retinol), vitamin C (ascorbic acid), and vitamin E (tocopherol), among others. The primary reason, for vitamin deficiencies often stems from

a combination of factors linked to intake including dietary choices. Estimating the prevalence of vitamin insufficiency in the United States poses a challenge due to varying factors such as the vitamin involved different population groups, geographical regions, dietary habits, ethnicities, underlying health conditions and socioeconomic status. Additionally, depending on the kind of vitamin deficiency, the clinical appearance differs greatly. Yet, the most typical signs and symptoms are exhaustion, lightheadedness, muscle weakness, poor balance, and digestive or neurological issues [1].

For several metabolic functions, including DNA synthesis and myelin creation, cobalamin, also known as vitamin B12, is an essential dietary component. It is present in a number of animal products, such as dairy, eggs, and red meat. A megaloblastic anemia that can cause weakness, exhaustion, and dyspnea is one of the clinical manifestations of cobalamin insufficiency. Glossitis, skin abnormalities, and other symptoms are possible diarrhea, vomiting, and nausea. B12 plays a crucial function in supporting the neurological system, therefore a deficiency can also result in a variety of neurologic symptoms. The complex central and peripheral neurological systems, as well as the production of red blood cells (RBC) in the bone marrow, particularly DNA synthesis, depend on vitamin B12. Vitamin B12 insufficiency is common in low-income and developing nations, particularly in Africa and India, where the older population makes up the majority of the population.² Specific skin symptoms such as hyperpigmentation, vitiligo, angle stomatitis, and changes to the hair and nails can result from a vitamin (Vit) B12 deficiency [2,3].

Deficiency affects people of all ages, socioeconomic backgrounds, races, and genders. It is the most prevalent dietary inadequacy in the US. Premature mortality, suboptimal results, and neurological problems can all be avoided with early detection and treatment. B12 deficiency is most frequently caused by pernicious anemia. This autoimmune illness lacks an intrinsic factor that is necessary for the gastrointestinal system to absorb vitamin B12 from food. But the problem is more common in women, those over 60, and those with autoimmune diseases including vitiligo and Addison's disease. The condition known as autoimmune gastrectomy (AG) arises when the body creates antibodies—which are typically produced against viruses and bacteria—against healthy stomach cells.

Thiamine (Vitamin B1)

Vitamin B1, also known as thiamine is an essential, for energy metabolism and the proper functioning of the nervous system. This nutrient dissolves in water. Can be found in grains, legumes, nuts, cattle and pork. In countries thiamine deficiency is more common among those who consume rice or processed grains lacking in thiamine. The symptoms of vitamin B1 deficiency can vary in severity and duration leading to a variety of signs. Cardiovascular issues associated with thiamine deficiency include heartbeats, enlarged heart size (cardiomegaly) well as acute or chronic heart failure [4,5]. These cardiovascular problems are often seen in cases of deficiency linked to alcohol abuse. Additionally a shortage of thiamine can affect the tract resulting in loss of appetite, weight loss and constipation. Various symptoms related to disorders may include numbness, tingling sensations (paresthesias) weakness, decreased reflexes, confusion or disorientation delirium episodes memory loss seizures behavioral changes (such as irritability melancholy apathy) visual disturbances (like nystagmus eye muscle paralysis).

Riboflavin (Vitamin B2)

Riboflavin (also known as Vitamin B2) produces FMN and FAD coenzymes that are important, for processes.

Flavoproteins play a role, in the production of heme proteins essential for our body, such as hemoglobin, nitric oxide synthases and P450 enzymes. They are also involved in processes like electron transfer, oxygen transport and the conversion of niacin, folate and vitamin B6. Additionally, flavoproteins assist in iron absorption and utilization regulate thyroid hormones and help metabolize fatty acids found in brain lipids. Disruption of these systems due to a lack of riboflavin can negatively impact brain function.

Niacin (Vitamin B3)

Niacin is a component of the vitamin B complex. Acts as a coenzyme in numerous metabolic functions. Pellagra, a condition resulting from niacin deficiency commonly seen in regions like parts of Africa can be prevented by consuming diets in corn prevalent in areas, like Latin America, China and India. Due, to the fortification of foods like flour pellagra is a condition in the United States that is not linked to deficiencies. Instead it is often associated with malabsorption syndrome or chronic alcohol consumption. Niacin derived compounds, such as nicotinamide adenine dinucleotide (NAD) and NAD phosphate (NADP) play roles in functions and enzymes essential for the proper functioning of peripheral and brain cells. These roles range from energy production to activities, defense against radicals, DNA metabolism and repair intracellular calcium signaling and the conversion of folate into tetrahydrofolate.

