

The prevalence of zinc deficiency in 6-month to 12-year old children in Bandar Abbas in 2013Mohammadbagher Rahmati¹, Fateme Safdarian², Mohadese Zakeri³, Shahram Zare⁴¹ Assistant Professor, Pediatric Department, Hormozgan University of Medical Sciences, Hormozgan, Iran² Faculty Member of Pediatric Department, Hormozgan University of Medical Sciences, Bandar Abbas, Hormozgan, Iran³ General Physician, Infectious and Tropical Diseases Research Center, Hormozgan Health Institute, Hormozgan University of Medical Sciences, Bandar Abbas, Hormozgan, Iran⁴ Faculty of Medicine, Hormozgan University of Medical Sciences, Bandar Abbas, Hormozgan, Iran**Type of article:** Original**Abstract****Background:** Zinc deficiency is an important problem in children, especially in developing countries. Zinc supplements have beneficial effects on multiple factors, including treatment of growth retardation and hypogonadism, and they can be used as therapeutic and prophylactic agents against infection in children.**Objective:** To determine the prevalence of zinc deficiency in 6-month to 12-year-old children in Bandar Abbas.**Methods:** This study was done in Bandar Abbas in 2013. In this cross-sectional study, 583 children were evaluated after obtaining a written informed consent from their parents. Zinc levels < 6 µg/dl were defined as zinc deficiency, zinc levels of 80-66 µg/dl were defined as insufficient, and zinc levels of 80-115 µg/dl were defined as sufficient levels. SPSS software, version 20, descriptive statistics, the chi-squared test, and the t-test were used to analyze the data.**Results:** Five hundred and eighty-three children with a mean age of 42.82±30.68 months participated in this study. Among the participants, 263 (45.1%) were females, and 320 (54.9%) were males. The prevalence of zinc deficiency was 17.5% in this study. Zinc deficiencies were reported in 67 males (20.94%) males and in 35 females (13.30%). Zinc deficiencies were more common in boys, and this difference was statistically significant (p=0.01).**Conclusion:** The results of this study indicated that the prevalence of zinc deficiencies is high in Bandar Abbas and that it is more prevalent in males than in females. The children in this area should be screened for zinc deficiency. Future studies should focus on then treatment of zinc deficiency and its role in different aspects of children's health.**Keywords:** Zinc deficiency, Children, Growth retardation**1. Introduction****1.1. Background**

Zinc is an activator of co-factor in a large number of enzymes, including carbonic anhydrase, alkaline phosphatase, dehydrogenase, and carboxypeptidase. This element plays a role in the regulation of inflammatory cell activity, growth, tissue repair, wound healing, the synthesis of gonadal hormones, and the activity of the immune system and its effective response to infections (1-5). Evidence suggests that zinc may have an effect on some pathogens, such as cholera and E.coli (6). Oral intake of this element is in the range of 4-14 mg daily, and the recommended amount for children is 8 mg/day (7).

1.2. Statement of problem

Zinc deficiency is an important problem in children, especially in developing countries (8). Mild deficiency presents with various symptoms, such as taste and smell disorders and decreased spermatogenesis. Severe deficiency presents

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with severe immunosuppression, recurrent infection, bullous postural dermatitis, and alopecia (9, 4). Zinc supplements have beneficial effects on treatment of growth retardation and hypogonadism (10, 11). Zinc supplements have been used as therapeutic and prophylactic agents against infection in children (12). Measurement of plasma zinc levels is easily done in most laboratories, and zinc deficiency is defined as less than 60 mcg/dl (13). The zinc cofactor of the enzyme, alkaline phosphatase, can be used as a marker antibody for zinc deficiency (14).

1.3. Objectives

The general objective of this study was to determine the prevalence of zinc deficiency in children who were referred for growth monitoring to pediatric clinics in the south part of Iran. The specific objectives were:

- 1) to determine the prevalence of zinc deficiency according to gender
- 2) to determine the prevalence of zinc deficiency according to age group
- 3) to determine the prevalence of zinc deficiency according to season

2. Material and Methods

2.1. Study design and setting

This descriptive, cross-sectional study design was used for the evaluation of the prevalence of zinc deficiency in children whose ages ranged from 6 months to 12 years in Bandar-Abbas (south Iran). After obtaining the consent of the parents, 583 children were selected randomly.

2.2. Exclusion criteria

Exclusion criteria included chronic liver disease, kidney disease, diarrhea, malignancies, acrodermatitis enteropathica, Crohn's disease, sickle cell anemia, and those who had received high dosages of zinc.

2.3. Measurement tools

Blood was taken (3 ml) to measure the serum zinc level of the participants. Serum zinc levels were determined in the laboratory by atomic absorption spectrophotometry. Zinc levels <66 µg/dl were defined as zinc deficiency, 80-66 µg/dl was deemed to be insufficient, and 115-80 µg/dl was deemed to be a sufficient level in the blood.

2.4. Statistical analysis

SPSS 20 statistical software, descriptive statistics, the chi-squared test, and the t-test were used to analyze the data. In this study, p-values less than 0.05 were considered significant.

