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THE IMPACT OF VITAMIN B12 DEFICIENCY ON LEARNING PERFORMANCE AND NERVOUS SYSTEM FUNCTION IN SCHOOL-AGED CHILDREN

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Abstract

Vitamin B12 (cobalamin) plays a crucial role in the development of the central nervous system, myelin synthesis, and DNA biosynthesis. Recent epidemiological and clinical studies indicate that vitamin B12 deficiency in children is associated not only with hematological disorders but also with impairments in cognitive functions and academic performance.

Vitamin B12 is a water-soluble vitamin involved in DNA synthesis, erythropoiesis, and the myelination of nerve fibers. Its deficiency, particularly during periods of growth and development, can have a significant impact on central nervous system function.

According to recent scientific evidence, vitamin B12 deficiency remains a global public health concern among children, especially in low- and middle-income countries where its prevalence is higher. B12 deficiency disrupts the process of myelin formation, leading to slowed nerve impulse conduction and subsequent decline in cognitive functions.

Objective of the study

To conduct a comprehensive analysis, based on scientific literature, of the impact of vitamin B12 deficiency on cognitive functions (memory, attention, thinking),

academic performance, and the condition of the central and peripheral nervous systems in school-aged children.

Materials and methods

Analysis of scientific articles indexed in international databases such as PubMed, Scopus, and Web of Science. The review included randomized controlled trials and studies involving pediatric populations published between 2005 and 2025.

Main part

Numerous studies demonstrate a positive association between vitamin B12 levels and cognitive development. For instance, observational studies have shown that low B12 levels are associated with reduced ability to solve problems, recognize letters, and interpret social cues in children.

Other studies have reported that B12 levels influence attention, memory, and overall academic performance. Students with low B12 levels have been found to exhibit decreased concentration and reduced learning efficiency.

At the same time, not all studies have produced consistent findings. Some recent investigations have reported no statistically significant association between B12 levels and academic outcomes in school-aged children.

From a neurobiological perspective, B12 deficiency leads to the following processes:

– impaired myelination
– reduced neurotransmitter synthesis
– elevated homocysteine levels
– disrupted neuronal signal transmission

These mechanisms ultimately result in slowed cognitive performance and dysfunction of the nervous system.

Conclusion

Vitamin B12 deficiency in school-aged children is associated with a decline in cognitive functions, including memory, attention, and thinking abilities. It exerts a significant negative effect on academic performance, increasing the risk of academic failure and school absenteeism.

From a neurological standpoint, B12 deficiency causes pathological changes in both the central and peripheral nervous systems through impaired myelination. If not detected and corrected early, it may lead to long-term and potentially irreversible neurocognitive consequences. Preventive strategies such as рационал nutrition, screening of at-risk groups, and appropriate supplementation are essential for maintaining cognitive health and improving educational outcomes.

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