

VITAMIN D STATUS AND COGNITIVE FUNCTION OF CHILDREN WITH LEARNING DISABILITIES

Health Science

Divya D Nambisan Principal, Rajiv Gandhi Institute of Speech and Hearing, Trikaripur-671310, Kasaragod.

Rasitha Harish Professor, Baby Memorial College of Allied Medical Sciences, Kozhikode

ABSTRACT

The present study examines the potential effect of Vitamin D supplementation on the cognitive abilities of children with learning disabilities, a group characterized by distinct mental processing patterns that do not indicate a lack of intellect or motivation. The cognitive performance of adolescents, particularly in memory-related areas, may be affected by Vitamin D status, a modifiable lifestyle factor, according to a hypothesis. This influence has the potential to affect their capacity for learning. To investigate this issue, we administered the Linguistic Profile Test (LPT) to a group of minors both before and after a predetermined duration of Vitamin D supplementation. The LPT scores were used as a proxy for cognitive performance, focusing on language aptitude. This study aimed to examine the effect of vitamin D on cognitive development, prognosis, and treatment outcomes in children with learning disabilities. The results of our study reveal a significant correlation between a person's Vitamin D levels and their cognitive abilities, as measured by the LPT. Significantly, there was a discernible increase in LPT scores following administering Vitamin D supplements, indicating an improvement in the cognitive capacities of children with learning disabilities. This study highlights the significance of contemplating Vitamin D status as part of a comprehensive strategy for managing learning disabilities, considering the complexity of cognitive development and the frequent presence of multiple micronutrient deficiencies. Additional research is necessary to validate these findings and provide a more comprehensive understanding of the effect of vitamin D and other micronutrients on cognitive function in children with learning disabilities.

KEYWORDS

learning disability, Vitamin D, cognitive function, Linguistic Profile Test, cognitive development.

INTRODUCTION

Investigating the correlation between Vitamin D and cognitive abilities, specifically in children with learning disabilities, is a subject of interest in nutrition and neuroscience. Vitamin D, commonly called the "sunshine vitamin," fulfills crucial functions in various physiological processes. The significance of this substance lies in its vital role in maintaining bone health, supporting immune system function, and its emerging exploration of cognitive function¹. The human brain is an intricate organ that depends on many biochemical processes to operate effectively. Existing research indicates that Vitamin D may impact various facets of brain health, encompassing neuronal differentiation, synaptic plasticity, and neuroprotection². These processes are of utmost importance for acquiring knowledge and retaining memory. Examining cognitive function in children with learning disabilities is particularly interesting in these processes.

Children diagnosed with learning disabilities frequently encounter difficulties in their cognitive capacities, which directly impact their mental processes, learning capabilities, comprehension skills, and memory retention³. Suppose Vitamin D is indeed involved in these cognitive processes. In that case, it is reasonable to hypothesize that the vitamin levels in these children may impact their cognitive function and overall learning abilities.

Exploring the potential correlation between Vitamin D status and cognitive function in children with learning disabilities can provide valuable insights into these disabilities and potentially inform the development of intervention and support strategies⁴. Nevertheless, it is essential to acknowledge that cognitive function and learning disabilities are intricate and multifaceted problems, frequently impacted by various biological, environmental, and social elements. Further investigation is warranted to achieve a comprehensive comprehension of this correlation. However, the potential ramifications of these discoveries could have substantial effects on advancing therapeutic approaches and interventions for children afflicted with learning disabilities.

MATERIALS AND METHODS

Over two years, a case-control study was carried out at Sevana Speech and Hearing Center. The research involved a carefully selected sample of 100 children. Within this group, 60 children identified with learning disabilities were included in the study. A control group of 40 children, chosen based on age and gender compatibility, consisted of those with typical development. The ages of all participants ranged between 6 to 15 years. For further granularity in analysis, the group of children with learning disabilities was subdivided according to their specific management strategies and evaluation results. Vitamin D was quantitated using a chemiluminescence assay, and cognitive function

was assessed by The Linguistic Profile Test (LPT).

