



## EFFECTS OF MICRONUTRIENTS ON THE CHILDRENS' GROWTH

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### ABSTRACT

The aim of this study is to demonstrate the effect of micronutrients on linear growth pattern of children living in Istanbul, Turkey.

Between 2005 and 2010, we identified two heterogeneous groups of children who visited our outpatient department in Kagithane State Hospital. Comparison between two retrospective children group was initially observed at the use of micronutrients. Each child's initial length and weight Z score were monitored for two years variation of weight Z score and length in annual basis between the two groups. These two heterogeneous groups had not been diagnosed by anemia or chronic disease at the time of this study.

The study was carried out between 2005 and 2010, and it examined two hundred children; specifically, there were 97 females (48.5 %) and 103 males (51.5%). The mean age was  $4.66 \pm 2.78$ , and the range was 1-12. There was no significant difference between the two groups with regard to their initial length Z score levels ( $p > 0.05$ ). During the study, the children who used micronutrients for the duration of two years experienced a significant increase in their length Z score levels ( $p < 0.01$ ). In contrast, no considerable difference was observed in the control group, which did not use micronutrients ( $p > 0.05$ ). Lastly, there was no statistically significant difference between the groups with regard to their weight Z score ( $p > 0.05$ ).

This study illustrates how the use of micronutrient contributes to higher length Z scores of children. This data supports the idea that micronutrients should be included into children's diet. Using micronutrient supplement in children's diet suggests a better health.

**KEY WORDS:** Micronutrient, linear growth, children growth

### INTRODUCTION

In the developing countries, "malnutrition" in childhood and insufficient vitamin and mineral intake remain as a significant public health issue. Insufficient vitamin and mineral intake not only constitutes major health problems but also effects the economical development of the countries.<sup>1,2</sup> Insufficient vitamin and mineral intake is seen in all age groups but causing more risk in early childhood. As the children's growth progresses, their need for vitamin and mineral reserves increases. Children with vitamin and mineral deficiency experience an overall decrease in various functions and fields such as physical activity, endurance, cognitive function, school performance as well as a visible weakening of the immune system. Simultaneously, it is also clearly observed that it causes proneness to infections.<sup>1-6</sup>

In addition to regular nutrition; the growth process of the foods we consume are also to be taken into account. Fertilizers being used in the growth process do also cause a deprivation of vitamins and minerals in most of the fruits and vegetables. Simultaneously, methods of cooking and freezing also result in loss of vitamins. Additionally, processed foods also stimulate an increase of the necessity of vitamins in the body. Under such circumstances, it is thought that even healthy individuals are not having sufficient vitamin intake by their regular diet.<sup>7,8,9</sup>

Vitamin and mineral deficiency is a global major problem and in particular, Vitamin A, iodine, iron, zinc materials are among the primary targets of the World Health Organization Micronutrient Program. In the meta-analysis work, it is also shown that there are the positive effects of the micronutrient usage over the growth curve.<sup>10,11</sup>

Following these findings, we attempted to demonstrate the effect of micronutrient containing Vitamin A, Vitamin D, Vitamin C, Vitamin E, Vitamin B1, Vitamin B2, Vitamin B6, Vitamin B12, nicotinamide, pentatonic acid, folic acid, iron, zinc, magnesium, chrome, copper, selenium, and iodine on the growth of children living in Istanbul, Turkey. In our

country this is the first study about micronutrients effect on linear growth patterns of children.

### MATERIAL AND METHOD

In the period of five years between 2005 and 2010, we defined two heterogeneous groups of children selected out of two hundred patients, the characteristics of children in this group was no history of anemia or chronic diseases on physical examination and historical records, regularly monitored for the progress of growth who visited our outpatient department.

For further investigation we divided two hundred patients equally into two groups. First group consisted of one hundred children whose ages were between 1 and 12 and this group used micronutrient supplementation for two years.

