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Serum Zinc levels in Children with Growth failure in Kerman province, Iran

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Abstract

Zinc deficiency is a common dietary problem of children in many less-developed countries where diets have low levels of elements. The aim of the present case-control experiment was to determine whether there was any change in serum zinc concentration in children in growth retardation (n=82) and healthy group (n=82) with different status in Kerman city (Kerman, Iran). In the growth failure group, 49 children (29.9 %) had trivial malnutrition, 31 children (18.9 %) had moderate malnutrition, and 2 children (1.2 %) had severe malnutrition. Serum zinc between one-five year old children of healthy group was significant in compared with one-five year old children of growth failure. Serum zinc among healthy children (mean ± SD: 57.44 ± 8.62) in comparison with mild growth failure (mean ± SD: 46.33 ± 8.18), moderate growth failure (mean ± SD: 37.19 ± 5.28), and severe growth failure)(mean ± SD: 29.5 ± 6.36) were significant. Also, Serum zinc among mild growth failure compared with moderate growth failure, and severe growth failure were significant. Serum zinc levels in children that had history of infection disease; diarrhea and breastfeeding were significant compared with healthy children. Serum zinc levels in children that kept at nursery school were significant compared with children that kept at home. Conclusion: results of this experiment showed that there was considerable difference in the levels of zinc between growth retardation and healthy children in different status. According to the problems that caused zinc deficiency, families and societies need preventive and curative actions to solve these deficiencies.

Keywords: Zinc, growth failure, normal growth, children, Kerman.

Introduction

Zinc is an important element which has been known as anecessary element, which takes part in many metabolic pathways. Changes in serum zinc levels were revealed in persons with some disease like as nutritional disorders, anemia, hepatitis, hypertension, leukemia and other malignancies, hypothyroidism, ischemia, AIDS, diabetes, allergy, etc. on the other hand, zinc influences cell-division, growth, immune system, development and sexual maturation[1].

Intake of zinc is strongly linked to intake of protein as a result it is an vital part of nutritionally associated morbidity in the world. Zinc deficiency in many children lead to retardation of growth and also morbidity from many disease such as; diarrhea, pneumonia, and malaria. Results of studies have revealed that the popularity of zinc deficiency is 28 percent in east of Iran, 24 percent in 2-4 year olds in many rural part of Bangladesh, and 46 percent in an unofficial settlement in children of deprivedperi-urban part of South African. Zinc deficiency and related disease have reported in millions children of developing countries[2].

Zinc has known as an antioxidant and anti-inflammatory agent and as well as functions in immune routes of cell[2,3]. Zinc deficiency occur under two major type; first: dietary causes such as food consumption with either mild level of zinc or unavailable forms of zinc (Geologically-stimulated in local diets, intake of small amount of animal-protein, low-income diets, high fiber/phytate diets Infant formulae), andsecondary state, that in this circumstances conditioned deficiency correlated to diseases orhereditary malfunctions (Acrodermatitisenteropathica, sickle-cellanaemia (SCA), Down's syndrome, congenital adrenal hyperplasia (CAH)) that impair zinc absorption (elderly people, disorders in gastrointestinal tract, presence of excess fat in the stools or steatorrhea, Crohn's disease, Wilson's disease, cystic fibrosis, infections of many Parasites, deficiency of Protein, Inflammatory bowel disease(IBD))and/or increase loss of zinc from body (e.g. burns, surgery)[4].

Elements content of food in the different part of the word and different components are very broadly. For example, Saini S, et al. has showed that *Omum, Poppy seeds, Gingelly seeds, cumin seeds and curry leaves* are good source of calcium[5].Soils in various sections of the world are very low level of zinc and use of locally grown diets can leads to deficiency of zinc in varioussocieties[6]. In human zinc is a necessary trace element and has role in active site of about 300 enzymes[7,8,9]. For the first time, growth retardation has been found in young animals which experimentally deprived from zinc. Zinc deficiency in man is related to many disorder including hypogonadism, dwarfism, mental lethargy, geophagy, rough and dry skin and hepatosplenomegaly[3]. In a number of individual groups include children, elderly people, young women on weight-falling diets, and some other groups; ingestion of zinc per day may be inadequate relative. Therefore, in these individuals may be occur zinc deficiency[5]. The aim of the present case-control experiment was to determine whether there was any change in serum zinc concentration in children in growth retardation and healthy group with different status in Kerman city (Kerman, Iran).

