Micronutrients, especially zinc, are essential for the proper growth and development of children

(Case report)

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Abstract

Nutrition is a necessary factor for the child's growth, from this point of view, a special role is assigned to the balance of microelements. The paper presents a case description - growth retardation due to micronutrient deficiency

Conclusion

Unhealthy lifestyles and unbalanced nutrition, especially among children, lead to poor nutritional status, resulting in growth and developmental delays in adolescents

Key words: Zn deficiency, nutrition, developmental delay in children

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კვება ბავშვის ზრდის აუცილებელი ფაქტორია, ამ თვალსაზრისით განსაკუთრებული როლი ენიჭება მიკროელემენტების ბალანსს. ნაშრომში წარმოდგენილია შემთხვევის აღწერა - ზრდის შეფერხება მიკროელემენტების დეფიციტის გამო.

დასკვნა

არაჯანსაღი ცხოვრების წესი და გაუწონასწორებელი კვება, განსაკუთრებით ბავშვებში, იწვევს ცუდ კვებით მდგომარეობას, რასაც მოზარდებში ზრდის და განვითარების შეფერხება მოჰყვება.

საკვანძო სიტყვები: თუთია, კვება, განვითარების შეფერხება ბავშვებში.

Introduction

Growth in children is influenced by innumerable factors, and to achieve optimal final height, the child has to be healthy, its nutrition sufficient, and the psychosocial environment stimulating and positive[1]. Important factors for children’s growth are: Normal genetic constitution, adequate nutrition, sufficient hormone (growth hormone, thyroid hormone, cortisol and ect.), absence of chronic illness, psychosocial wellbeing. In recent years, much has been researched, discussed

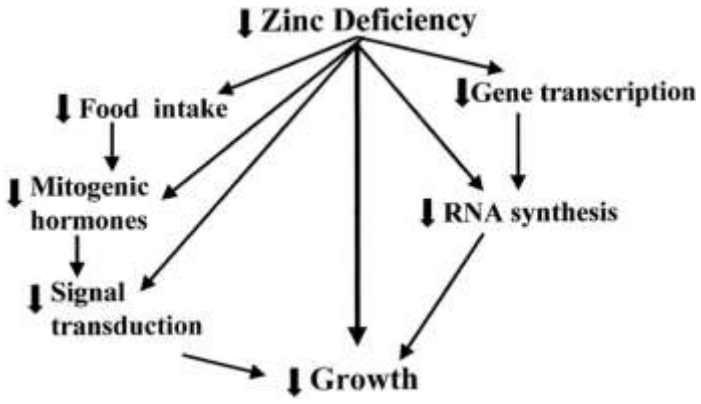
and written on the ideal nutritional approach, suitable growth and the possible short- and long-term health consequences related to over- or undernutrition and inappropriate growth[2].

Nutrition is essential for human growth, particularly in children. In children, growth is a recognized indicator of nutritional status. The number of children worldwide with poor growth remains alarmingly high today[3]. Children under-five are particularly vulnerable, as rapid growth and development necessitates a higher demand for micronutrients[4]. An optimal growth needs a correct diet, in order to ensure an adequate intake of macronutrients and micronutrients. Macronutrients are the compounds that humans consume in largest quantities, mainly classified in carbohydrates, proteins and fats. Micronutrients are instead introduced in small quantities, but they are required for an adequate growth in the pediatric age, especially zinc, iron, vitamin D and folic acid[5]. Micronutrients are vital dietary components for growth and development. Adequate intake of vitamins and minerals through diet is crucial for proper biomolecular and cellular functioning.

Zinc is an essential micronutrient for human beings and its deficiency affects their normal growth and development[6]. Globally, it is estimated that two billion individuals are in danger of clinical illness due to Zinc deficiency. It's deficiency drives more deaths per year than any other micronutrient deficiency except vitamin A deficiency, and Zn supplementation is one of the most impactful interventions for reducing child mortality[7]. Zinc deficiency is widespread throughout the world, in both developing and developed countries. Current estimates have revealed that about 17.3% of the World's population is at risk by using Zn deficient food commodities[8].

Zinc is essential for human growth due to its cellular interactions with insulin-like growth factor-binding protein 3 (IGFBP-3), growth hormone (GH), and insulin-like growth factor -1 (IGF-1)[9]. Zinc influences enzyme systems that control cell division and proliferation and affects the hormonal regulation of cell division, with the GH-IGF-1 axis responding to zinc status. Zinc may also affect mitogenic hormone signal pathways that specifically direct cell proliferation[10]. Zinc deficiency impairs GH secretion from the pituitary, while plasma IGF-1 levels and growth velocity improve with zinc supplementation in children. A possibility regarding the effect of Zn deficiency on IGF-1 levels maybe that Zn is involved in the expression of GH receptor and GH

