

A Study of Serum Zinc Levels in Children with Acute Gastroenteritis Admitted in Tertiary Care Hospital

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Abstract

Background: Acute gastroenteritis (AGE) is one of the common problems causing significant mortality and morbidity among children. In developing countries, diarrhoea is the main cause of illness and death in children. Although acute infection might have a prolonged course, acute diarrhoea is often a self-limited condition. With a wide range of biological functions in humans, zinc is a necessary nutrient. It is especially crucial for the physical growth of immunological and digestive systems. The absence of animal foods, high dietary phytate content, insufficient food intake, and increased fecal losses during diarrhoea all contribute to the prevalence of zinc deficiency in children.

Methods: 61 children with acute gastroenteritis for less than 14 days who were admitted to the emergency and general ward units at the tertiary care Hospital between April 1 and September 30, 2018 were the subjects of cross-sectional research. Their ages varied from 6 months to 5 years. For each patient, a thorough history and examination were conducted. For the investigation, a unique questionnaire was created. Patient's blood was drawn at the time of admission for the determination of the serum zinc level, complete blood count, serum electrolytes, renal functions and urine and stool samples were also collected. Patients' serum samples were drawn and held at (-20°C) until the zinc levels were measured. Atomic absorption spectrophotometer measurements for zinc concentrations used.

Results: The research included 61 children with acute gastroenteritis, ranging in age from 6 months to 5 years (40 male and 21 female).

Patients with diarrhea lasting longer than five days had mean blood zinc levels that were lower than those with diarrhea lasting less than five days; this finding is statistically significant in both groups with a p-value of 0.01. The demographic and clinical features of individuals with normal zinc levels and those with zinc insufficiency were not significantly different.

Conclusion: Children with longer duration of gastroenteritis had considerably lower serum zinc levels.

Keywords: Acute gastroenteritis, children, serum zinc.

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Introduction

Around the world, children frequently contract acute gastroenteritis. The Centres for Disease Control and Prevention (CDC) estimate that diarrhoea kills 2 million children under the age of five each year in developing countries [1,2]. Zinc is an essential micronutrient and requirement for physiological functions of humans, protein synthesis, cellular metabolism, bone growth, intestinal fluid-electrolyte transport, the reproductive system. Zinc has a significant impact on how the immune and digestive systems physically grow. Zinc deficiency in children may cause immune system deterioration, affect neurological and behavioural functions, and raise the risk of infections (gastroenteritis). Zinc insufficiency affects populations of low socioeconomic status worldwide, in both developing and developed countries [3-5].

Methods

In a cross-sectional study, 61 patients with acute gastroenteritis who were admitted to the inpatient unit at a tertiary care hospital between age group of 6 months to 5 years. The parents of each patient gave their consent in writing. The study's goal was approved by the ethics committee. Acute gastroenteritis was defined as loose or watery consistency of stool or increased frequency of bowel movements (≥ 3 daily), with or without fever or vomiting. The duration of diarrhea was not more than 14 days.

Prior to the start of the trial, complete medical history obtained from each patient and each patient undergone the necessary examinations. Patient history was documented, including characteristics of diarrhoea, presence of vomiting or fever, previous drug usage, presence of breast-feeding, previous illnesses. A complete physical examination was performed and World Health Organization

Guidelines were used to assess the degree of dehydration. In order to conduct the study, a special questionnaire was developed, and the following information was assessed:

1. Age, gender, height or length, and body weight.
2. Duration of diarrhoea.
3. Stool consistency (watery or semi formed).
4. Dehydration level as determined by normal WHO recommendations.

Exclusion criteria

1. Parents did not give consent
2. Any indication that diarrhoea is due to extra intestinal etiology such as otitis media, urinary tract infections, etc.
3. Bloody stools.

For all patients, the following investigations were carried out:

Complete blood count, serum zinc, renal function test, serum electrolyte, stool sample collection for culture and direct microscopic analysis, and urine sample collection for culture and direct microscopic analysis.

Patients' serum samples were drawn and held at (-20°C) until the zinc levels were measured. At the laboratory, zinc concentrations were measured using an atomic absorption spectrophotometer. Without using antibiotics, all patients treated with supportive treatment ORS and if required intravenous fluids (in accordance with WHO recommendations).

Following collection of blood for S. zinc, we advised the patient to take oral zinc sulphate for 14 days, at a dose of 20 mg per day. A second dosage was given if vomiting or regurgitation occurred within one hour after consuming zinc.

Statistic Evaluation

SPSS version 23 was used for data input and analysis in the statistical analysis. For the categorical data frequency and percentage were utilized, while mean and standard deviation (SD) were used for numerical data. For examination of various markers utilizing the Odd Ratio (OR) and 95% Confidence Interval, appropriate tests (paired sample t-test, chi-square, and binary logistic regression) were performed (CI). P-values under 0.05 were seemed statistically significant.

