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A critical study of nutritional effects based on supplements among affected pediatric patients with a focus on nutrition and health status

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Abstract---Aim: This research aimed to determine whether supplemental nutrition is useful to the well-being of pediatric patients or in improving their effectiveness of nutritional status and overall health. Moreover, we also examined whether nutritional supplements can be used to treat malnutrition in pediatric patients. Method: The study involved 200 children aged 5-10 years (affected pediatric patients). Before the trial began, none of the subjects had taken vitamin B6 supplement. Parameters like, height, weight, and bone density were assessed. Statistical analysis was done by IBM SPSS 25.0. Result: Treatment with the vitamin B6 supplement went well in most cases, and dosages were gradually increased to achieve the highest level of benefit for individual patients. Vitamin levels rose, indicating better adherence and absorption. Because of the dramatic rise in weight and height showed a significant ($p < 0.005$) effect on the afflicted children. After taking vitamin supplements orally, bone density steadily increased. Conclusion: Oral vitamin B6 supplementation has a positive effect on children's nutritional and metabolic health. The result shows that for the majority of malnourished children, taking a vitamin supplement is an acceptable supplementary treatment.

Keywords---bone density, dietary supplement, pediatrics, pyrodoxine, treatment, vitamin,

Introduction

Individuals have seen dietary supplements as an essential component of nutrition and have accepted them in the majority of developed nations. It entails health advantages for preserving well-being that develop obvious links between nutrition and the proper consumption of micronutrients, vitamins, minerals, and other trace elements. Accessibility, ease of use, and the idea that dietary supplements have no negative side effects have all contributed to the widespread usage of these items. The majority of health authorities have provided adequate definitions for food supplements, dietary recommendations, and nutritional reference values, allowing consumers to adopt a healthy diet plan. In addition, one of the research projects, including European pediatric populations, found that a significant number of children had lower intakes of vitamins and other dietary components such as vitamin D, vitamin E, iron, iodine, and folate when compared to the estimated average needs. This means that nutritional deficits in the body are linked to insufficient body weight and that when food is ingested in this state, bad food choices are made.^{1,2}

Vitamins and minerals are required for human health, owing to their crucial role as enzyme cofactors in various bodily activities, including neurotransmitter synthesis and fatty acid metabolism. Hypothyroidism, rickets scurvy (vitamin C deficiency), and anaemia have long been linked to a lack of vitamins and minerals in children's diets owing to poor diets in the United States and across the globe as other health issues. There has been a recent shift in the connection between relative metabolic imbalances and developmental illnesses, such as intellectual development, cognitive disabilities, and attention deficit disorder.³⁻⁵

Several studies have found that dietary supplements containing omega-3 polyunsaturated fatty acids, docosahexaenoic acid, and eicosatetraenoic acid are beneficial for maintaining health and health conditions in pediatric patients, particularly children in neurodevelopment. Other advantages of dietary supplements include the treatment of attention deficit hyperactivity disorder, the enhancement of the immune system via the use of probiotics, which aid in the modulation of the gut flora (although the use of dietary supplements has expanded significantly among pediatric patients, there is still a lack of information about the qualities of these supplements, as well as the adverse risk events and interactions with other treatments. It has become critical to educate pediatric patients on the use of dietary supplements and keep physicians and other health professionals up to speed on the supplementing of dietary products among patients. As a result, physicians and other associated professionals have been regarded as one of the most prevalent sources of knowledge about dietary supplements.^{6,7} Health practitioners prefer to urge patients to use dietary supplements by questioning their usage, evaluating these supplements together with safety measures and data effectiveness, and monitoring adverse events with therapeutic responses. Much more research has also disclosed the nutritional level and information about dietary supplements and a therapeutic understanding of these supplements. It has also been shown that certain hospitalized pediatric patients are unable to eat correctly owing to gastrointestinal tract dysfunction. This entails using oral nutritional supplements (ONS), which are also termed dietary supplements. ONS is beneficial in eradicating

