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Original Article

Effects of Zinc and Multivitamins Supplements on growth in School Children

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ABSTRACT

Zinc and many vitamins are important for development. Various vitamins and zinc deficiencies are communal in emerging states. **Objective:** The purpose of this anlaysis was to evaluate the effectiveness of multivitamin supplementation with zinc in enhancing the schoolchildren growth. **Methods:** Children aged 5-15 attending a public school were included. 160 participants were randomised to take multivitamins (200 IU vitamin D, 1,000 IU vitamin A, 10 mg B1, 1 mg B6, 3 mg B2, nicotinamide 40mg, B12 10 mcg) along with zinc chelated zinc glycinate (20 mg elemental zinc) or once daily placebo treatment was given for 5 days in a week for six-months. The height change from reference value was the primary outcome which was taken significant till conclusion of the analysis. The outcomes which were secondary were variations in BMI, body weight, hip and waist circumference, and ratio of waist-to-height. An intent to treat analysis was accomplished. **Results:** 80 children were randomly assigned to the control group or 80 in the treatment groups. Children who took multivitamins along with zinc had a greater height increase ((4.5±5.1 vs 3.5±4.1 cm, correspondingly; 0.001 of P value). Subgroup analysis exhibited substantial height improvement, particularly among preadolescents. The greatest increase in height occurred regardless of the initial weight and height. An additional increase in growth is visible subsequently two months of supplement. Variations in the other anthropometrical measures did not differ substantially. **Conclusions:** 6-month supplementation with zinc chelated and multivitamins significantly increase height among school going children and was better endured.

INTRODUCTION

Micronutrients, counting multivitamins and zinc, are crucial for growing babies. As a constituent of many most important classes of enzymes and metalloenzymes, zinc is essential for growth of cells, metabolism and differentiation [1-2]. It chelates compound with histidine and cysteine to formulate zinc fingers that have vital part in the transcription of proteins [3]. The deficiency of zinc is communal in under-developed states like Pakistan with a predictable incidence exceeding 21%. The deficiency of zinc is associated with poor growing [4]. Various analysis to assess the effectiveness of zinc supplementation to increase development of child have exhibited unreliable outcomes. Statistics on the effectiveness of supplementation with zinc in children of school-age are sparse [5-6]. There is inadequate research evaluating the zinc role supplementation in encouraging growth in children. Growth factors that play a role in the repair and growth of tissues, bones, and muscles depend on an adequate supply of multivitamins [7-8]. Observational studies from a number of under developed states, counting Pakistan, confirms that children with vitamin A deficiency in growth results in various problems of health and supplements progresses linear growth and weight gain [9-10]. Though the precise mechanisms by which vitamin A

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stimulates development are indistinct, the probable vitamin A effects on promoting factors of growth helps in the regulation of extracellular matrix and bone [11]. Children's growth is also hampered by vitamin deficiency, including vitamin D and the vitamin B complex deficits. Vitamin D affects chondrocytes and osteocytes biologically and performs a well-defined role in calcium homeostasis [12-13]. According to prior research, children who have more severe development retardation also have lower serum vitamin D levels. The several water-soluble vitamins that make up the complex of vitamin B have crucial functions as coenzymes in several metabolic paths in the cellular system and in the production of RNA and DNA [14-15]. Supplementing with multivitamins rather than just zinc or vitamins will increase the length of the lower legs. The purpose of this anlaysis was to evaluate the effectiveness of multivitamin supplementation with zinc in enhancing the schoolchildren growth.