The Linguistic Profile Test is a psycholinguistic assessment tool utilized to evaluate cognitive functioning through the analysis of language production⁵. The underlying principle of this approach is that the study of language usage can offer valuable insights into a range of cognitive processes, including but not limited to memory, attention, and executive function. The LPT encompasses various activities, including producing narrative speeches and examining linguistic components such as vocabulary usage, sentence construction, coherence, and fluency. This tool offers significant advantages when evaluating cognitive function in individuals with neurological disorders or cognitive impairments, as it can identify specific language usage patterns that may indicate their mental status. Although the LPT is considered valuable, it is commonly incorporated as a component of a comprehensive neuropsychological evaluation. This is because obtaining a comprehensive understanding of cognitive functioning necessitates utilizing multiple assessment techniques.

RESULT AND DISCUSSION

A comprehensive analysis is warranted to discuss the correlation between the administration of Vitamin D supplements and cognitive functions, as evaluated through the LPT. Proficiency in utilizing and comprehending language, which is the central concern of the LPT, constitutes an essential component of cognitive capabilities. Prior studies have indicated that Vitamin D is crucial in diverse cognitive functions, potentially influencing learning and memory processes⁶. Moreover, scientific evidence supports the notion that Vitamin D plays a significant role in various facets of brain health, encompassing neuronal differentiation and synaptic plasticity, both crucial for learning and memory⁷. The study's findings demonstrate a distinct correlation between administering Vitamin D supplements and enhancing cognitive function, particularly in linguistic aptitude, as evidenced by the improved LPT scores. This observation is consistent with previous studies that indicate a correlation between Vitamin D and cognitive function. Prior research has also stated that sufficient Vitamin D levels may improve cognitive performance, specifically in language and memory. Nevertheless, although the outcomes of this investigation align with the discoveries above, it is imperative to comprehend them within their appropriate framework. Various factors can have an impact on cognitive function, including linguistic abilities. Therefore, although administering Vitamin D supplements appear to have enhanced LPT scores in this particular instance, it is essential to acknowledge that a comprehensive understanding of cognitive well-being and performance will likely involve a more intricate framework.

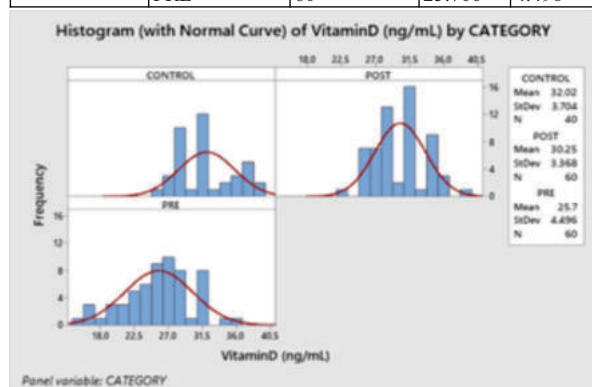
The study employed a longitudinal pre-test/post-test design, wherein two groups of 60 children each were subjected to the LPT. One group

underwent the test before receiving Vitamin D supplementation (pre), while the other group underwent the trial after receiving supplementation (post). Upon examination of the pre-supplementation group, it was observed that the average LPT score was 25.70, accompanied by a standard deviation (StDev) of 4.50. The calculated standard deviation indicates considerable variability in the LPT scores among the children before supplementation administration. On the other hand, the group that received post-supplementation exhibited a mean LPT score of 30.25, accompanied by a standard deviation of 3.37. This data demonstrates that, on average, there was an improvement in the children's LPT scores following the administration of Vitamin D supplementation, as evidenced by the increase in the mean value. The post-supplementation group exhibited a lower standard deviation, indicating higher data points clustering around the mean than the pre-supplementation group.