The formulation and dosage of micronutrients received by children of 1 to 4 years old of age was Vitamin A 1333 IU, Vitamin D 400 IU, Vitamin C 40 mg, Vitamin E 5 mg, Vitamin B1 0.7 mg, Vitamin B2 0.8 mg, Vitamin B6 0.9 mg, Vitamin B12 1 mcg, nicotinamide 9 mg, pentatonic acid 3 mg, folic acid 20 mcg, iron 10 mg, zinc 5 mg, magnesium 1 mg, chrome 20 mcg, copper 1 mg, selenium 25 mcg and iodine 70 mcg.

The formulation and dosage of micronutrient received by children of 4 to 12 years old of age was Vitamin A 2666 IU, Vitamin D 200 IU, Vitamin C 60 mg, Vitamin E 10 mg, Vitamin B1 1.4 mg, Vitamin B2 1.6 mg, Vitamin B6 2 mg, Vitamin B12 1 mcg, nicotinamide 18 mg, pentatonic acid 6 mg, folic acid 100 mcg, iron 14 mg, zinc 15 mg, magnesium 2.5 mg, chrome 50 mcg, copper 2 mg, selenium 50 mcg and iodine 150 mcg.

The second group consisted of one hundred children whose ages were between 1 and 12. The characteristics of children in this group having no anemia and chronic diseases on physical examination and historical records, regularly monitored for the progress of linear growth patterns for at least two years with no history of micronutrient intake.

The core of the study was to compare the variation of weight and length Z scores in annual basis between the two groups.

We paid special attention to the formation of our two groups (one using micronutrient and other not) in such a way that each children should be followed up by the same outpatient department and the same physician. We used Harpenden Stadiometer for the length measurements and standard electronic weight for the weight Z score.

Z score is the best method for evaluating the grown-up children. Length and weight for age Z scores for each child at each visit were computed using the Nelson Textbook of Pediatrics' list of Z scores.<sup>12</sup> The initial length and weight Z score monitored for every child were at least two year records.

#### **Statistical Analysis**

In the evaluation of evidences resulted from in this study, we used the NCSS (Number Cruncher Statistical System) 2007 & PASS 2008 Statistical Software (Utah, USA) program for statistical analyses. In addition to descriptive statistical methods (Mean, Standard Deviation) for the comparison of the parameters that do not follow normal distribution between the two groups have been made by the Mann Whitney U test. The evolution of the initial, first year and second year weight Z score and length changes have been made by the Friedmann Test and for the determination of the period that has caused the significance; the Post Hoc Wilcoxon Signed Rank Test has been used. The level of significance has been evaluated when  $p < 0.05$ .

#### **RESULTS**

This study was carried out between 2005 and 2010 using data of 200 children consisting of 97 females (48.5 %) and 103 males (51.5%) mean age  $4.66 \pm 2.78$ ; range 1-12. The age of the children varies from 1 to and the average age is. All the hemoglobin levels of the children are normal (Table-I).

Inspection of two groups, the results showed that there was no significant difference between the initial length and Z score levels ( $p > 0.05$ ).

In the initial, first and second year observations in the micronutrient using group showed change that in the length Z score levels statistically highly significant, ( $p < 0.01$ ). In reference to the initial length Z score levels the increase in the length Z score levels at the end of the first and second year was statistically highly significant ( $p < 0.01$ ). The increase in the length Z score levels at the end of second year was also statistically significant compared to that at the end of first year ( $p < 0.01$ ).

In contrast, for the Control Group, which did not use micronutrient, there was no statistically significant difference between the initial, first and second year length Z score ( $p > 0.05$ ) (Figure I).

The change in the weight Z score levels of the initial and first year in the micronutrient using group was statistically highly significant ( $p < 0.01$ ). The changes in the weight Z score levels at the end of second year in reference to that at the end of the first year did not appear to be statistically significant ( $p > 0.05$ ).

Similar to the case for the weight Z score, there was no statistically significant difference between the initial, first and second year weight Z score ( $p > 0.05$ ) for the control group (Figure II).

