

# Original Article: Comparison of Serum Zinc Levels in Short and Normal Height Children in Tabriz: A Cross-Sectional Descriptive Study

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## ABSTRACT

**Introduction:** Due to nutritional differences in different regions, the study of micronutrient deficiencies, including zinc in each region, is very important and useful for the medical and health groups of that region. Studies and the high prevalence of zinc deficiency in different parts of Iran, this study was conducted to determine the prevalence of zinc deficiency among six-year-old children with short stature in Tabriz.

**Materials and Methods:** This is a cross-sectional descriptive study that was conducted during 2018 with the participation of 214 children referring to health centers in Tabriz. Children's height and weight were measured by serum zinc levels and their relationship was reported based on normal and abnormal zinc levels.

**Results:** Zinc deficiency was seen in 75 participants, the mean of zinc in these subjects was  $69.41 \pm 25.96$   $\mu\text{g}/\text{dl}$ ; The height of these children was significantly lower than the group in which the serum zinc level was normal ( $81.65 \pm 31.75$   $\mu\text{g}/\text{dl}$ ) ( $P=0.041$ ). On the other hand, it was found that the serum zinc level in lean children ( $59.70 \pm 25.41$   $\mu\text{g}/\text{dl}$ ) was significantly lower than normal weight children ( $81.02 \pm 34.66$   $\mu\text{g}/\text{dl}$ ) ( $P=0.039$ )

**Conclusion:** Zinc deficiency leads to short stature as well as weight loss in six-year-olds; It is recommended that the use of zinc supplements in children be considered in health planning.

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## Introduction

**Z**inc is an element that is involved in the growth of height. In areas with low zinc intake, short stature is common. Zinc is found in various sources, the most important of which are red meat and poultry [1]. Nuts like walnuts, pistachios, hazelnuts and almonds are also rich in zinc. Short stature is usually more common in poor areas where consumption of nuts and meat is low due to low-income levels. People who do not eat meat either because of an interest in or lack of access to meat or a vegetarian diet should take zinc supplements. Of course, the dose should be determined by a nutritionist [2,3].

Zinc is one of the basic micronutrients in the human body, which is present in the structure of many enzymes that are effective in metabolism and is necessary for growth, development, central nervous system and immune system [4]. Deficiency in the body reduces growth rate, short stature and delayed puberty; It also increases the prevalence of infections such as diarrhea and pneumonia. Other symptoms of zinc deficiency include loss of appetite, alopecia and decreased taste and smell, delayed wound healing, chronic diarrhea, and prolonged deficiency of symptoms such as stunted growth and hypogonadism have been reported in men. Zinc deficiency was first reported in 1962 in Iran and Egypt in boys who did not grow up and were not sexually mature [5,6].

Treatment of mild to moderate deficiencies and supplementation with zinc in children has had beneficial effects in reducing the incidence of diarrhea and pneumonia and even reducing their incidence in areas with a high prevalence [7]. Zinc deficiency has been known in the Middle East for the past three decades and has been present in children in various regions. Studies have been conducted on the prevalence of zinc deficiency in different parts of the world and a few areas in Iran [8].

Due to nutritional differences in different regions, the study of micronutrient deficiencies, including zinc in each region, is very important and useful for the medical and health groups of that region. Studies and the high prevalence of

zinc deficiency in different parts of Iran, this study was conducted to determine the prevalence of zinc deficiency among six-year-old children with short stature in Tabriz.

## Materials and Methods

**Study design:** This is a cross-sectional descriptive study that was conducted during 2018 with the participation of 214 six-year-olds referring to health centers in Tabriz. The sample size was estimated at 214 people based on the number of referrals to health centers during the previous six months and taking into account the alpha level of 0.05 and the test power of 80%. Detrus sampling was based on the priority of children referring to health centers.

**Inclusion criteria:** age six years and satisfaction with the company was rejected; Exclusion criteria also included zinc supplementation during the last six months, children with thyroid disorders, and children with developmental problems.

**Methods:** The weight of children in light clothing and without shoes was measured by a German Soehnle scale with 250 grams of measuring error, which was adjusted daily by the control weight. The height of barefoot children was measured with a tape measure fixed to the wall and a sack perpendicular to the meter at the top of the head, with the legs glued and the hips, shoulders and back in contact with the wall. The ratio of weight and height to weight and standard height on the same age is extracted from the NCHS table and below two standard deviations from the standard population average for weight, weight to height and height to age are considered as underweight, slim and short height, respectively. .3 cc of radial venous blood was taken from each child. The samples were diluted evenly using deionized water and then the serum zinc level was determined by spectrometry with Shimatzer apparatus and those with serum less than 70 micrograms per deciliter were considered as zinc deficient.

**Data analysis:** The collected data were analyzed using SPSS software (version 21) and displayed as a percentage and frequency or mean and standard deviation. T-test, one-way analysis of variance and Chi-Square at the

significant level of P 0.05 were used to analyze the data.

**Ethical considerations:** This study was approved by the ethics committee of Tabriz University of Medical Sciences ([IR.TBZMED.REC.1397.870](#)) and coordinated by the Deputy Minister of Health of East Azerbaijan Province. No fees were charged for children. Conscious consent was completed by the children's parents.