Pantothenic Acid (Vitamin B5)

While uncommon a deficiency in acid can occur in individuals with eating disorders or severe malnutrition due to famine. Symptoms of deficiency typically include wound healing, fatigue, tingling sensations and muscle cramps. Pantothenic acid deficiency may also result from a mutation in the pantothenate kinase 2 (PANK2) gene that hinders the conversion of acid into CoA necessary for cellular metabolism. Mutations in the PANK2 gene lead to pantothenate kinase associated neurodegeneration (PKAN) also known as Hallervorden syndrome – a brain disorder characterized by increased iron accumulation, in the basal ganglia as revealed by MRI scans. This image resembles a tiger, with eyes in a view known as the “eye of the tiger.” PKAN leads to loss of motor skills, cognitive decline and vision problems. Behavioral challenges, obsessions, aggression, personality changes, strong emotions and sudden mood shifts are symptoms. Informal feedback suggests that PKAN patients tolerate vitamin B5 supplements well without causing harm. Vitamin B6, also known as pyridoxine is essential for metabolic functions such as neurotransmitter production, red blood cell formation and amino acid metabolism. Foods like nuts, bananas, salmon, chicken legumes naturally contain sulfur. It is commonly used as a supplement for conditions like premenstrual syndrome carpal tunnel syndrome and morning sickness.

Pyridoxine (Vitamin B6)

Pyridoxine supports skin health and eye health while maintaining system function. It plays a role in hormone regulation and immune system support. A deficiency in pyridoxine can lead to symptoms, like anemia dermatitis seizures depression confusion. May increase the risk of cancers and heart conditions.

Folate (Vitamin B9)

Fruits, leafy greens and liver are all rich, in folate, a water vitamin. Folic acid, a man-made version of folate is included in fortified vitamins and foods for absorption. Folate plays a role in preventing birth defects like tube defects. It supports blood cell production. Is involved in making nucleoproteins, purines and pyrimidines. Nowadays many developed countries mandate adding folic acid to flour and recommend supplements before pregnancy and during the trimester. However excessive folate levels can pose risks to development. Increase the chances of precancerous cell formation. The symptoms of folate and vitamin B 12 levels are similar neurologically including conditions like Alzheimers disease, dementia, depression, spinal cord degeneration and cognitive issues. Ongoing research aims to understand how folic acid affects childrens behavior those with autism spectrum disorder (ASD). Some studies suggest a connection between ASD risk factors and specific gene variations or increased autoantibodies, against receptors but conclusive evidence is still lacking. Nevertheless, additional clinical studies, with increased numbers and extended monitoring durations are necessary considering the evidence regarding the beneficial impact of folate, in preventing neural tube defects.

Cobalamine (Vitamin B12)

Vitamin B12, often known as cobalamin, is a necessary ingredient for various metabolic processes, including the formation of DNA and myelin. It is found in a variety of animal products, including milk, eggs, and red meat. Its insufficiency affects both men and women equally and is more prevalent among those over the age of 60. People of African and European heritage are more likely to have it, with rates of 4.3% and 4%, respectively. The overall incidence of this disease is 25/100,00 people. Megaloblastic anemia, which can induce weakness, tiredness, and dyspnea, is one of the clinical signs of cobalamin

deficiency. Additional symptoms may include skin changes, glossitis, nausea, vomiting, and diarrhea. Furthermore, because B12 is essential for maintaining the neurological system, a deficiency can produce a variety of neurologic symptoms. It may cause nerves to become demyelinated, resulting in damage and malfunction. This can result in peripheral neuropathy, a condition that causes tingling, numbness, and weakness in the hands and feet. Cobalamin is the mineral cobalt that is found in B12. Other kinds include methylcobalamin, deoxyadenosylcobalamin, hydroxocobalamin, and cyanocobalamin. The most active form of cobalamin in the bloodstream is methyl cobalamin, which can be found in dietary supplements. For absorption, the body must convert this form to either 5-deoxyadenosylcobalamin or methyl cobalamin.

Conclusion

Neurological illnesses are diseases that affect both the central and peripheral nervous systems. The autonomic nervous system includes muscles, cranial nerves, peripheral nerves, nerve roots, the brain, spinal cord, and the neuromuscular junction. A neurologic deficiency is a condition characterized by abnormal neurologic function of a body part. This reduced function is caused by damage to the brain, spinal cord, muscles, or nerves that supply the affected area. Abnormal reflexes are one example. This is also related to shortages in B-Complex vitamins (B1, B2, B3, B5, B6, B9, and B12).

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