#### **DISCUSSION**

We studied the effect of micronutrients on children's linear growth since there was no study available in our region about micronutrient supplements in Turkey. At the end of the study

we analyzed that in the initial, first and second year observations in the group in taking micronutrient supplement revealed a change that in the length Z score levels statistically highly significant ( $p < 0.01$ ).

The differences across trials in various geographic regions may be attributable to differences in prevalence of stunting, iron and other micronutrient deficiencies or to infectious disease burden and spectrum.<sup>13</sup> In our study we especially choose the characteristics of children in this group include having no anemia and chronic diseases on physical examination and historical records. In this study the initial length and weight Z scores of between two groups there is no significant statistically differences ( $p > 0.005$ ) in region of Istanbul, Turkey.

Sandstead et al. reported that neither Vitamin A nor iron alone but micronutrients improved longitudinal growth in children. This is further supported by a research in Chinese children revealed micronutrients with zinc to have a greater effect than zinc alone in improving growth velocity.<sup>14</sup> Considering these indications as motivation of our study, length Z scores and weight Z scores of the children regularly taking micronutrient and those of children not taking micronutrient in the beginning and at the end of the first two years were compared in this study. As a result, it was seen that there was a significant increase in values of the length Z scores in the group taking micronutrients. At the same time our study showed us micronutrient effects length much more than weight. There is significant difference weight Z score in first year but in second year there is no significant difference weight Z score group of using micronutrient.

In a meta-analysis study, Brown et al. reported that the additional zinc supplementary had mild-moderate effect on the length of children below age of 18.<sup>15</sup> In another meta-analysis study it was shown that iron and Vitamin A supplementary had no effect on the growth.<sup>16</sup> However, the meta-analysis results of the study by Usha et al. indicated that zinc supplementary was not effective on weight and length but the meta-analysis results of multiple micronutrient supplement study suggested that multiple micronutrient was effective on the growth and there are a few studies support this finding.<sup>15,16,17</sup> The %80 of micronutrients used in these studies contained Vitamin A, iron and zinc, some included iodine, selenium and copper.

Suitable nutrition has a vital importance for monitoring the healthy children as well as treatment of the sick children.<sup>2</sup> Recalling the vitamin deficiency mentioned in studies above, effect of vitamin deficiency cannot be underestimated in a healthy diet. The vitamin and mineral levels are insufficient in our food intakes because of incorrect cooking and freezing techniques and the fertilizers. The studies carried out in Turkey indicated that diagnosed with insufficient micronutrient.<sup>7,18,19</sup> Considering these researches findings and our study result, it is possible to conclude that it is required to give micronutrient support to the children in our country.

In our country this is the first study about micronutrients effect of growing up. The significant increase in the growth of the children, using micro nutritional supplements has driven us to ponder one more time two essential questions: For healthy nutrition do we need vitamin and mineral supplements. Do we need to pay more attention to empowered nutrients for the healthy nutrition; we are planning to shed a light on further investigation.

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Table 1: Evolution according to groups

		Control Group (n=100)	Micronutrient Taking Group (n=100)	<sup>+</sup> p
		Mean±SD	Mean±SD	
Length Z score	At the onset	0.36±0.81	0.08±0.53	<b>0.058</b>
	1 Year later	-0.38±6.97	0.65±0.66	<b>0.001**</b>
	2 Years later	0.28±0.77	0.81±0.67	<b>0.001**</b>
	<sup>++</sup> p	<b>0.004**</b>	<b>0.001**</b>	
Weight Z score	At the onset	0.020±7.47	0.23±0.70	<b>0.824</b>
	1 Year later	0.26±0.76	0.33±0.65	<b>0.102</b>
	2 Years later	0.26±0.76	0.37±0.67	<b>0.090</b>
	<sup>++</sup> p	<b>0.226</b>	<b>0.001**</b>	

<sup>+</sup>Mann-Whitney U test is used <sup>++</sup>Friedman test ve Post Hoc Wilcoxon test is used  
SD: Standard Deviation \* p<0.05 \*\*p<0.01

