EXPLORING THE NUTRITIONAL IMPACTS OF SUPPLEMENTS ON PEDIATRIC PATIENTS: A CRITICAL ANALYSIS WITH EMPHASIS ON NUTRITION AND HEALTH STATUS

Palak Dua Grover[1*], Dr. Anuja Pandey[2]

Article History: Received - 17 October 2022 Revised - 22 November 2022 Accepted - 17 December 2022

Abstract

This study aimed to investigate the impact of supplementary nourishment on the general health and nutritional status of pediatric patients, with a specific focus on the utilization of dietary supplements for treating pediatric malnutrition. A total of 200 children (aged 5 to 10), all affected by malnutrition, participated in the research. Notably, none of the participants had prior exposure to vitamin B6 supplements. Evaluation parameters included bone density, weight, and height, and statistical analysis was conducted using SPSS. The results revealed a positive response to treatment with vitamin B6 supplements, leading to progressive dose increases to maximize individual benefits. Elevated vitamin levels were indicative of improved absorption and adherence to the treatment plan. Significantly ($p<0.005$), affected children experienced a substantial increase in both height and weight following the abrupt rise in vitamin levels. Moreover, bone density showed a gradual improvement with oral vitamin supplementation. In conclusion, oral supplementation of vitamin B6 demonstrated favorable effects on the metabolic and nutritional well-being of children. The results suggest that vitamin supplements could serve as a reasonable additional therapy for most malnourished youngsters.

Keywords: Dietary supplement; Pyrodoxine; Vitamin; Bone density; Pediatrics; Treatment

[1*]Research Scholar, Department of Pharmacy, Himgiri zee University Dehradun, Uttarakhand, India, palakashangh@gmail.com
[2]Professor, Department of Pharmacy, Himgiri zee University Dehradun, Uttarakhand, India, anuja.pandey@hzu.edu.in

***Corresponding Author:** Palak Dua Grover
*****palakashangh@gmail.com

DOI: - 10.53555/ecb/2023.12.7.383

1. Introduction

For the most part, people in industrialised countries have recognised dietary supplements as a necessary part of their diet. This involves health benefits that underscore the clear connections between optimal nutrition and the intake of micronutrients, vitamins, minerals, and other indispensable trace elements. The notion that dietary supplements have no unfavourable side effects, accessibility, and simplicity of use have all led to the widespread use of these products. Customers may now choose a healthy diet plan since most health authorities have given sufficient criteria for nutritional reference values, dietary advice, and food supplements. Furthermore, in a study encompassing pediatric populations across Europe, a notable proportion of children exhibited inadequate intakes of vitamins and various dietary elements, including iron, vitamin D, folate, iodine, and vitamin E, when compared to the estimated average requirements. This implies that inadequate body weight and nutritional deficiencies in the body are related, and that poor eating decisions are formed when food is consumed in this condition [1,2].

Because vitamins and minerals are essential for the creation of neurotransmitters and the metabolism of fatty acids, among other vital biological processes, they are also necessary for human health. Insufficient diets in both the United States and globally have historically been linked to vitamin and mineral deficiencies in children, leading to conditions such as hypothyroidism, rickets, scurvy (caused by vitamin C deficiency), and anemia, along with other associated health issues. The relationship between relative metabolic abnormalities and developmental disorders, including attention deficit disorder, cognitive impairments, and intellectual development, has changed recently [3-5].