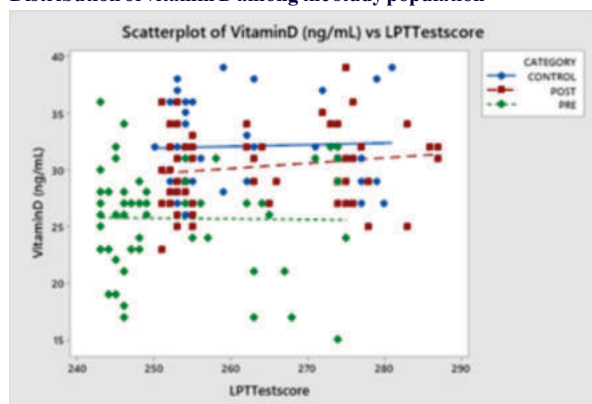
The obtained t-value of 6.27 and the corresponding p-value of 0.000 indicate a statistically significant difference between the scores before and after supplementation. The obtained p-value, which falls below the conventional threshold of 0.05 commonly used to determine statistical significance, indicates a low probability that the observed difference is a result of random chance. Hence, the findings of this study suggest that the administration of Vitamin D supplements potentially yielded a beneficial effect on the Language Processing Test (LPT) scores among the participants, who were children.

Distribution of vitamin D among the study population

Variable	CATEGORY	Total Count	Mean	StDev
VitaminD (ng/mL)	CONTROL	40	32.025	3.704
	POST	60	30.250	3.368
	PRE	60	25.700	4.496



Distribution of vitamin D among the study population



Scatter plot of Vitamin D and LPT Test Scores among the categories

CONCLUSIONS

The results obtained from this research suggest that administering Vitamin D supplements may benefit children's cognitive abilities, as evidenced by their performance on the Linguistic Profile Test. The increase in LPT scores following Vitamin D supplementation is consistent with prior research emphasizing Vitamin D's influence on cognitive functions. However, it is crucial to underline that cognitive function is a complex concept that depends on various factors. Vitamin D, while important, is just one of the numerous elements that

contribute to cognitive well-being. Although the findings of this study show promise, additional research is necessary to validate these results, examine the underlying mechanisms, and delve into the wider implications of Vitamin D supplementation in children with learning disabilities. The present study provides significant contributions to the ongoing discourse regarding the potential advantages of Vitamin D for cognitive function. This highlights the significance of incorporating nutritional factors into managing learning disabilities and sets the stage for further investigation in this crucial field.

REFERENCES:

1. McDowell LR. Vitamins in animal nutrition: comparative aspects to human nutrition. Elsevier; 2012 Dec 2.
2. Banerjee A, Khemka VK, Ganguly A, Roy D, Ganguly U, Chakrabarti S. Vitamin D and Alzheimer's disease: neurocognition to therapeutics. International Journal of Alzheimer's Disease. 2015 Aug 17;2015.
3. Drigas A, Mitsea E, Skianis C. Virtual reality and metacognition training techniques for learning disabilities. Sustainability. 2022 Aug 16;14(16):10170.
4. Baburamani AA, Patkee PA, Arichi T, Rutherford MA. New approaches to studying early brain development in Down syndrome. Developmental medicine & child neurology. 2019 Aug;61(8):867-79.
5. Dromi E, Oren A, Mimouni-Bloch A. Language comprehension and speech production in young children with autism spectrum disorder: Psycho-linguistic insights on restricted, repetitive behaviors and interests. Repetitive and Restricted Behaviors and Interests in Autism Spectrum Disorders: From Neurobiology to Behavior. 2021:143-57.
6. Roy NM, Al-Harathi L, Sampat N, Al-Mujaini R, Mahadevan S, Al Adawi S, Essa MM, Al Subhi L, Al-Balushi B, Qoronfleh MW. Impact of vitamin D on neurocognitive function in dementia, depression, schizophrenia and ADHD. Frontiers in Bioscience-Landmark. 2020 Oct 1;26(3):566-611.
7. Cohen Kadosh K, Muhandi L, Parikh P, Basso M, Jan Mohamed HJ, Prawitasari T, Samuel F, Ma G, Geurts JM. Nutritional support of neurodevelopment and cognitive function in infants and young children—an update and novel insights. Nutrients. 2021 Jan 10;13(1):199.