## Results

**Table 1:** Mean, standard deviation and amplitude of changes in height, weight and zinc level in serum of the studied population

Variable	Mean serum zinc level (µg/dl)	SD	t	P Value	
<b>thin</b>	Yes	70.35	21.14	0.551	0.489
	No	75.59	25.71		
<b>Stunting</b>	Yes	78.02	29.96	1.059	0.556
	No	72.65	27.35		
<b>Low weight</b>	Yes	74.89	21.97	0.592	0.519
	No	70.56	23.64		
<b>Sex</b>	Boy	75.79	25.31	0.859	0.789
	Girl	75.74	26.73		

Zinc deficiency was seen in 75 participants, the mean of zinc in these subjects was  $69.41 \pm 25.96$  µg/dl; The height of these children was significantly lower than the group in which the serum zinc level was normal ( $81.65 \pm 31.75$  µg/dl) ( $P=0.041$ ). On the other hand, it was found that the serum zinc level in lean children ( $59.70 \pm 25.41$  µg/dl) was significantly lower than normal weight children ( $81.02 \pm 34.66$  µg/dl) ( $P=0.039$ ).

## Discussion

Identifying the effective factors in short stature of children and applying treatment methods such as hormonal corrections and dietary and nutritional corrections has always been of interest to families [9]. Although genetic and hereditary factors can be cited as the main cause of short stature in children, they are not the only possible factor. Growth hormone deficiency, malnutrition in adulthood, chronic diseases such as celiac disease, kidney disease and diabetes in

In this study, zinc levels were measured in 214 six-year-old children (111 girls and 104 boys). The mean serum zinc level in the whole study population was  $75.56 \pm 29.84$  µg/dl. Zinc deficiency was observed in 118 patients (55.1%). Mean zinc levels in girls and boys were not significantly different ( $P=0.74$ ). The prevalence and deficiency of zinc as well as the mean level in girls, boys, short stature, low weight and thin compared to the population without growth disorders, there was no significant difference (Table 1).

children are other factors contributing to short stature in children [10,11].

When parents notice that their children are shorter than their peers and classmates, a wave of anxiety sets in. But for some children, being short is not an abnormality and is accepted and shows that they are healthy. Genetics is the most important and powerful factor in the height of any person. In fact, children can blame their parents, or at least their genes, for their short stature [12,13].

Before puberty, boys and girls grow at more or less the same speed. On average, babies grow about 10 inches in their first year of birth and an extra 4 inches in their second year of birth. After that, children continue to grow at a declining rate (about 2 inches per year) until puberty. Children reach adulthood at puberty. For girls, puberty usually begins between the ages of 8 and 13, while for boys, it usually starts between the ages of 9 and 14. Girls grow about 3 to 3.1 inches per year during their growth spurt during puberty, and boys grow about 4 inches per year

during this period. Adolescents, after reaching the peak of their growth, will still be able to grow their height until they stop growing, approximately four to five years after the growth spurt occurs [14]. Most teens reach adulthood somewhere between the ages of 14 and 16, depending on when they reach puberty [15].

In this study, the mean serum zinc level in the study population was  $75.56 \pm 29.84$  micrograms per deciliter, which is lower than the standard mean level, which is approximately 100 micrograms per deciliter [16]. Lack of vitamins and minerals can reduce or stop the growth of children. Children should be provided with a variety of vitamins as they grow. Taking nutritional supplements is one of the best ways to ensure your children get the vitamins and minerals they need [17]. Supplementation to increase height and bone growth in children is one of the best options to help children grow taller and stronger. Calcium, magnesium, B vitamins, vitamin A, zinc, vitamin D, vitamin C, phosphorus and... have a direct effect on height growth have. Calcium is essential for bone growth and density. Bones grow during childhood and adolescence, and even after growth stops, bone formation continues but does not cause longitudinal bone growth and height increase. Magnesium stimulates the thyroid gland to secrete the hormone calcitonin, which regulates the amount of calcium in the blood and the activity of bone cells [18, 19]. As magnesium and calcium in the blood increase, bone formation and longitudinal growth increase. Among the B vitamins, vitamins B1 and B2 are more effective in height growth and prevention of short stature than the others [20]. Zinc has an effect on increasing bone growth and height by affecting the production of vitamin D and thus calcium absorption. Therefore, its deficiency will cause acute problems such as short stature [20]. Zinc is a vital mineral that our body uses in countless ways. In fact, zinc is the second most important micro-mineral in the body after iron and is present in every cell. Zinc is needed for the activity of more than 300 enzymes that help with metabolism, digestion, nerve function and many other processes. In addition, zinc is essential for the growth and function of immune cells. This mineral is also

essential for skin health, DNA synthesis and protein production. Also, the growth and development of the body depends on its role in the growth and division of cells. Zinc is also necessary for our sense of taste and smell. Because one of the most important enzymes for good taste and smell depends on this nutrient, zinc deficiency can reduce our ability to taste or smell. Zinc supplementation can be helpful in children, especially children with anemia; On the other hand, the best source of zinc in the diet is meat and fish, and the high consumption of foods high in phytate, such as traditional breads and legumes, which combine almost all of it with phytate, can affect the availability of zinc, and it seems that consumption of this Bread is also high in this area; Therefore, in preventive measures, teaching the correct consumption pattern and improving the eating habits of families can be effective. In addition, broader studies in other age groups and case-control studies are suggested to investigate the effect of supplementation on height and weight of children.

### Conclusion

Lack of knowledge about children's diet, lack of measurement of serum calcium and other chemical biomarkers in children were among the limitations of this study and it is recommended that these limitations be addressed in future studies; Also, due to the role of zinc in short stature in children, it is recommended to use zinc-containing supplements in children. Zinc deficiency leads to short stature as well as weight loss in six-year-olds; It is recommended that the use of zinc supplements in children be considered in health planning.

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