Numerous studies have shown the benefits of dietary supplements including docosahexaenoic acid, eicosatetraenoic acid, and omega-3 polyunsaturated fatty acids for preserving health and conditions in paediatric patients, especially those with neurodevelopmental disorders. Dietary supplements offer extra advantages in addressing attention deficit hyperactivity disorder and influencing gut flora positively through probiotic use. Although there has been a notable rise in the utilization of dietary supplements among pediatric patients, there is limited knowledge about the characteristics of these supplements, potential side effects, and their interactions with other medications. Teaching young patients how to utilise dietary supplements and keeping doctors and other medical professionals informed about patients' dietary product supplementation has become essential. As a result, healthcare professionals, including doctors and related practitioners, are recognized as some of the primary sources of information regarding dietary supplements [6,7]. Health professionals would rather encourage patients to utilise dietary supplements by raising concerns about their use, assessing the supplements' efficacy and safety alongside data, and keeping an eye on side effects in relation to treatment outcomes. Furthermore, extensive research has provided insights into the nutritional composition, specifics of dietary supplements, and therapeutic understanding of these supplements. Moreover, studies indicate that some pediatric hospital patients experience gastrointestinal tract malfunction, hindering their ability to consume food adequately. This involves the use of dietary supplements, generally known as oral nutritional supplements (ONS). When it comes to treating paediatric patients who have been clinically cleared for oral feeding, ONS is helpful in eliminating malnutrition. Oral nutritional supplements (ONS) have not, however, shown to be cost-effective or beneficial for paediatric hospital patients [8]. Prior studies on the inclusion of ONS to the diets of young cystic fibrosis patients discovered that these dietary supplements improved nutritional status and had positive effects on clinical health outcomes. Comparable results have been seen in young patients with Crohn's disease who used ONS supplements, which improved their nutritional status and overall health care. Furthermore, studies have demonstrated that these supplements enhance energy intake and promote weight gain in children facing acute illnesses and susceptible to antibiotic treatment [9, 10].

Hence, considering the aforementioned concerns, the current study explores the utilization of dietary supplements in pediatric patients to improve their nutritional quality and health benefits. The body of studies indicating improved health outcomes in paediatric children has focused on the utility of dietary supplements.

2. Material and method

2.1Material

Data was acquired from January 2022 until June 2022. There were four hundred children in the 5–10 age range. The Max Hospital in Delhi served as the site of the study. In this study, just one dietary supplement was used. Excluded from the study were those who did not get professional advice to use nutritional supplements, all paediatric patients

who did not fit the age range, and paediatric patients who had additional conditions including heart disease and did not want to provide informed consent.

2.2 Method

The research included subjects who were deficient in pyridoxine. Every participant was treated equally. The research physician conducted a medical assessment on the youngsters to verify their suitability for participation in the study. The liquid supplement was provided to the candidates in three equal dosages for breakfast, lunch, and supper. Dosing was determined and administered based on volume using oral syringes. Every participant in the experiment was titrated progressively to reach their maximal dosage throughout the first three weeks. The nutritional dosage levels of the supplement were chosen to be much higher than the RDA, but still within the acceptable maximum range, based on prior studies. The supplement that the paediatrician prescribed was to be administered by the parents. "Dual-energy X-ray absorptiometry" was used to assess the bone density. A weighing machine and a height measuring tape were used to determine the subjects' weight and height.

2.3Data Analysis

Various statistical methods were employed in accordance with the study's subject matter. The purpose of these tests was to compare the parameter values between the two groups. Unpaired t-tests were carried out with the presumption of equal variance if the p-values for the F-tests for an equal variance were more than 0.05.

3. Result

3.1Clinical observation

One participant, out of the 200 who were originally signed up for the experiment, left the low-dose group prior to the intervention due to a taste aversion to the reconstituted beverage and some gastrointestinal distress. Subsequent research revealed that these problems subsided after the participant left the study. The food regimens were reported to have been followed by all other participants. The participants in the 8-week trial did not report any additional health concerns or negative consequences from consuming the liquid without supplementation or the liquid with vitamin B6 supplementation.

3.2Effects of supplementation

Of the 200 participants, 75% had a diagnosis of urinary tract infection and pharyngitis. However, following a three-week trial period, the symptoms subsided because vitamin B6 helps to prevent phosphyrlation, which is the normal excretion of urine without essential components like protein or carbohydrates, and to maintain homocysteine levels. Table 2 illustrates how drastically improved height, weight, and bone density were.

