

Beyond rickets: sunshine vitamin's impact on ADHD: A review

Madhurima Mahanti *

Food and Nutrition, Department of Home science, University of Calcutta, West Bengal, India.

Magna Scientia Advanced Research and Reviews, 2025, 14(01), 087-090

Publication history: Received on 25 April 2025; revised on 12 June 2025; accepted on 14 June 2025

Article DOI: <https://doi.org/10.30574/msarr.2025.14.1.0076>

Abstract

ADHD (Attention Deficit Hyperactivity Disorder), a neurodevelopmental disorder now reaching at its highest level due to modern lifestyle, micronutrients deficient diet. This disorder not only affects the brain functions but also simultaneously affects the all-round development of the individuals. Since this disorder predominantly affects the childhood age period. Thus, ADHD retards the base of the life cycle. Much is not known about the treatment of ADHD but with the proper micronutrient rich diet specially vitamin D rich diet, we can fight against ADHD. In this review a detailed insight of the effectiveness of vitamin D towards ADHD is established with different proven studies.

Keywords: ADHD; Neurodevelopmental; Micronutrients; Vitamin D

1. Introduction

Now days with modern lifestyle, there are different types of disorder that are associated with the improper development of neurons, ADHD is one of the well-known neurodevelopmental disorders. Neurodevelopmental means it is associated with brain. The occurrence of ADHD is more prevalent in children and adults [1].

The characteristics of ADHD are buried in its name itself, there are different types of symptoms like difficulties on attention or concentration, hyperactivity and impulsivity [2]. All these combined symptoms result in disturbances in academic, social functions. Children with ADHD have difficulties in learning, academic areas associated with cognitive and motor development [3].

The subtypes of ADHD also buried in its names. There are mainly two types of ADHD. The subtypes of ADHD follow-Inattentive, hyperactive ADHD. Inattentive ADHD signifies that there is problem related to adjustment of concentration whereas hyperactive ADHD signifies that there is an issue of impulsiveness [4].

2. Occurrence of ADHD

ADHD is commonly seen in children. The characteristics are clearly seen in preschool and early school years. The characteristics still continues in the period of adolescents and adulthood period [5]. ADHD is common worldwide, but the prevalence of ADHD in India is reported to be 1.6% to 17.9%. From a survey study in India, it is concluded that out of 205 children between the age of 6 to 12 years, 13 children are associated with ADHD. The prevalence of ADHD is more common in males rather than females [5].

* Corresponding author: Madhurima Mahanti

3. The complex causes of ADHD- genes, brain, neurotransmitters and more

Brain and spinal cord are two components of central nervous system. There are different types of lobes in the brain, frontal lobe is one of them. Frontal lobe is responsible for the works associated with organization, planning and decision making.

It is observed that the frontal lobe of individuals with ADHD is immature than those without ADHD. Concurrently because of immature frontal lobe, the size of the brain is also small in children with ADHD [6].

In ADHD, not only changes in the frontal lobe occurs but also ,there are some dimensional changes in the caudate nucleus and cerebellar vermis in the brain occur [7].

There is a specific gene called DRD2 gene which is involved with the brain dopamine system. This gene helps to create dopamine receptor in the brain [8]. Dopamine is one of the neurotransmitters. Neurotransmitters are the chemical messenger that transmits signals from one nerve cells to another. Not only neurotransmitter but also an organic chemical means hormone which is of the catecholamine family, often referred as feel-good hormone influencing motivation, pleasure etc. [9].

There are certain medications like methylphenidate, dextroamphetamine and atomoxetine that are given in ADHD individuals. These medications are proven to increase brain catecholamine levels for example dopamine [10].

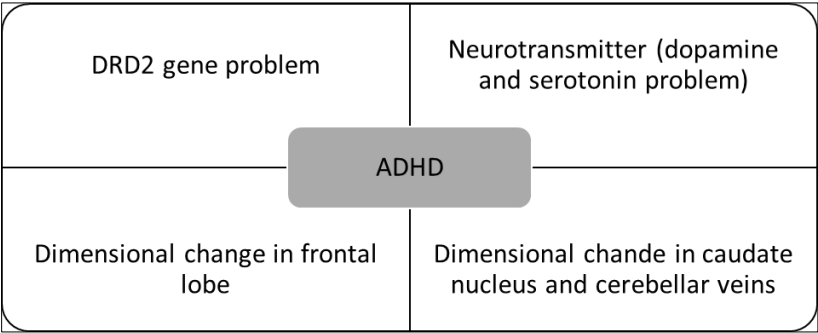


Figure 1 Complex causes of ADHD (attention deficit hyperactivity disorder)

4. The fat-soluble sunshine vitamin D

Vitamin D also known as sunshine vitamin is a fat-soluble vitamin. This vitamin is present in different forms- 7 dehydrocholesterol, calcitriol or cholecalciferol and 1,25 dihydroxycholecalciferol.