Material and Methods

Fresh blood sample of children were collected in laboratory (Afzalipour Hospital, Kerman, Iran). Blood samples were gained on an empty stomach at 8:30 AM. before blood collection, the children did not eat any vitamin and dietary supplementswhich containing zinc sulfate as a component[10].

The elimination criteria were based on the following criteria: measles infection in the past 6 month; existence of apparent systemic illnesses, such as meningitis, pneumonia, leukemoid reaction, septicemia, hemolytic uremic syndrome, diarrhea, etc; severe malnutrition; any hereditary disorder, supplementation of zinc and using any drug[11].

We was take approximately 3.0 ml of fresh blood samples in a sterile, closed tube untreated with any anticoagulants and then allowed it to stand for approximately half hourat room temperature. The samples centrifuged at 3500 rpm for 10 minutes and serum transferred in other tube. The serum samples were put in closed plastic tubes and were kept at -18°C until use[12,13,14].

In this case-control[15] study according to Gomez criteria provides data for concentrations of serum zinc which measured in group of 82 children between one-five years oldand 82 children that have clinical history and growth curves malnourished according to Gomezcriteria that selected randomly for controls from 5 points from Kerman city.

The health condition of the control group was established by examination of blood zinc and physical indicators in the range of normal. The healthy neuropsychological condition of children was confirmed[1].

The quantity of serum zinc was measured by spectrophotometric method (Atomic Absorption) following deproteinisation of samples. The absorbance (A) of solution was recorded at λ = 490 nm. An analytical control was used for zinc assay, and every sample was measured for 2 times[16]. Ethical approval of this experiment was obtained from the ethics committee of Kerman Medical University (Kerman, Iran) and the parents of all children gave written informed consent prior to employment in the experiment.

Statistical analysis: The data of this experiment were analyzed using one-way analysis of variance with ANOVA followed by Student's t-test. Results were expressed as mean values ± SD. SPSS 14.0 for windows (SPSS Inc., Chicago, USA) was used for data analysis and p-value is smaller than 0.05 was taken as the level of statistical significance.

Results and Discussion

The experimental group consisted of 82 children in healthy and 82 of growth failure. In growth failure group, 36 children (46.8%) were girls and 46 children (52.9 %) were sons. On the hand, in healthy group; 41child (53.2%) were girls and 41 child (47.1 %) were sons. In the growth failure group, 49 children (29.9 %) had trivial malnutrition, 31 children (18.9 %) had moderate malnutrition, and 2 children (1.2 %) had severe malnutrition.

There was no noticeable change in zinc levels between genders in two groups (P>0.05). In the two groups of study, there was no notice able change in zinc levels between children that those father or mother have different job (P>0.05). Therefore, the job of father or mother had no effect on zinc level (figure 1 and 2).

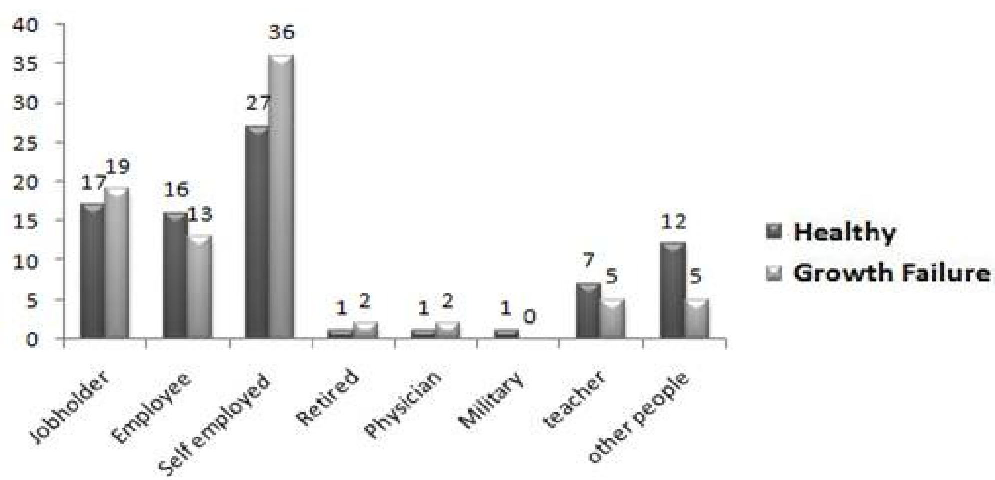

Figure-1
Percent of children in growth retardation and healthy children according their father's job