malnutrition in pediatric children who are clinically authorized for oral feeding intake. However, the benefits and cost-effectiveness of oral nutritional supplements (ONS) have not been realized in hospitalized pediatric patients.⁸ Previous research on the addition of ONS in pediatric patients with cystic fibrosis found that these dietary supplements were beneficial in improving nutritional status and exhibiting favourable impacts on clinical health outcomes. Similar findings have been made in juvenile Crohn's disease patients supplemented with ONS, resulting in improvements in nutritional status and health management. Furthermore, these nutritional supplements have been found to enhance calorie intake and promote weight growth in children suffering from acute illnesses who are prone to antibiotic use.^{9,10} As a result, the current research examines dietary supplements among pediatric patients to improve their nutrition quality and health benefits while taking the aforementioned factors into account. The available research on the usefulness of dietary supplements in pediatric patients has been emphasized, demonstrating better health outcomes.

Material and Method

Material

From January 2022 through June 2022, data was gathered. There were 400 pediatric patients in the age category of 5-10 years. The research was carried out at Delhi's Max Hospital. Only one dietary supplement was included in the research. Individuals who were not advised to take dietary supplements by experts, all pediatric patients who were not in the age range and pediatric patients with other diseases such as heart disease and who were unwilling to provide informed permission were also excluded from the research.

Method

The participants were included in the study suffering from pyridoxine deficiency. All participants received the same treatment. A medical examination was performed by the study physician to ensure that the children were healthy enough to participate in the research. For breakfast, lunch, and dinner, applicants were given a liquid supplement to ingest in 3 equal doses. Using oral syringes, dosing was assessed and delivered on a volume basis. Over the first three weeks of the trial, all individuals were gradually titrated to their maximum dose. Based on previous research, the supplement's nutritional dose levels were selected to be much greater than the RDA, yet even under the tolerable upper limit. The parents were in charge of administering the supplement given by the paediatrician. The bone density was measured using dual-energy X-ray absorptiometry. Height and weight were measured using a height measuring tape and a weighing machine.

Analysis of the data

Various statistical methods were used depending on the research question. These tests were performed to compare the values of parameters in two groups. If the p-values for the F-tests for an equal variance were > 0.05 , then unpaired t-tests

were performed under the assumption of equal variance. A p-value of 0.05 or less was considered substantial for individual assessments.

Result

Clinical observation

Of the 200 subjects initially enrolled in the trial, 1 withdrew from the low-dose group before the intervention because of a dislike of the taste of reconstituted liquid and some digestive discomfort. Follow-up studies indicated that these symptoms ended after the subject withdrew from the trial. All other subjects reported compliance with the dietary regimens. Throughout the 8-week study, the subjects reported no other adverse effects on health or any general health problems associated with consumption of either the unsupplemented liquid or the liquid containing the vitamin B6 supplement.

Effects of supplementation

Among 200 participants, 75% participants was diagnosed with symptoms of pharyngitis and urinary tract infection but after three weeks of trial, symptoms reduced as vitamin B6 helps to stop phosphorylation and removal of urine normally without any important constituent like protein, carbohydrate and maintain the homocysteine level. The increase in height, weight and bone density were significantly improved as shown in table 2.

Table 1. Before Supplementation

Pre-treatment		
Parameters	Female	Male
Height (average)	68.58 cm	76.2 cm
Weight (average)	13 kg	18kg
Bone density(average)	-1 to -1.7	-1 to -2.5

Table 1 represents the pre treatment (before supplementation) data of the participants included in the study. The average height of females was found to be 68.58 cm whereas that of males was 76.2 cm. The body weight of males and females were 13 kg and 18 kg respectively and the bone density were found to be in the range of -1 to -1.7 in females and -1 to -2.5 in males.

Table 2. After Supplementation

Post-treatment		
Parameters	Female	Male
Height (average)	122 cm	122.9 cm
Weight (average)	22.9 kg	23.2 kg
Bone density(average)	-1 to +1	-1 to +1

Table 2 represents the post treatment (after supplementation) data of the participants included in the study. The average height of females was found to be

122 cm whereas that of males was 122.9 cm. The body weight of males and females were 23.2 kg and 22.9 kg respectively and the bone density were found to be in the range of -1 to +1 in females and -1 to +1 in males.