METHODS

This blind, randomized, controlled trial was held in the department of Pediatrics and Community Medicine at Sialkot Medical College, Sialkot and Abbasi Shaheed Hospital Karachi for one-year duration from January 2021 to December 2021. Healthy children aged 5 to 15 and in grades KG to six were evaluated for study eligibility. Children who take vitamin or mineral supplements on a regular basis or have allergies to them were not permitted to participate. The study excluded participants who had a known history of behavioural or psychiatric issues, congenital heart disease, or chronic systemic illness. The ethics committee gave its approval to the protocol. Prior to registration, the children's written informed consent of their parents or legal guardians were obtained. All volunteers, including parents and children, was free to leave the study whenever they want. The reasons for quitting the study were noted. A statistician unrelated to the study's implementation phase used a two-block computer program (GraphPad QuickCalcs, USA) to randomly assign children who had been enrolled to receive a zinc supplement plus multivitamin or a placebo. The intervention was hidden from the researchers, parents, children and teachers. Participants were randomised to take multivitamins (200 IU vitamin D, 1,000 IU vitamin A, 10 mg B1, 1 mg B6, 3 mg B2, nicotinamide 40mg, B12 10 mcg) along with zinc chelated zinc glycinate (20 mg elemental zinc) or once daily placebo treatment was given for 5 days in a week for six-months. Children in the study population received vitamin supplements in amounts roughly equivalent to the Recommended Dietary Allowances (RDA) for childs. The medication was provided in single-dose sachets as a powder. Before administration, the sachet's contents were dissolved in one glass of water. The volunteers in the group of control were given solution for oral rehydration grounded on a placebo that was produced by the similar company and was the same colour and flavour as the experimental product. The medication was not given on weekends, holidays, or when the youngster was not present on the designated day. During the time of the study, parents were advised not to take mineral or vitamin supplements. The difference in height between the study's beginning and completion was its primary outcome. Changes in other anthropometric measurements like BMI, body weight and hip and waist circumferences, served as secondary outcomes. Training research staff record the anthropometric data and baseline demographic, such as gender, age, height, weight and hip and waist circumference. Using an electronic scale, the weight was determined with an accuracy of 100 grammes. A stadiometer was used to measure the height with a precision of 0.1 cm. The age Z-score (HAZ) index and age Z-weight index (WAZ), which expresses a child's height or weight relation to children of the similar gender. In order to determine the waist-to-height ratio (WHTR), the size of the waist was divided by the height. At the beginning of the study and till its end, anthropometric indices were measured using the same scales at one-month intervals. To evaluate the side effects in both groups, open-ended questions were posed. Medication intake was added to determine therapy compatibility. The Kolmogorov-Smirnov test was applied to examine the distribution of the continuous data, and found to have the normal distribution. To determine the percentage, standard deviation and mean; descriptive statistics are presented for anthropometric and demographic data. Comparisons of continuous and categorical variables between groups were made using the student's t-test and Pearson's chi-square test. Each anthropometric parameter's deviation from the mean was determined using a paired t-test and accessible as a mean with CI of 95%. All of the randomly selected children were included in an intent-to-treat analysis. For the statistical analysis, SPSS version 22.0 for Windows was used.

RESULTS

160 Parents and their children were included and randomly assigned to the treatment group (multivitamins along with zinc) and the control group. The participants average age was 8.3 years, with 90 (56.3%) of them being men (range 4.3-13.2 years). 111 (69.4%) participants were less than the age of ten-years. According to the assessment of the nutritional status of Children, 120 (75%) of them were less in height than normal and 110 (68.8%) were under weight than average. Gender distribution, age, nutritional status, baseline anthropometrical measurements such as height, body weight, hip and waist circumference, and WHTR did

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not significantly vary among the groups (Table 1).