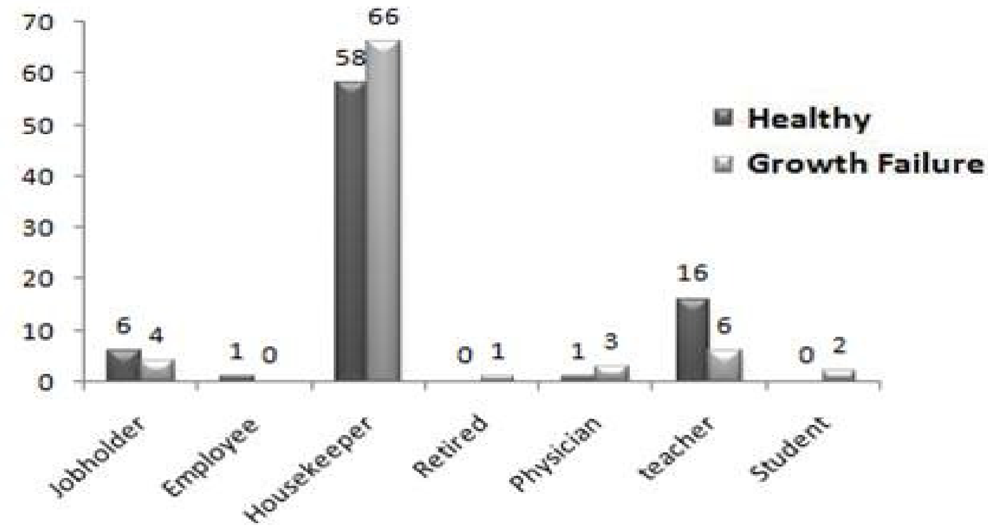

Figure-2
Percent of children in growth retardation and healthy children according their mother's job

Serum levels of zinc among healthy children (mean ± SD: 57.44 ± 8.62) in comparison with mild growth failure (mean ± SD: 46.33 ± 8.18), moderate growth failure (mean ± SD: 37.19 ± 5.28), and severe growth failure) (mean ± SD: 29.5 ± 6.36) were significant. Also, Serum levels of zinc among mild growth failure (mean ± SD: 46.33 ± 8.18) compared with moderate growth failure (mean ± SD: 37.19 ± 5.28), and severe growth failure)(mean ± SD: 29.5 ± 6.36) was significant. Twenty nine children (28.2 %) in growth failure group and 6 children (7.3 %) of healthy group had a diarrhea which this change was significant between two groups. Twenty two children (28.2%) in growth failure and 8 children (9.8%) of healthy group had a history of infection disease which this change was significant between two groups. Seventy six children (92.7%) in growth failure and 77 children (93.9%) of healthy group had used from mother's milk which this change was not significant between two groups. Twenty four children (29.3%) in growth failure and 16 children (20%) of healthy group had kept in preschool, which this change was not significant between two groups. Serum levels of zinc between one year old children of healthy group (mean ± SD: 54.30±12.86) was significant in compared with one year old children of growth failure (mean ± SD: 46.20 ± 15.14). Serum levels of zinc between two years old children of healthy group (mean ± SD: 56.78±13.3) was significant in compared with in comparison with two years old children of growth failure (mean ± SD: 42.48±7.80). Serum levels of zinc between three years old children of healthy group (mean ± SD: 60.33±13.6) was significant in compared with in comparison with three years old children of growth failure (mean ± SD: 39.94±6.01). Serum levels of zinc between four years old children of healthy group (mean ± SD: 56.00±9.39) was significant in compared with in comparison with four years old children of growth failure (mean ± SD: 41.78±4.61). Serum levels of zinc between five years old children of healthy group (mean ± SD: 56.50±7.79) was significant in compared with in comparison with five years old children of growth failure (mean ± SD: 43.33±9.29) (table 1 and 2).