3. Results

3.1. Descriptive statistics

Five hundred and eighty-three children with a mean age of 42.82±30.68 months participated in this study. Of that number, 263 (45.1%) were females, and 320 (54.9%) were males. Zinc deficiency was reported in 102 of the children in this study (17.5%).

3.2. Prevalence of zinc deficiency according to gender, season, and age

The prevalence of zinc deficiency is presented in the Table 1. Of the participants, 102 (17.5%) were deficient in zinc, and 67 of these participants (20.94%) were males, and 35 (13.30%) were females. Zinc deficiency was more common in boys in this study, and this difference was statistically significant (p=0.01).

Table 1. Prevalence of zinc deficiency according to gender, season, and age

Variables		Zinc deficient [n (%)]	Normal zinc level [n (%)]	p-value
Gender	Male	67 (20.9%)	253 (79.1%)	0.016
	Female	35 (13.3%)	228 (86.7%)	
Season	Spring	25 (17.2%)	120 (82.8%)	0.772
	Summer	22 (15.2%)	123 (84.8%)	
	Fall	26 (17.7%)	121 (82.3%)	
	Winter	29 (19.9%)	117 (80.1%)	
Age group (month)	6-12	22 (20.6%)	85 (79.4%)	0.729
	13-24	29 (19%)	124 (81%)	
	25-60	33 (16.8%)	163 (83.2%)	
	61-96	14 (14.7%)	81 (85.3%)	
	97-144	4 (12.5%)	28 (87.5%)	

The serum zinc levels were measured in 145 children, and, in the spring, 25 children (17.24%) had Zn deficiencies, in the summer 22 children (15.17%) had Zn deficiencies, in the autumn 26 children (17.69%) had zinc deficiencies, and in the winter 29 children (19.86%) had Zn deficiencies, and these differences were significant ($p=0.77$). In this study, no statistically-significant difference was shown between the prevalence of zinc deficiency and age group of the participants. As shown in Table 1, the highest prevalence of zinc deficiency was reported in the age group of 6-12 months, but this difference was not statistically significant ($p=0.729$).

4. Discussion

Today, the lack of micronutrients, such as zinc, is a challenging health problem in developing countries. Symptoms of zinc deficiency can be resolved by replacement of zinc in the diet. Also, complications of zinc deficiency are preventable by treatment. The importance of zinc deficiency is for its role in child growth and its tendency to prevent severe infections. The prevalence of zinc deficiency varies from country to country.

4.1. Prevalence of zinc deficiency

Zinc deficiency is common in South Africa (46%), India (43.8%), and Mexico (26.9%) (15-17). Also, there is considerable variable in the prevalence of zinc deficiency in Iran. Its prevalence was reported to be 7.9% in Shiraz and 28.1% in Mashhad (18, 19). In this study, the prevalence of zinc deficiency was 17.5%. The prevalence of zinc deficiency was high in our study. Its prevalence is higher in comparison to Shiraz and lower in comparison to Mashhad. The high prevalence of zinc deficiency in Bandar Abbas indicated the importance of dietary intervention to lower its prevalence and the associated complication rate. In addition to diets that contain zinc, supplements of zinc also may be helpful.

4.2. Prevalence of zinc deficiency according to gender

Based on our results, the prevalence of zinc deficiency was higher among males. The results of Kapil and his colleagues were compatible to our findings (16). In the Morales-Ruán study, there was no difference in zinc deficiencies between the genders (17). The results of Samuel's and Dehghani's study were compatible with our study (15, 18). Therefore, it seems that the prevalence of zinc deficiency is higher in males. More careful evaluation and preventive strategies, including zinc-containing diets and supplements in males, are recommended. Zinc deficiency may be asymptomatic. Therefore, screening of zinc deficiency in males may be helpful. Studies to evaluate the cost effectiveness of screening for zinc deficiency in high risk patients may be helpful.

4.3. Prevalence of zinc deficiency according to season

In this study, there is no significant difference in zinc deficiency in different seasons of the year. The results of Kapil, Samuel, Morales-Ruán, and Dehghani's study in Shiraz produced results that were consistent with our study (15, 18).

Based on these results, measurement of zinc level is independent of the season and the differences in zinc level in different seasons were slight and statistically insignificant.

4.4. Prevalence of zinc deficiency according to age group

In our study, there was no significant difference in the different age groups. Samuel and Dehghani's study results and our results were similar (15, 18). But the results of Kapil and Morales-Ruán's study were not consistent with our results (16, 17).

4.5. Study limitation

Since the findings of different studies vary concerning the relationship between zinc deficiency and age, larger sample sizes may be needed to show the differences in the prevalence of zinc deficiency between age groups.

5. Conclusions

In this study, the prevalence of zinc deficiency, 17.5 % (102 of 583 children) was more common in boys and in different seasons of the year, and there were no significant differences between different age groups. Some of the results of this study were consistent with previous studies in this field. It is suggested that further prospective research should be conducted to determine how to reduce the percentage of children who have zinc deficiencies.

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Conflict of Interest:

There is no conflict of interest to be declared.

Authors' contributions:

All authors contributed to this project and article equally. All authors read and approved the final manuscript.

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