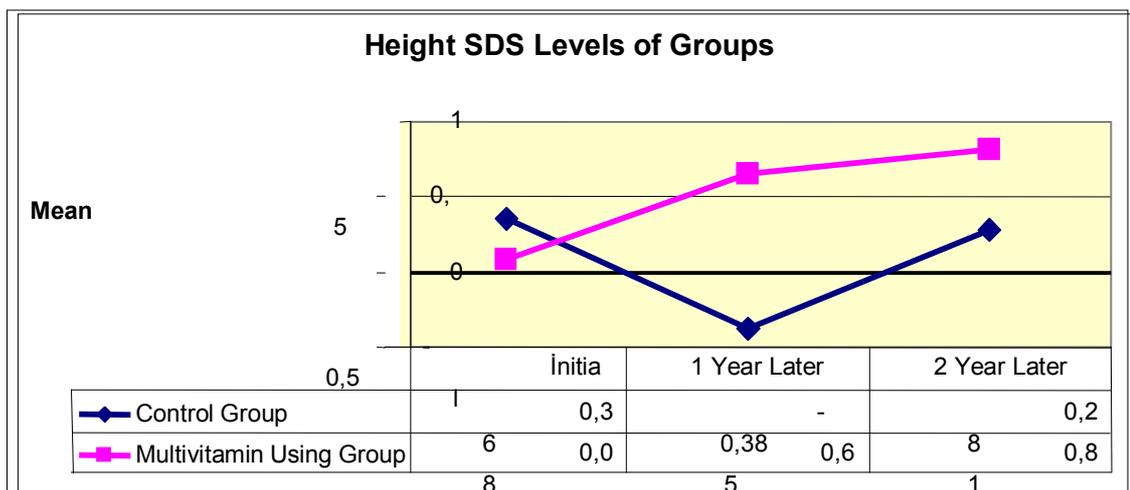


Figure I: Distribution of height SDS of the groups

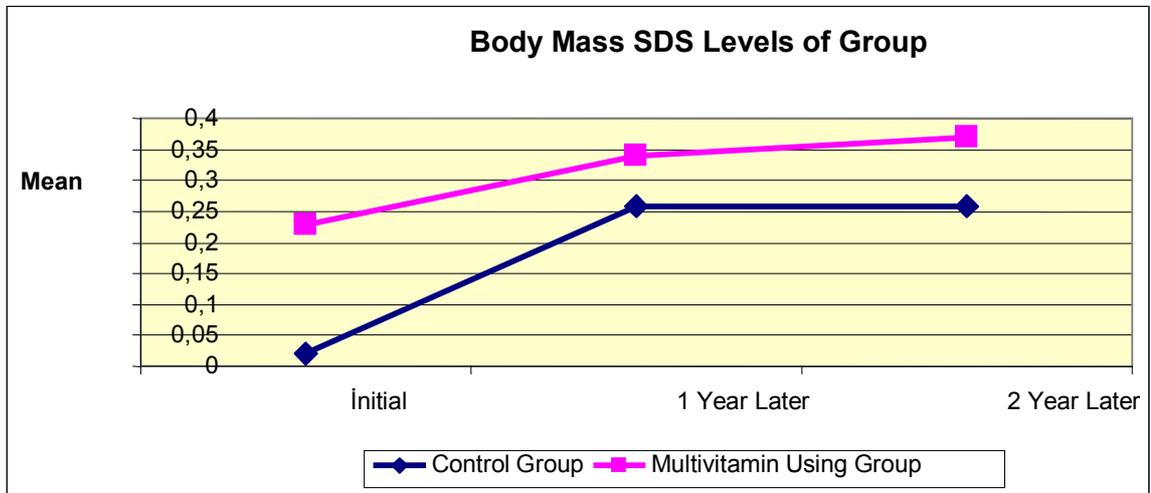


Figure II: Distribution of body mass SDS of the groups