Table-1
Serum zinc levels in growth retardation and healthy children

Mean ± SD	Number		
8.18±46.33	49	mild Malnutrition	Growth Failure
5.28±37.19	31	Moderate Malnutrition	
6.36±29.5	2	Severe Malnutrition	
8.62±57.44	82	Healthy	

Serum zinc among healthy children in comparison with mild growth failure, moderate growth failure, and severe growth failure was significant. Serum zinc among mild growth failure compared with moderate growth failure, and severe growth failure were significant.

Table-2
Zinc levels in different groups

Mean ± SD	Number		
49.80±12.31	122	HOUSE	Keeping Place
50.55±14.93	40	Nursery School	
57.71±13.50	77	FEMALE	Gender
49.28±12.36	87	MALE	
41.11±8.51	35	YES	Diarrhea
52.35±12.85	129	NO	
45.17±14.87	30	YES	Infection Disease
51.35±12.16	130	NO	
50.07±13.12	153	YES	Breastfeeding
48.27±9.37	11	NO	

Serum zinc levels in children that had history of infection disease; diarrhea and breastfeeding were significant compared with healthy children. Serum zinc levels in children that kept at nursery school were significant compared with children that kept at home.

The results of numerous experiments reveal that, there is relationship between low levels of serum zinc and the time period and severity of prolonged diarrhea[17].In this study, 29 children (35.4 %) of growth failure group and 6 children (7.3%) of healthy group have a history of diarrhea(more than 5 times per years). This change was significant between two groups (P >0.05). It has been shown that zinc deficiency is responsible for about 10% of diarrheal diseases in the world and supplementation of zinc declined the morbidity and mortality of constant diarrhea in children[17] (11). Ghishan, et al. (1984) reported that zinc-deficient animals show a significant decrease in transport of water and sodium from intestine. It is established that zinc stimulate water and electrolytes absorption[18].

Zinc deficiency contributes to dysfunction of immune system and zinc supplementation corrected this condition. Results of several studies have shown useful effects of supplementation containing zinc in treatment of shigellosis. The majority of these effects are mediated viamodulation of immune function[19].

In physical examination, 24.4 % of children in growth failure group and 8.9 % of healthy children have a history of infectious disease (more than 5 times per years).

In this experiment, there was no significant difference in serum zinc in children that kept at home or pre-school. Moreover, zinc levels in children were not related to children father or mother's job. The result of Ogboko B, et al.(2011) also, showed that hair zinc has not been changed by socioeconomic status[20].

Results of many studies have shown that zinc has vital role in growth. For example, Zinc with effect on secretion and growth hormone (GH) synthesis and insulin-like growth factors (IGFs) have important role in growth. Zinc is closely related to bone development through its mediating effect on several hormones which involved in bone homeostasis and the cross-talk with the metabolic pathways of calcium[21.22]. In addition, zinc have key role in DNA and RNA synthesis which reasonable vital metabolic pathways which take part in growth including transcription and replication of cell; and synthesis of collagen, somatomedin-c, osteocalc in, insulin and alkaline phosphatase[23].

In this study, 29.9 % of children have mildmalnutrition, 18.9 % moderate malnutrition and 1.2 % of children have severe malnutrition. In compared with healthy children, zinc levels significantly reduced in mild malnutrition, mild malnutrition and severe malnutrition.

Results of 33 prospective intervention meta-analyses showed that supplement with zinc has markedly effect on children growth and body weight and they also gain weight after taking daily zinc supplementation[24].Studies have accepted that zinc deficiency have negative effects on intestinal absorption of other nutrients[25].In this experiment, there was no significant difference in serum zinc levels between girls and sons in two groups. Therefore, the results of study show that gender has not effect on serum zinc.

In this study, 92.7% of growth failure group and 93.7% of healthy group have been breastfed. This change was not significant between two groups. But, we observed low serum zinc concentrations in the children that used artificial feed. Breastfeeding promotes wellbeing and protect body against many diseases. While, artificial feeding is related to further deaths from infantsdiarrhea[26].

Conclusion

Results of this experiment showed that the difference in zinc levels between growth retardation and healthy groups was statically significant. According to the type of the problems that reason of zinc deficiency, families and societies need preventive and curative actions and program to solve these deficiencies.

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