THE ASSOCIATION BETWEEN VITAMIN D DEFICIENCY AND ATTENTION AND MEMORY IMPAIRMENTS IN CHILDREN

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Vitamin D has traditionally been linked to bone and mineral metabolism; however, recent studies highlight its crucial role in central nervous system development and the regulation of cognitive functions. Vitamin D deficiency in children is a widespread global issue, particularly in regions with limited sunlight exposure, in children with higher skin melanin levels, and in populations with inadequate nutrition.

Neurobiological research demonstrates that vitamin D receptors and metabolites are distributed widely across the brain—participating in neuronal differentiation, glial cell regulation, synaptic plasticity, and modulation of neuroinflammation. These mechanisms form the biological foundation for the development of key cognitive domains in children, including sustained attention, memory function, and executive functioning.

Attention and memory impairments in children—such as attention deficit/hyperactivity disorder (ADHD), visual memory deficits, and reduced executive functioning—are common. Several epidemiological and clinical studies suggest that low serum 25-hydroxyvitamin D (25(OH)D) levels may be associated with cognitive disturbances in children. For example, one study reported significantly lower vitamin D levels in children with ADHD compared with healthy controls. Another study found that school-aged adolescents with higher 25(OH)D levels demonstrated superior visual memory performance.

However, the causal nature of this association remains unclear. Some studies found no significant relationship between vitamin D status and later cognitive development. This highlights the need for systematic examination of the link between vitamin D deficiency and attention and memory impairments, as well as the development of practical preventive guidelines.

Most studies indicate a likely association between low vitamin D levels and cognitive impairments (attention deficits, weakened memory, reduced executive functioning). In the above-mentioned study of 9–13-year-olds, a significant correlation was found between 25(OH)D levels and both visual and working memory.

Nonetheless, some studies—particularly those examining school-aged children or long-term outcomes from early-life vitamin D measurements—did not find statistically meaningful

associations. For example, a study of Indian children found no significant link between vitamin D deficiency and cognitive development.

This variability suggests that although a relationship is probable, robust causal evidence is still lacking. Methodological differences—such as age groups studied, varying definitions of vitamin D deficiency, and diverse cognitive assessment tools—limit the comparability of findings.

Vitamin D deficiency increases inflammation and oxidative stress, impairing neuronal network function. Therefore, adequate vitamin D levels are considered an important protective factor in cognitive development among children.

Preventive approaches—including consumption of vitamin D-fortified foods, appropriate sunlight exposure, and pharmacologic supplementation when necessary—may help preserve attention and memory functions in children.

Future large-scale epidemiological and clinical research is needed to clarify the causal pathways linking vitamin D status and cognitive performance, providing evidence for the development of scientifically grounded preventive strategies that support healthy child development.

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