Parameter	Treatment group (80)	Placebo group (80)	p-Value
Boys (%)	47(58.8%)	43(53.8%)	0.98
Age (yr.)	8.6(2.1)	8.1(1.8)	0.88
< 10 years	52(65%)	59(73.8%)	0.39
≥ 10 years (%)	28(35%)	21(26.2%)	
Baseline nutritional status			
Underweight			0.091
≤ -1-1	15(18.8%)	14(17.5%)	
<0WAZ	49(61.2%)	40(50%)	
< 0≥ 0	16(20%)	26(32.5%)	
Stunting			
≤ -1-1	30(37.5%)	13(16.2%)	0.61
<0WAZ< 0	36(45%)	38(47.5%)	
≥ 0	14(17.5%)	29(36.3%)	
Weight (kg)			
At start of study	24.1(7.5)	22.1(6.2)	0.91
At conclusion of study	27.1(5.9)	25.8(8.1)	0.77
Weight for age Z score			
At start of study	-0.47 (0.70)	-0.28 (0.86)	0.18
At conclusion of study	-0.22 (0.61)	-0.13 (0.80)	0.60
Height (cm)			
At start of study	120.1 (11.2)	121.9 (11.6)	0.62
At conclusion of study	128.6 (13.8)	126.7 (9.4)	0.49
Height for age Z score			
Baseline	-0.82 (0.84)	-0.79 (0.97)	0.89
End of study	-0.38 (0.65)	-0.55 (0.90)	0.52
Body mass index (kg/m2)			
Baseline	14.34 (1.39)	14.20 (3.60)	0.29
End of study	16.80 (1.95)	17.20 (2.92)	0.21
Waist circumference (cm)			
Baseline	55.2 (6.2)	56.1 (7.1)	0.29
End of study	27.1(5.8)	59.2 (5.8)	0.40
Hip circumference (cm)			
Baseline	65.1 (6.2)	67.2 (7.8)	0.22
End of study	68.5 (7.1)	69.1 (8.6)	0.63
Waist-to-height ratio			
At start of study	0.43 (0.03)	0.47 (0.05)	0.19
At conclusion of study	0.44 (0.03)	0.46(0.05)	0.089

Table 1: shows the Demographic features and anthropometrical information at baseline and at the end of study

The children in the treatment group had increase heights at the end of the study (4.5±5.1 vs 3.5±4.1 cm, correspondingly; p-value 0.001) and had higher HAZ scores (0.34±0.46); p-value 0.001) as compared to 0.15±0.21). (Table 2). BMI, waist circumference, and hip circumference all significantly increased in both groups from baseline; however, there was no discernible difference between the two groups (Table 2). During the study, WHTR in both groups remained constant. Regardless of the baseline HAZ and WAZ scores, it was noted that HAZ scores and height augmented for all of the children in the group given treatment. Age-related differences in FAT alterations were only found in children under the age of ten. The children (WAZ 0) who were under weight than average acquired considerably more weight in a subgroup analysis (0.14±0.35vs 0.02±0.27, respectively), despite the fact that total changes in body weight between the placebo and treatment were not statistically significant. None of the children experienced any serious negative effects. 3 children, two in the placebo group and one in the treatment group, experienced mild abdominal pain and nausea for a few days and all were recovered without any problems. There was no specific treatment given to these children. The 6-month trial was completed by all 3 children. At the conclusion of the second month, one child in the treatment group who complained of unpleasant taste was omitted from the research. Both groups had good compatibility; 82% and 81%, respectively, of the recommended medicines were consumed in the group given treatment and the placebo group (p-value = 0.328).

Anthropometric features	Treatm ent group (80)	Placebo group (80)	p-Value
Weight (kg)	2.9 (2.5-3.5)	2.8 (2.4 to 2.9)	0.69
Weight for age Z score	0.21 (0.14±0.35)	0.15 (0.02±0.27)	0.21
Height (cm)	5.1 (4.5±5.1)	3.8 (3.5±4.1)	<0.001
Height for age Z score	0.41 (0.34±0.46)	0.19 (0.15±0.21)	<0.001
Body mass index (kg/m2)	0.60 (0.34±0.81)	0.68 (0.53±0.91)	0.40
Hip circumference (cm)	2.4 (2.0±3.1)	2.5 (2.1±3.0)	0.61
Waist circumference (cm)	1.9 (1.5±2.1)	1.7 (1.4±1.9)	0.300.19
Waist-to-height ratio	-0.003(-0.005± 0.002)	0.001 (-0.001± 0.004)	