Results

The 61 patients were included in the research, of age group 6 months to 5 years, and 40 (65.6%) of them were male and 21 (34.4%) were female. There were 20 (32.8%) and 41 (67.2%) individuals with semi-formed and watery diarrhoea, respectively, based on the consistency of their stools. 11 (18.0%) patients had severe dehydration, 34 (55.7%) had some dehydration, and 16 (26.2%) of patients had no

dehydration. Before being admitted to the hospital, 9 patients (14.7%) got zinc sulphate, whereas 52 patients (85.2%) did not. Regarding the fever, 53 patients (86.9%) had it, compared to 8 patients (13%), who did not. Table 1 displays all of these [1].

The average blood zinc levels were 68.4 for patients in the age groups of 6 months to 2 years and 90.0 for the age group of 2 years to 5 years, whereas the normal levels were 60 to 90 g/dl, 80 to 110 g/dl in respectively. These findings were statistically significant with p-value of 0.004 in both the age groups. The table 2 displays all of these results [2].

Patients with diarrhea lasting longer than five days had lower mean blood zinc levels than the patients with diarrhea lasting less than five days; this finding is statistically significant in both groups (p-value 0.006). The results are shown in table [3].

Table 1: Frequency and percentage of some characteristics of the studied sample.

Variables		No.	%
Sex	Male	40	65.6%
	Female	21	34.4%
Consistency of stool	Watery	41	67.2%
	Semi formed	20	32.8%
Degree of dehydration	Severe dehydration	11	18%
	Some dehydration	34	55.7 %
	No dehydration	16	26.2 %
Recently received zinc sulfate	Yes	9	14.7%
	No	52	85.2%
Fever	Yes	53	86.9%
	No	8	13.1%

Table 2: Mean value of zinc according to age groups.

Age group (years)	No.	Mean	Std.Deviation	Student 't' Test value	P value
6 months to 2 years (normal value 60-90)	34	68.4	22.12	2.963	0.004
2 years to 5 years (normal value 80-110)	27	90.0	34.54		

Table 3: Mean value of zinc level according to the duration of diarrhea.

Duration of diarrhea/day	Mean of zinc level	Std. Deviation	Students 't' test value	P- value
≤5 days(n=42)	90	25.0	2.815	0.006
> 5 days(n=19)	71	23.0		

Discussion

With a wide range of biological functions in humans, zinc is a necessary nutrient. This component is crucial to the physical development of the immunological and digestive systems [3].

While slightly different from other studies obtained by Kara aga oglu *et al* (39%) in Turkey [8] and Baqui *et al* [9] (44%) in India, children with acute gastroenteritis on admission in the current study showed that (34%) were below the lower limit of the range for our laboratory at medical city/toxicology center and they were asymptomatic for zinc deficiency.

We discovered a significant difference between our findings and those of other studies, including those conducted in Pakistan by Arora *et al* [10] and in Netherlands by Fischer *et al* [11] and in Turkey by Olmez *et al* [12].

Additionally, Lamberti *et al* comprehensive's study in China found no association between zinc levels and the degree of dehydration. These data support those findings [13]. Although Brown KH *et al* [14] conducted another trial, we discovered that the serum zinc levels of the patients hospitalized with acute gastroenteritis, fever, and high CRP were unaffected. It's possible that children with low blood zinc levels before to their sickness went on to acquire a more serious illness that was accompanied by a higher body temperature and raised CRP levels.

It has been discovered that a decrease in serum zinc content is proportional to the amount of induced parasitemia and the dosage of bacterial endotoxin [10,11]. Interleukin 1 response, which is involved in the partial and direct mediation of fever, is followed by an increase in the hepatic production of the metal-binding protein metallothionein, which again increases plasma zinc absorption [15].

There is no correlation between fever, CRP, or serum zinc that would have been caused by an interleukin-1-induced hepatic zinc uptake. Furthermore, even with both variables included in the linear regression model, plasma zinc concentration was still substantially correlated with plasma CRP concentration and axillary temperature [16]. The current study demonstrates that the disease state, type of feeding, and degree of dehydration did not affect the serum zinc levels of the patients admitted with acute gastroenteritis without any other disease and without moderate or severe malnutrition. These findings are consistent with other studies conducted by Cousins RJ *et al*. In individuals with asymptomatic or subclinical zinc insufficiency, gastroenteritis did not further lower blood zinc levels [17].

This research found no associations between low blood zinc levels with sex, weight, or age. This finding is similar to one from an Egyptian study by Elnemr FM *et al* [18]. The research was subject to several restrictions. First off, the study population was small (since our hospital is a tertiary centre, the majority of gastroenteritis patients were treated in primary health care facilities, and many samples were discarded due to haemolysis during specimen collection); however, it was sufficient to detect the prevalence of low zinc diarrheal children, which were expected to be 34% in hypothesis. levels in close to Second, the parents refused to return to the hospital for follow-up and reassessment of serum zinc level in order to determine the effect of zinc treatment, which includes reductions in episode duration, stool output, stool frequency, and length of hospitalization; similarly, we were unable to study the control group. Therefore, the study did not measure serum zinc after zinc supplementation for 14 days or recovery.

Conclusion

The current research, which was conducted to measure the serum zinc levels in children with

gastroenteritis, showed that serum zinc levels were significantly decreased in patients with prolonged diarrhoea.

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