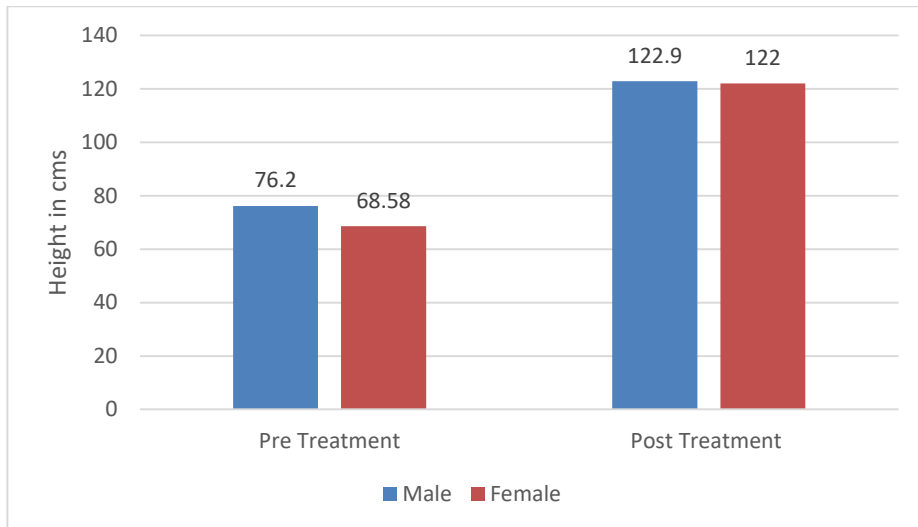


Figure 1. Represent the change in height before and after supplementation

Figure 1 depicts the average height of males and females both before and after supplementation. A significant increase is observed in pre and post supplementation.

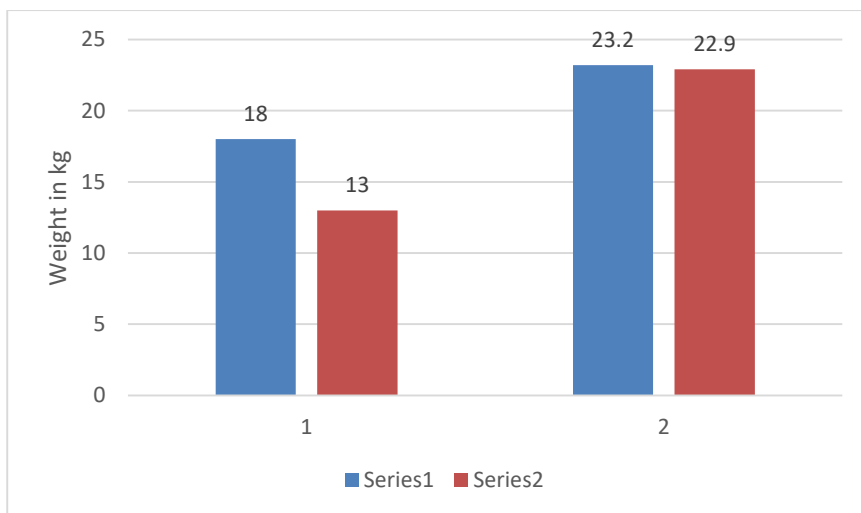


Figure 2. Represent the change in weight before and after supplementation

Figure 2 depicts the average weight of males and females both before and after supplementation. A significant increase is observed in both female and male after getting supplementation.

Pair	Pre treatment - Post treatment	-2.54050	0.95990	0.06788	-2.67435	-2.40665	-37.429	199	0.000
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Table 4 depicts the t-test comparison of pre and post supplementation of participants. The data showed statistically significant difference between the bone density of the participants before and after supplementation ($P \leq 0.05$). The table shows the standard deviation of 0.95990 and standard error of mean of 0.06788. the confidence interval was calculated at 95%.