Table 2: shows the anthropometric features variations from baseline to the end of study

DISCUSSION

In this randomised controlled study, we demonstrated that, regardless of baseline ZAT, supplementation with multivitamins along with zinc chelated (20 mg elemental zinc) for 6 months at a BMI level significantly promoted height gain in schoolchildren [15-16]. The variations in BMI, body weight, hip and waist circumference, and WHTR were not significantly affected [17]. However, when treating children who were under weight than normal children, a subgroup study revealed a significant weight gain. The effects of supplementation with zinc on linear growth have been inconsistently studied in the past [18]. In 2 meta-analyses, Brown et al., stated that linear growth had shown favourable results. Ramkrishnan et al., haven't demonstrated any advantage [19-20]. However, preschoolers were a part of the majority of the studies in the meta-analysis. There is not enough information to determine whether zinc supplementation increases school-age children's height [21]. Various studies have shown the beneficial impact of zinc supplementation in our investigation on linear growth. Castillo-Duran et al.,

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discovered that pre-adolescents with idiopathic short stature who received a 10 mg zinc supplement showed improvements in height gain and HAZ scores [22-23]. Ronaghy et al., demonstrated that supplementing 13-year-old malnourished Iranian schoolchildren with 40 mg of zinc in the zinc carbonate form in addition to other nutrients (proteins, fats, minerals and vitamins) led to a considerably larger rise in height and weight [24]. In contrast to our study, which revealed substantial differences in increase from month two, height gain and weight gain were not substantial in the initial six months of the trial but were substantial in the last twelve months. In Indian schoolchildren between the ages of 11-17 Sharma et al., demonstrated that supplementation with 30 or 50 mg of zinc had a significant effect but had no effect on gain in weight, WAZ score in the first three months [25]. In Guatemalan children with a mean age of 81.5 months, Cavan et al. compared supplementing with zinc chelated with amino acids at 10 mg/day with minerals and vitamins alone (without zinc) for three months [26]. Despite having no apparent impact on height, zinc supplementation assisted to increase body structure measurements including the middle arm circumference and triceps skinfold [27]. According to research by Sandstead et al., children's height increased more when given 20 mg of zinc along with specific micronutrients than when given either zinc or micronutrients alone [28]. The height of children of school age has not been positively impacted by zinc supplementation, according to several earlier research. It should be remembered that inhabitants in underdeveloped nations frequently co-exist with a variety of impairments. In school-age children with low plasma concentrations of zinc and retinol, Udomkesmalee et al., studied the effects of supplementing with zinc and/or vitamin A. Its main aim was to determine the functional and biochemical indicators (time of eyesight recovery) following vitamin A and zinc supplements. They discovered that following supplementation, zinc levels and visual function both improved. Plasma levels vary for a few weeks following zinc depletion; therefore, they might not accurately reflect the level of copyright protection for this article [29]. Plasma zinc levels can also be impacted by dietary intake, endotoxemia, infections, steroid use, and plasma volume expansion. In our study, we did not evaluate food intake [30]. High dietary phytate consumption or concurrent mineral intake that affects zinc bioavailability can affect how much zinc is absorbed. Using a blind, randomised, controlled methodology, we predicted that the two matched groups' eating habits would be comparable. Additionally, we urged families not to take any minerals or vitamins throughout the study and delivered study medicine with meals. At the finish of supplementation, the growth results measured. We don't know if the advantages will last or if taking supplements for a longer time will still be beneficial for growth.

CONCLUSIONS

Regardless of baseline height and weight, supplemental zinc and multivitamins increased linear height (height) in healthy schoolchildren, particularly in adolescents (10 years). Additionally, it increased weight in children that were underweight. During treatment, no notable side effects were noticed. Consideration should be given to conducting bigger, multi-center trials and other delivery strategies, such as dietary supplements, to enhance the school-going children growth in regions where zinc deficit is widespread.

Conflicts of Interest

The authors declare no conflict of interest.

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