THE IMPACT OF VITAMIN A, D, AND B-GROUP DEFICIENCIES ON COGNITIVE DEVELOPMENT IN CHILDREN

Nigmatullayeva D. J.
Umedova M. E.
Tashkent State Medical University

Childhood is the most critical ontogenetic stage of human life, during which the central nervous system develops intensively. Optimal nutrition and an adequate supply of micronutrients are essential for the formation of interneuronal connections, synaptic plasticity, and myelination processes. Vitamins act as biological catalysts and play a key role in neurotransmitter synthesis, antioxidant defense, and regulation of gene expression.

According to reports of the World Health Organization, hypovitaminosis in children is associated not only with impaired physical growth but also with reduced indicators of intellectual development. Vitamin A deficiency suppresses neuronal differentiation, vitamin D deficiency affects mechanisms of brain plasticity, while deficiencies of B-group vitamins—particularly B_{12}, B_6, and folate—are accompanied by disturbances in neurotransmission and myelin synthesis.

Vitamin A (retinol) regulates neuronal migration and synaptogenesis during central nervous system development. Studies indicate that children with vitamin A deficiency exhibit lower performance in visual perception, spatial reasoning, and memory. A cohort study conducted in South Asia showed that children with hypovitaminosis A had cognitive test scores that were on average 10–15% lower.

Vitamin D has neuroprotective properties and regulates calcium homeostasis in brain cells. Numerous epidemiological studies have reported associations between vitamin D deficiency during the prenatal period and early childhood and attention deficit as well as reduced learning capacity. European cohort studies have demonstrated that children with low serum 25-hydroxyvitamin D [25(OH)D] levels had IQ scores that were on average 7–8 points lower.

B-group vitamins, especially vitamin B_{12} and folate, play a crucial role in the formation of the neuronal myelin sheath. Their deficiency is associated with cognitive slowing, delayed speech development, and psychomotor dysfunction. Studies conducted in African countries have found that children with vitamin B_{12} deficiency show significantly poorer academic performance at school.

The analyzed scientific evidence indicates that hypovitaminosis of vitamins A, D, and B group exerts a multifactorial and profound impact on cognitive development in children. This effect is not limited to biological mechanisms alone but is closely linked to socio-economic conditions, dietary patterns, and access to healthcare services. Vitamin deficiencies often

remain subclinical and can impair brain development before overt clinical signs appear, highlighting the importance of early screening and preventive strategies.

Deficiency of vitamins A, D, and B group in children is reliably associated with delayed cognitive development, as well as reduced memory and attention functions. Scientific evidence confirms that adequate provision of these vitamins is an important preventive factor in the development of children's intellectual potential.

Prevention of hypovitaminosis should begin in early childhood. Nutritional strategies and vitamin fortification programs must be developed on a solid scientific basis. Reducing vitamin deficiencies should be regarded as one of the priority directions of public health in safeguarding child health.

References

1. Axmadaliyeva, N. O., Bozorova, M. Y., Nigmatullayeva, D. J., & Jalolov, N. N. (2023). GIPERTONIYA KASALLIGI SABABLARI VA DAVOLASH USULLARI. Евразийский журнал медицинских и естественных наук, 3(6 Part 2), 130-133.
2. Жалолов, Н. Н., Ахмадалиева, Н. О., Нигматуллаева, Д. Ж., & Хайдарова, М. З. (2022, April). Умумтаълим мактаблари бошланғич синф ўқитувчиларнинг саломатлиги бўлажак авлодни тарбиялашнинг асосий мезони. Республиканской научно-практической конференция "ДНИ МОЛОДЫХ УЧЕННЫХ".
3. Umedova, M. E., & Jalolov, N. N. (2025, April). The role of interactive educational technologies in the modern education system. International Conference on Advance Research in Humanities, Applied Sciences and Education.
4. Нигматуллаева, Д. Ж. (2018). Исследование функционального состояния зрительного и слухового анализаторов у работников умственного труда. In advanced science (pp. 218-220).
5. Ахмадалиева, Н. О., Нигматуллаева, Д. Ж., Жоханов, Ж. Ф., & Турабаева, З. К. (2017). Воззрения абу али ибн сино на болезни и возможности укрепления защитных свойств организма на основе природных факторов.
6. Feruza, S., Nigora, A., Guzal, S., & Dilafruz, N. (2025, March). FEATURES OF THE EMOTIONAL BURNOUT CONDITION AMONG GENERAL EDUCATION SCHOOL TEACHERS. In The Conference Hub (pp. 1-4).
7. Ахмадалиева, Н. О., Нигматуллаева, Д. Ж., Ёкубов, М. С., & Хакимова, Д. С. (2018). Исследование показателей терморегуляции у рабочих в условиях нагревающего микроклимата. In INTERNATIONAL INNOVATION RESEARCH (pp. 223-225).
8. Нигматуллаева, Д. Ж., Икрамова, Н. А., Махкамова, Д. М., Холтураева, Ш. Ж., & Толибжанова, М. А. (2025, March). ОЦЕНКА СТАТУСА ПИТАНИЯ

ПРЕПОДАВАТЕЛЕЙ СРЕДНИХ ШКОЛ. Europan youth innovation society conference.

9. Umedova, M. E., & Jalolov, N. N. (2025, April). Integration of multimedia tools in the educational process and their importance. In The Conference Hub (pp. 95-98).
10. Jalolov, N. N., Sharipova, S. A., & Tashmatova, G. A. (2023). Clinical and morphological features of gastroduodenitis in children with saline diathesis. American Journal of Pedagogical and Educational Research, 10.
11. Qizi, A. M. X., & O'G'Li, J. N. N. (2023). Jismoniy faollik orqali stressni boshqarish. Ta'lim fidoyilari, 13(1), 19-20.
12. Сатторов, А. С., & Жалолов, Н. Н. (2025, May). ВЛИЯНИЕ РАЗЛИЧНЫХ ФАКТОРОВ НА РАЗВИТИЕ ХРОНИЧЕСКОГО ГЕПАТИТА. In The Conference Hub (pp. 169-172).
13. Равшанова, М. З., & Тошматова, Г. А. (2023, February). Влияние питание на здоровье школьников обучающихся в городских и сельских условия. Соғлом турмуш тарзи" мавзусидаги халқаро илмий–амалий конференция материаллари тўплами/.
14. Khalmatova, B., Mirrakhimova, M., Tashmatova, G., & Olmosov, R. (2017). Efficiency of the usage of antagonists of leukotrienic receptors at children with bronchial asthma. In International Forum on Contemporary Global Challenges of Interdisciplinary Academic Research and Innovation (pp. 291-296).