The vitamin D has two forms; one is from animal sources cholecalciferol and other one is from plant sources ergocalciferol. The preform of these two forms is 7 dehydrocholesterol and the active form of vitamin D is 1,25 dihydroxycholecalciferol. Previously we knew that this vitamin is only effective in the prevention of bone related problems like ricket, osteomalacia and osteoporosis. But this vitamin has a significant role in the prevention of ADHD [11].

Mostly animal proteins are a noticeable source of this vitamin. Cod liver oil, shrimp, egg yolk, milk have a considerable amount of vitamin D. But out of them cod liver oil is the most protuberant source of this vitamin. Besides the food sources like its other name sunshine vitamin, the UV-B radiation from sun is a prominent source this vitamin [12].

5. The link between Vitamin D and ADHD

There are different types of evidences that vitamin D deficiency causes different problems in brain and spinal cord, these two together make CNS.

From a randomized, double blind, placebo controlled clinical trial studies on 66 ADHD children, children with the supplementation of vitamin D and Mg together showed improved behavioral functions [13].

Besides dopamine there is another type of neurotransmitter that can control the symptoms of ADHD. Deficit of serotonin at the junction of two neurons popularly known as synapse triggers the onset of ADHD [14]. Being a neurotransmitter, serotonin regulates different motor and cognitive related functions such as executive functions, social behaviors that are connected to ADHD.

Vitamin D and serotonin are directly related to each other. Serotonin is synthesized from one of the amino acids Tryptophan. The enzyme Tryptophan Hydroxylase-2 helps in the synthesis of serotonin from Tryptophan and this tryptophan is transcriptionally activated by vitamin D hormone [15]. One of the major components of serotonin metabolic pathway is serotonin reuptake transporter (SERT). 1,25 dihydroxyvitamin D increases the expression of TPH 2 (Tryptophan Hydroxylase 2) and it subdues the expression of SERT [16]. It means less serotonin is taken back by neurons but more is in the synapse.

Vitamin D is also known as neuro hormone because the brain produces the active form of vitamin D and several vitamin D binding proteins and receptors are also present in central nervous system. That is why vitamin D and neurodevelopment are closely related [17].

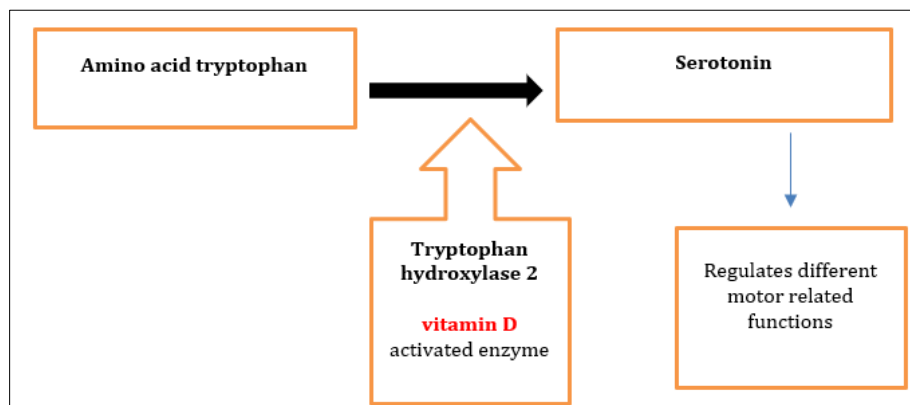


Figure 2 The link between vitamin D and Serotonin

6. Conclusion

In recent times, due to modern and hectic lifestyle there are multiple changes in the daily dietary habits. All these can lead to different neurodevelopmental disorders.

Through the detailed review, we can come across several beneficial effects of Vitamin D towards attention deficit hyperactivity disorder. Previously we knew that sunshine vitamin D is only effective regarding calcium and phosphorous metabolism and this vitamin can cure several problems like rickets, osteomalacia and osteoporosis. Vitamin D predominantly controls neurotransmitter synthesis leading to the prevention of ADHD. So, balanced diet with the inclusion of animal protein as a good source of vitamin D should be included.

Compliance with ethical standards

Disclosure of conflict of interest

There is no conflict of interest.