Table 1. Before-Intervention (Prior to Supplementation)

Variables	Male	Female
Body Height	76.2 cm	68.58 cm
Body Weight	18kg	13 kg
Density of bone	-1 to -2.5	-1 to -1.7

The pretreatment (prior to supplementation) information for each research participant is shown in Table 1. It was determined that the average height of men was 76.2 cm, while the average height of females was 68.58 cm. The findings indicated that the bone density for males and females ranged from -1 to -1.7 and -1 to -2.5, respectively. Additionally, the body weights for males and females were 13 kg and 18 kg, respectively.

Table 2. After-intervention (After Supplementation)

Variables	Male	Female
Body Height (average)	122..9 cm	122 cm
Body Weight (average)	23.2 kg	22.9 kg
Density of bone (average)	-1 to +1	-1 to +1

The post intervention (after supplementation) statistics for the study subjects are shown in Table 2. It was observed that the average height of boys was 122.9 cm, while the average height of girls was 122 cm. The bone density of the men and females was determined to be in the range of -1 to +1 in the males and 22.9 kg in the females. The males' body weight was 23.2 kg, while the females' body weight was 22.9 kg.

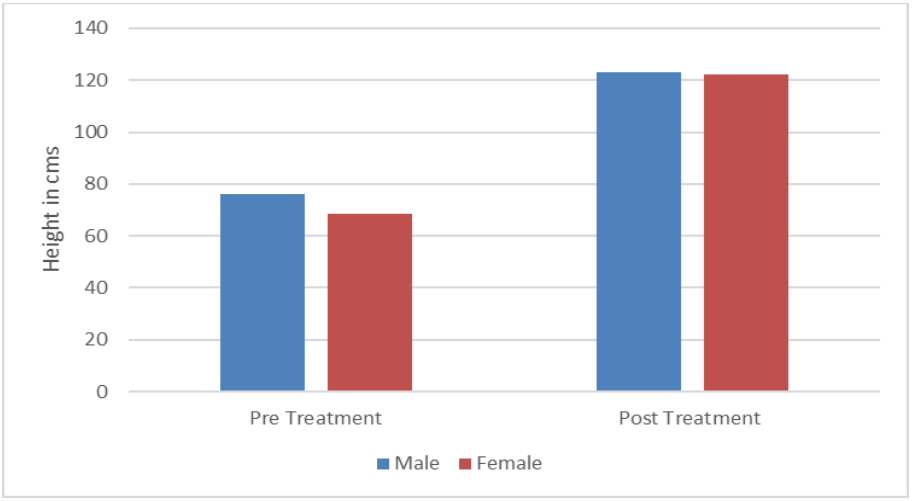

Figure 1 Variation in height pre- and post-supplementation.

Figure 1 depicts the mean height of males and females before and after supplementation. A discernible increase is evident in both periods – before and after supplementation.

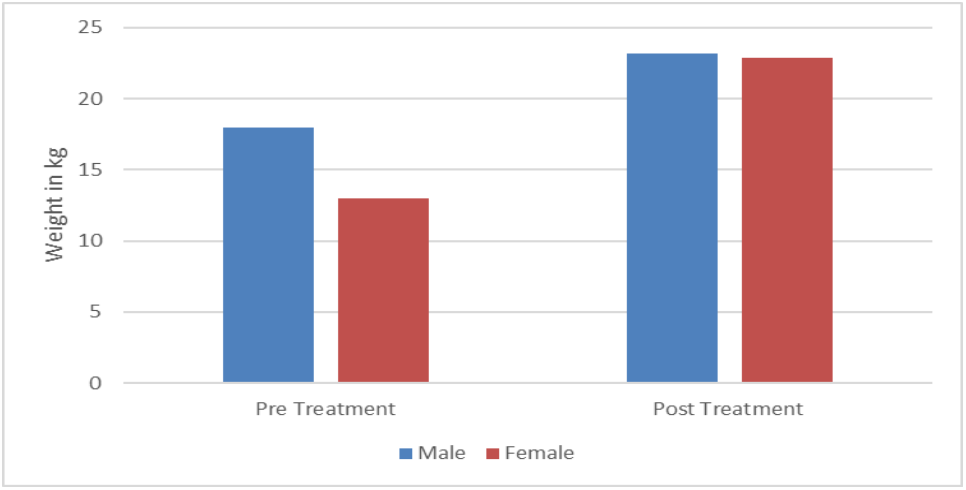

Figure 2 Alteration in weight prior to and following supplementation.