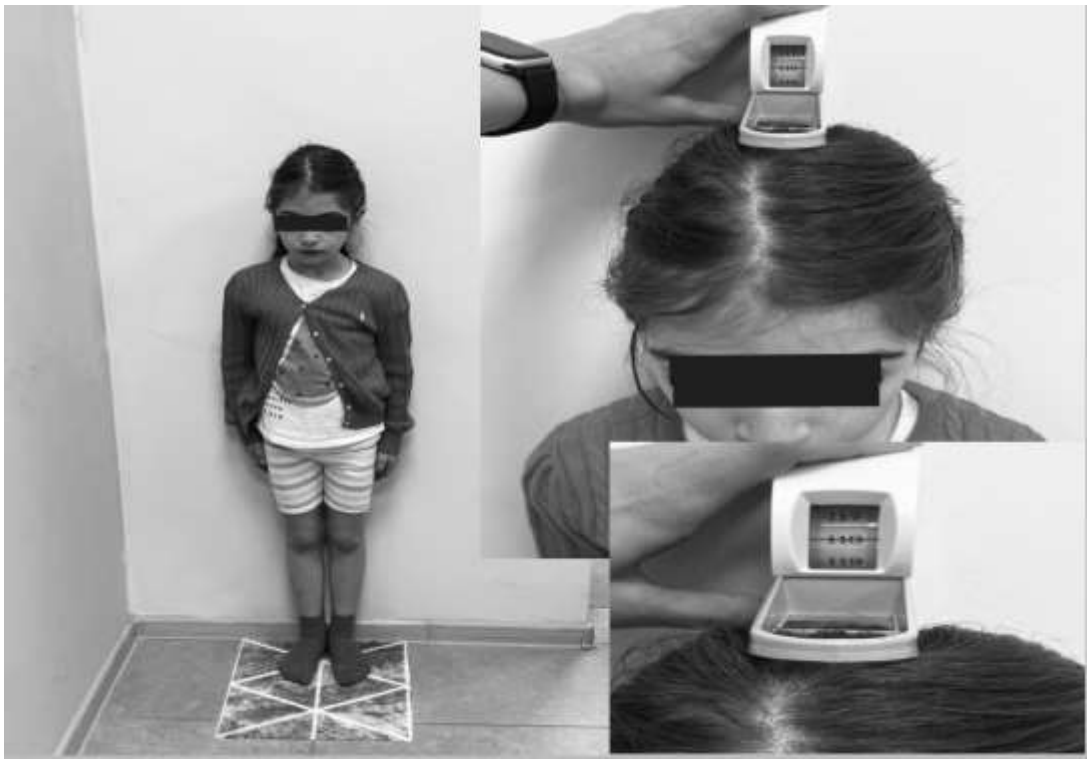
binding protein in the liver, and its deficiency reduces their expression, leading to low IGF-1 levels[11]. Many of the studies also showed that zinc supplementation increased GH secretion, and IGF-1 as well as IGFBP-3 generation, leading to a promotion of growth[12].



Studies have shown that serum IGF-1 and IGFBP-3 levels were low in short children with Zn deficiency, and increased after Zn supplementation for 3 months but their levels were still lower than the normal reference ranges in most children; therefore, Zn supplementation may be necessary for longer periods[13].

Case Presentation

A 7-year-old girl was referred to our endocrinology department due to growth problems. She was born in a family with normal psychosocial development, at 38 weeks, from the first pregnancy, with a birth weigth of 3.1 kg and a length of 50 cm. Her Apgar scores were 9-10, and her medical history is unremarkable, with no known genetic diseases. She was breastfed for only one month. According to her parents, she could stand independently at 7 months and stasted walking at 9 months. She has a younger sister with normal heigth for her age. The patient's IQ is within the normal range (score of 108), and her bone age corresponds to her chronological age of 7 years. According parents she was growing well, but recently her growth has slowed down, she has diffuse hair loss, sweating, feeding disorder (Feeds mainly on carbohydrates), irregular sleep, less physical activity.



- Weight: 23 kg (40th percentile)
- Height: 118 cm (20th percentile)
- BMI: 16.5 kg/m^2 (48th percentile)
- Target height: 168 cm (65th percentile)
- Tanner stage: 1 (ma: 1; ax: 1; pub: 1)

Laboratory data are given in Table 1

Table 1. Laboratory data

Test	**Result**

IGFBP3 (1.94-5.19 mg/L)	2.37 mg/L
IGF-BP3 SD	- 1.47
IGF-1 (50.0-246 µg/L)	69.4 µg/L
IGF-1 SD	- 2.03
TSH/FT_4/anti-Tpo	Normal Range
Total IgA; tTG IgA, tTG IgG	Normal Range
Ca/K/Na/Mg/Fe	Normal Range
Zn (NR: 80-120 µg/dL)	43.00 µg/dL
25OHD (NR: 30-100 ng/ml)	8.60 ng/ml

The blood test shows that growth hormone levels are at the lower limit but still within the normal range. The thyroid gland is functioning ideally, and the patient does not have any absorption problems. Microelements are normal, except for zinc and vitamin D, which are in deficient levels.

Nutrition during the children's formative years remains the foundation for long-term health and productivity of the individuals who make up society. Childhood education, the basis for societal development, is not possible without adequate nutrition [14].

Conclusion

Unhealthy lifestyles and unbalanced nutrition, especially among children, lead to poor nutritional status, resulting in growth and developmental delays in adolescents.

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