References

- [1] Faraone, S. V., Bellgrove, M. A., Brikell, I., Cortese, S., Hartman, C. A., Hollis, C., Newcorn, J. H., Philipsen, A., Polanczyk, G. V., Rubia, K., Sibley, M. H., & Buitelaar, J. K. (2024). Attention-deficit/hyperactivity disorder. Nature reviews. Disease primers, 10(1), 11.
- [2] Salvi, V., Migliarese, G., Venturi, V., Rossi, F., Torriero, S., Viganò, V., Cerveri, G., & Mencacci, C. (2019). ADHD in adults: clinical subtypes and associated characteristics. Rivista di psichiatria, 54(2), 84–89.

- [3] Rajaprakash, M., & Leppert, M. L. (2022). Attention-Deficit/Hyperactivity Disorder. *Pediatrics in review*, 43(3), 135–147.
- [4] ADHD[internet]ClevelandClinic@2025[cited2025April15].Availablefrom:<https://my.clevelandclinic.org/health/diseases/4784-attention-deficithyperactivity-disorder-adhd>
- [5] Sharma, P., Gupta, R. K., Banal, R., Majeed, M., Kumari, R., Langer, B., Akhter, N., Gupta, C., & Raina, S. K. (2020). Prevalence and correlates of Attention Deficit Hyperactive Disorder (ADHD) risk factors among school children in a rural area of North India. *Journal of family medicine and primary care*, 9(1), 115–118.
- [6] ADHD & the brain[internet] AMERICAN ACADEMY OF CHILD &ADOLECENT PSYCHIATRY @2017[cited 2025 April15]. Available from :https://www.aacap.org/AACAP/Families_and_Youth/Facts_for_Families/FFF-Guide/ADHD_and_the_Brain-121.aspx
- [7] Tripp, G., & Wickens, J. R. (2009). Neurobiology of ADHD. *Neuropharmacology*, 57(7-8), 579–589.
- [8] Exploring DRD2 Gene's Role in ADHD [Internet] ClarityX @2024 [cited 2025 April 16]. Available from :https://clarityxdna.com/blog/learn/exploring-drd2-genes-role-in-adhd/?srsltid=AfmBOorqd2gmYOg_w7DQgfsPiGmQ48LwioEAR-XuhQ-eqgwqPvCKPdZn
- [9] UNDERSTANDING ADHD [Internet]. ADDA @ 2024 [cited 2025 April 16]. Available from :<https://add.org/adhd-dopamine/>
- [10] Del Campo, N., Chamberlain, S. R., Sahakian, B. J., & Robbins, T. W. (2011). The roles of dopamine and noradrenaline in the pathophysiology and treatment of attention-deficit/hyperactivity disorder. *Biological psychiatry*, 69(12), e145–e157.
- [11] Kumar P, Mina U, Life Sciences Fundamental and practice (Part 1). 9th ed. Delhi: Pathfinder Publication ;2024.
- [12] Srilakshmi B, NUTRITION SCIENCE. 5th ed. Delhi: New Age International (P) Ltd., Publishers; 2016 .
- [13] Hemamy, M., Pahlavani, N., Amanollahi, A., Islam, S. M. S., McVicar, J., Askari, G., & Malekahmadi, M. (2021). The effect of vitamin D and magnesium supplementation on the mental health status of attention-deficit hyperactive children: a randomized controlled trial. *BMC pediatrics*, 21(1), 178.
- [14] Banerjee, E., & Nandagopal, K. (2015). Does serotonin deficit mediate susceptibility to ADHD?. *Neurochemistry international*, 82, 52–68.
- [15] Patrick, R. P., & Ames, B. N. (2015). Vitamin D and the omega-3 fatty acids control serotonin synthesis and action, part 2: relevance for ADHD, bipolar disorder, schizophrenia, and impulsive behavior. *FASEB journal : official publication of the Federation of American Societies for Experimental Biology*, 29(6), 2207–2222.
- [16] Alimohammadi-Kamalabadi, M., Ziaei, S., Hasani, M., Mohammadi, S., Mehrbod, M., Morvaridi, M., Persad, E., Belančić, A., Malekahmadi, M., Estêvão, M. D. D. M. A. O., Daneshzad, E., & Heshmati, J. (2024). Does vitamin D supplementation impact serotonin levels? A systematic review and meta-analysis. *Health science reports*, 7(8), e2276.
- [17] Kaviani, M., Nikooyeh, B., Zand, H., Yaghmaei, P., & Neyestani, T. R. (2020). Effects of vitamin D supplementation on depression and some involved neurotransmitters. *Journal of affective disorders*, 269, 28–35.