Figure 2 displays the mean weight of the male and female participants before and after supplementation. Following supplementation, there is a noticeable rise in both male and female populations.

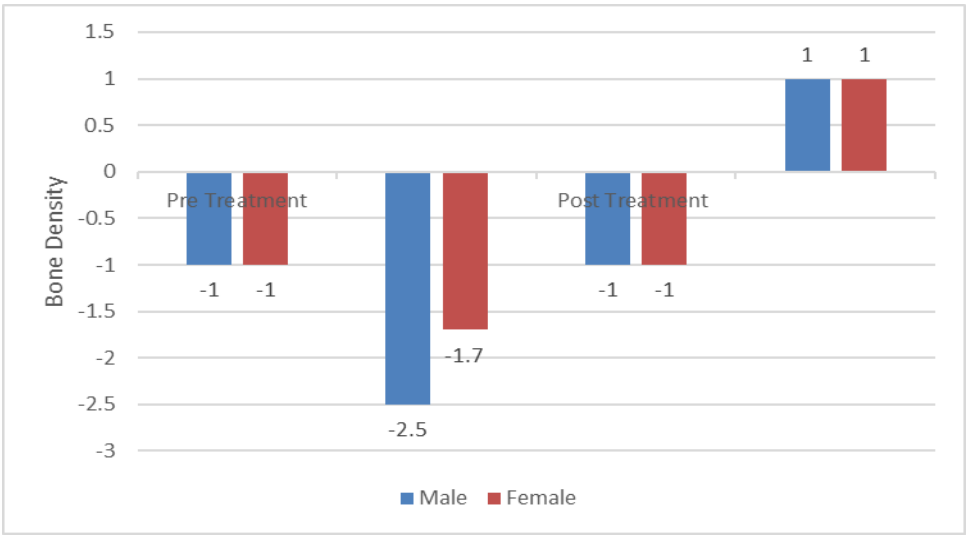

Figure 3 Shift in bone density prior to and following supplementation.

Figure 3 displays the mean bone density of males and females, both before and after supplementation. Prior to receiving supplements, the T-score indicated that the participants with pyrodoxine deficiency were in poor health, as shown by the negative values on the graph. A clear and significant enhancement in bone density was observed following the supplementation.

Table 3. (Paired Samples Test) comparison of body weight pre- and post-supplementation.

		Paired Differences					T	df	Sig. (2-tailed)
		Mean	SD (Standard Deviation)	SEM (Standard Error Mean)	95% CI of the Difference				
					Highest	Lowest			
Pair 1	Before-intervention After intervention	-8.64800	3.46517	0.24502	-8.16482	-9.13118	-35.294	199	0.000

Table 3 presents the t-test comparison of the subjects' conditions before and after supplementation. There was a statistically significant change (P≤0.05) in the subjects' body weight before and after supplementation, according to the data.

Table 4. Paired Samples Test of bone density pre- and post-supplementation.

		Paired Differences					T	df	Sig. (2-tailed)
		Mean	SD (Standard Deviation)	SEM (Standard Error Mean)	95% CI of the Difference				
					Highest	Lowest			
Pair 1	Before intervention-After intervention	-2.54050	0.95990	0.06788	-2.40665	-2.67435	-37.429	199	0.000

Table 4 displays the t-test comparison of the subjects' conditions before and after supplementation. There was a statistically significant change (P≤0.05) in the subjects' bone density before and after supplementation, according to the data. The table displays the 0.06788 standard error of mean and the 0.95990 standard deviation. A 95% confidence interval was computed.

4. Discussion

Water-soluble vitamin B6, commonly referred to as pyridoxine, is found in various foods and supplements. The most prevalent indicator of B6 levels in the body is pyridoxal 5-phosphate (PLP). PLP functions as a coenzyme, aiding more than 100 other enzymes in performing diverse functions. These functions include the breakdown of proteins, carbohydrates, and fats, maintenance of normal homocysteine levels (essential for heart health), and support for the well-being of the immune system and brain.