Discussion

Vitamin B6, or pyridoxine, is a water-soluble vitamin that may be found in a variety of foods, as well as in supplements. In the body, the most frequent marker of B6 blood levels is pyridoxal 5-phosphate (PLP). PLP is a coenzyme that aids more than 100 enzymes in a variety of tasks, including protein, carbohydrate, and fat breakdown; maintaining appropriate homocysteine levels (because elevated levels may cause cardiac issues); and supporting immune system and brain health. A dose-dependent inverse correlation between vitamin B6 intake and urinary infection rates was revealed in this cohort research after controlling for confounding variables. As compared to pre-treatment patients, male and female subjects had a greater probability of overall death. Several sensitivity studies produced comparable results, and the unfavorable relationship persisted across subgroups.

According to the findings of our study, the health of patients with pyridoxine insufficiency may be improved by supplementation with vitamin B6. There are several studies that show vitamin B6 to be protective when it comes to one's health. Low vitamin B6 consumption has been linked to an elevated risk of cardiovascular disease (CVD) and cancer in epidemiological studies. Based on the results of observational studies, a recent meta-analysis indicated that dietary intake of vitamin B6 and blood levels of the antioxidant pyridoxal 5'-phosphate (PLP) were both linked to lower cancer risk at any location in terms of dose-response relationship.^{11,12}

Vitamin B6 seems to have a biologically reasonable impact. It has been shown that epigenetic and metabolic variables perform important tasks in the etiology of chronic illnesses like as aging, heart disease, diabetes and cancer. It is possible that a deficit of vitamin B6 may lead to alterations in the DNA methylation pathway, an imbalance in DNA precursors, and a lack in DNA repair, all of which have been linked to detrimental health consequences. Because of this, it has the potential to disrupt the delicate balance of one-carbon metabolism, resulting in long-term health problems. As a secondary effect, vitamin B6 has been shown to influence immunological response and gene expression. Vitamin B6 has been shown to have an important function in both humoral and cell-mediated immunity.¹³ Morris et al. also discovered that vitamin B6 consumption from food was related with lower levels of C-reaction protein in the NHANES. Anti-inflammatory qualities may also be found in vitamin B6, according to this study.¹⁴

There is a greater need for vitamin B6 as we become older. When it comes to vitamin B6 insufficiency in children and adolescents, it is quite uncommon due to the abundance of this nutrient in everyday meals.¹⁵ Vitamin B6 insufficiency is more common in the elderly, and this should not be overlooked and its prevalence ranges from 11 to 65 percent in the UK and US surveys.^{16,17} 36.5 percent of male and 40.3 percent of female in our cohorts had vitamin B6 intakes that were lower than the guideline nutritional consumption. This means that dosage of the supplement depends on the age, we should select the consumption of vitamin B6 in our diets according to weight and height. To limit the risk of common biases, the current investigation was based on two ongoing prospective studies. We can extrapolate to the global population more easily because of the population-based design and high response rate, which reduces the risk of selection bias.¹⁸ Overall, the supplement raised the height, weight, and bone density of the aforementioned individuals. The supplement was discovered to be beneficial to children's growth and development.

Conclusion

Height, weight, and bone density were all improved as a consequence of taking the oral nutrition supplement. The supplement was well-tolerated, with little health consequences, however individual titration dosages for certain individuals were lower than originally recommended for the supplement. It was clear that supplementation had a positive effect on those who took it. More time in therapy, we believe, will lead to better results. A broad range of improvement was seen, with some people seeing little change and others seeing moderate or considerable improvement. For children with pyridoxine deficiency, this research found that oral vitamin B6 treatment improved their nutritional and metabolic condition and reduced their symptoms. Most children and adults with pyridoxine deficiency might benefit from vitamin B6 supplementation, according to the current data. The results of this research may be used to develop vitamin supplements for children who are deficient in pyridoxine in the future.

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