In this cohort study, vitamin B6 consumption was shown to have a dose-dependent negative connection with urinary infection rates, even after confounding factors were adjusted for. The total mortality risk was higher for male and female individuals compared to pre-treatment patients. Similar findings were obtained from many sensitivity analyses, and the negative association remained across subgroups.

The results of our investigation suggest that vitamin B6 supplements may benefit people suffering from pyridoxine deficiency. Numerous studies have shown the health-protective properties of vitamin B6. Epidemiological studies have connected low vitamin B6 intake to an increased risk of cancer and cardiovascular disease (CVD). A recent meta-analysis, drawing from observational study data, uncovered a dose-response relationship between decreased cancer risk across various sites and both blood levels of the antioxidant pyridoxal 5'-phosphate (PLP) and vitamin B6 intake [11,12].

There seems to be a physiologically plausible effect of vitamin B6. Research has shown the significant roles that epigenetic and metabolic factors play in the aetiology of chronic diseases, including cancer, heart disease, diabetes, and ageing. A deficiency in Vitamin B6 has been linked to adverse health consequences, such as alterations in the DNA methylation process, an imbalance in DNA precursors, and a deficiency in DNA repair. This implies a potential disruption in the intricate equilibrium of one-carbon metabolism, leading to potential long-term health complications. Vitamin B6 has also been shown to affect gene expression and the immune response as

a secondary impact. Studies indicate that vitamin B6 plays a noteworthy role in both humoral immunity and cell-mediated immunity [13]. Morris et al. additionally identified a correlation between reduced levels of C-reactive protein in the NHANES dataset and the dietary intake of vitamin B6. This research suggests that vitamin B6 may potentially have anti-inflammatory properties [14]. As we age, there is an increased requirement for vitamin B6 in our bodies. Fortunately, vitamin B6 deficiency is relatively uncommon in children and adolescents due to the abundant presence of this nutrient in regular meals [15]. It is important to remember that vitamin B6 deficiency is more frequent among the elderly; studies conducted in the US and the UK have shown that the prevalence of this condition varies from 11 to 65 percent [16, 17]. 36.5% of the male participants and 40.3% of the female participants in our cohorts were observed to have vitamin B6 intakes below the recommended dietary requirement. This indicates that the age-related supplement dose varies, and we should choose the amount of vitamin B6 we consume based on our height and weight. The present study was predicated on two ongoing prospective investigations in order to mitigate the potential for common biases. Given the population-based design and a high response rate, minimizing the likelihood of selection bias, we can more confidently generalize our findings to the global population [18]. In summary, the supplementation resulted in increased height, weight, and bone density among the participants. It was shown that the supplement helped children's growth and development.

5. Conclusion

The utilization of the oral nutrition supplement demonstrated enhancements in height, weight, and bone density. The supplement was well-tolerated with minimal adverse effects on health; however, some individuals needed lower supplement amounts during titration than initially recommended. It was evident that individuals who took supplements benefited from them. We think that longer treatment sessions will provide greater outcomes. There was a wide range of improvement, with some reporting no change and others reporting moderate to significant improvement. This study discovered that giving children with pyridoxine insufficiency vitamin B6 orally improved their nutritional and metabolic status and lessened their symptoms. Based on the available information, vitamin B6 supplementation may be beneficial for the majority of children and adults who are pyridoxine deficient. The findings of this study might be used in the future to create vitamin supplements for kids with pyridoxine deficiencies.

References

1. Breakey, J. (1997). The role of diet and behaviour in childhood. Journal of paediatrics and child health, 33(3), 190-194.
2. Van Oudheusden, L. J., & Scholte, H. R. (2002). Efficacy of carnitine in the treatment of children with attention-deficit hyperactivity disorder. Prostaglandins, Leukotrienes and Essential Fatty Acids, 67(1), 33-38..
3. Harding, K. L., Judah, R. D., & Gant, C. E. (2003). Outcome-based comparison of Ritalin® versus food-supplement treated children with AD/HD. Alternative Medicine Review, 8(3), 319-330..
4. Carlton, R. M., Ente, G., Blum, L., Heyman, N., Davis, W., & Ambrosino, S. (2000). Rational dosages of nutrients have a prolonged effect on learning disabilities. Alternative Therapies in Health and Medicine, 6(3), 85-91..
5. Schoenthaler, S. J., Bier, I. D., Young, K., Nichols, D., & Jansenns, S. (2000). The effect of vitamin-mineral supplementation on the intelligence of American schoolchildren: a randomized, double-blind placebo-controlled trial. The Journal of Alternative and Complementary Medicine, 6(1), 19-29..
6. Meyers, L. D., Hellwig, J. P., & Otten, J. J. (Eds.). (2006). Dietary reference intakes: the essential guide to nutrient requirements. National Academies Press.
7. Nogovitsina, O. R., & Levitina, E. V. (2005). Diagnostic value of examination of the magnesium homeostasis in children with attention deficit syndrome with hyperactivity. *Klinicheskaia Laboratornaia Diagnostika*, (5), 17-19.
8. Argao, E. A., Heubi, J. E., Hollis, B. W., & Tsang, R. C. (1992). D-α-tocopheryl polyethylene glycol-1000 succinate enhances the absorption of vitamin D in chronic cholestatic liver disease of infancy and childhood. Pediatric research, 31(2), 146-150..
9. Adams, J. B., George, F., & Audhya, T. (2006). Abnormally high plasma levels of vitamin B6 in children with autism not taking supplements compared to controls not taking supplements. Journal of Alternative & Complementary Medicine, 12(1), 59-63.
10. Papas, K., Kalbfleisch, J., & Mohon, R. (2007). Bioavailability of a novel, water-soluble vitamin E formulation in malabsorbing

patients. Digestive diseases and sciences, 52(2), 347-352..

11. Rimm, E. B. (1998). W illett WC, Hu FB, Sampson L, Colditz GA, Manson JE, Hennekens C, Stampfer MJ. Folate and vitamin B6 from diet and supplements in relation to risk of coronary heart disease among women. J Am Med Assoc, 279, 359-364.
12. Mao, B., Li, Y., Zhang, Z., Chen, C., Chen, Y., Ding, C., ... & Wang, G. (2015). One-carbon metabolic factors and risk of renal cell cancer: a meta-analysis. PLoS One, 10(10), e0141762.
13. Ulvik, A., Pedersen, E. R., Svingen, G. F., McCann, A., Midttun, Ø., Nygård, O., & Ueland, P. M. (2016). Vitamin B-6 catabolism and long-term mortality risk in patients with coronary artery disease. The American journal of clinical nutrition, 103(6), 1417-1425.
14. Morris, M. S., Sakakeeny, L., Jacques, P. F., Picciano, M. F., & Selhub, J. (2010). Vitamin B-6 intake is inversely related to, and the requirement is affected by, inflammation status. The Journal of nutrition, 140(1), 103-110.
15. Ueland, P. M., Ulvik, A., Rios-Avila, L., Midttun, Ø., & Gregory, J. F. (2015). Direct and functional biomarkers of vitamin B6 status. Annual review of nutrition, 35, 33-70.
16. Bates, C. J., Pentieva, K. D., Prentice, A., Mansoor, M. A., & Finch, S. (1999). Plasma pyridoxal phosphate and pyridoxic acid and their relationship to plasma homocysteine in a representative sample of British men and women aged 65 years and over. British Journal of Nutrition, 81(3), 191-201.
17. Morris, M. S., Picciano, M. F., Jacques, P. F., & Selhub, J. (2008). Plasma pyridoxal 5′-phosphate in the US population: the National Health and Nutrition Examination Survey, 2003–2004. The American journal of clinical nutrition, 87(5), 1446-1454.
18. Villegas, R., Yang, G., Liu, D., Xiang, Y. B., Cai, H., Zheng, W., & Shu, X. O. (2007). Validity and reproducibility of the food-frequency questionnaire used in the Shanghai men's health study. British journal of nutrition, 97(5), 993-1000.