



Serum Zinc Level and Its Correlation with Vesikari System Scoring in Acute Pediatric Diarrhea

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Abstract

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BACKGROUND: Diarrhea remains the most common infectious disease worldwide. Zinc has been studied extensively recently for its potential effect on prevention, control and treatment of acute diarrhoea.

AIM: This study was designed to correlate the level of zinc with the severity of pediatric diarrhoea estimated by Vesikari Scoring System.

PATIENTS AND METHODS: The present study included 80 children aged two months to 30 months from those suffering from the acute diarrheal episode and admitted to Pediatric Hospital "Abo El Rish" Cairo University. Serum Zinc level was assessed by a colorimetric method with a spectrophotometer.

RESULTS: Zinc deficiency was detected in 45 (56.2%) patient of the studied group. Significant negative correlations were found between serum zinc level and severity of dehydration and duration of hospitalization ($p < 0.05$).

CONCLUSION: Zinc level has an essential role in acute pediatric diarrhoea. Zinc therapy should be considered beside Oral rehydration salts (ORS) to achieve maximum impact on diarrheal diseases; clinical trials are recommended to support the zinc supplementation in developing countries.

Introduction

Diarrheal disease remains the most common infectious disease worldwide and still presenting the third cause of mortality among children younger than five years of age [1, 2]. In developing countries, acute diarrhoea was reported to cause a significant mortality rate. On the other hand, it is rarely fatal in the developed countries. However, acute diarrhoea was considered a leading cause of emergency department visits and hospitalizations causing a significant economic burden [3].

The clinical spectrum of the diarrheal disease range from a self-limiting disease with the potential of short hospitalization for few days up to more prolonged disease that may be complicated by severe dehydration, malnutrition, and death [4].

These differences had generated different definitions. Moreover; different treatment protocols and diversity in recommendations of diarrheal diseases [5].

According to the WHO recommendations; acute diarrheal main treatment is the prevention of dehydration with adequate liquids and oral rehydration salts (ORS) maintenance of oral feeding, and supplementation of zinc [6].

Zinc considered as an essential trace element required for normal intestinal mucosal integrity, sodium and water transport and immune function [7]. Unfortunately, 30% of the world's population is zinc deficient [8].

The role of zinc level and its association with the outcome of acute pediatric diarrhoea has been studied evidently over the last years in both developing and developed countries showing a potential effect of zinc in reducing complications and

mortality rates [9-11].

In developed countries, some guidelines recommend the use of zinc in addition to the ORS and oral feeding maintenance [12-14].

The present study was designed to estimate serum zinc level in children with acute diarrhoea and its correlation with the severity of diarrhoea estimated by Vesikari Scoring System.

Subjects and Methods

The present study was conducted on 80 children aged from 2 months to 30 months from those diagnosed as having acute diarrheal episodes according to the WHO criteria and admitted to Abo El Rish Pediatric Hospital, Cairo University from February 2016 to October 2016.

Children came to the clinic suffered from acute diarrhoea was screened for inclusion and exclusion criteria. Those fulfilled the criteria were considered for sampling. According to their number, a systematic technique random sampling was used to select the desired number. Children with acute diarrhoea were included. Any child with history suspecting surgical or extra intestinal causes of diarrhoea or receiving immunosuppressive therapy were excluded from the study.

The study followed the regulations of the medical ethical committee of the Cairo University. Signed informed consents were collected from mothers of the children enrolled in the study before participation. Demographic data and medical history were collected from the mothers via questionnaires.

Acute diarrhoea was defined as caregiver's report of \geq three loose or watery stools in a 24-hour period [7]. The clinical picture and severity degree of each case was assessed based on a direct examination and categorized into mild, moderate and severe using a clinical scoring system (Vesikari Scoring System) [15].

Table 1: Vesikari Scoring System

Parameter	1	2	3
Diarrhea			
Maximum number stools per day	1-3	4-5	≥ 6
Diarrhea duration (day)	1-4	5	≥ 6
Vomiting			
Maximum number per day	1	2-4	≥ 5
Vomiting duration (day)	1	2	≥ 3
Maximum body temperature ($^{\circ}$ C)	37.1-38.4	38.5-38.9	≥ 39.0
Severity of dehydration (%)	N/A	1-5	≥ 6
Treatment	Rehydration	Hospitalization	N/A
Severity rating scales	<7 (mild)	7-10 (moderate)	≥ 11 (severe)

Vesikari Scoring System (VSS) can be considered a useful and reliable infectious marker for pediatric gastroenteritis are enabling development of an early treatment plan and recently verified by many studies [16, 17] (Table 1).

Laboratory investigations

Blood Sample was collected using plain tubes and let to stand until clotting. Clotted blood was centrifuged, separated, and serum transferred into aliquots stored frozen at -20° C. Zinc level was estimated by using the colorimetric method with a spectrophotometer wavelength 560 nm (Atomic Absorption Spectrometer equipped with a graphite furnace atomizer and an auto-sampler; Quimica Clinica Aplicada S.A. Company, Amposta, Spain). The normal serum zinc level was considered for values of 60-110 μ g/dl.

Statistical analysis

Statistical analysis was performed using the SPSS statistical package software for windows version 21 (SPSS Inc, Pennsylvania, USA). Parametric variables are described as the mean \pm SD. Pearson's correlation coefficients were used to evaluate correlations between the data exhibiting parametric distribution. P value < 0.05 was considered significant difference and p < 0.005 was considered highly significant difference.

Results

The descriptive and clinical data are demonstrated in table 2. The mean age of the included children was 5.9 ± 11.2 months.

According to the collected clinical data, 57 (71.3%) cases were reported to have a fever and 52 (65%) cases were associated with vomiting.

Table 2: Demographic and clinical data of studied children

	"Minimum and maximum."	Mean \pm SD
Age (months)	3 - 30	11.2 \pm 5.9
Weight (Kg)	4 - 13.5	8.1 \pm 2.3
Duration of hospitalization (days)	1 - 6	2.3 \pm 1.3
	No	%
Vomiting	52	65.0
Fever	57	71.3
Dehydration	66	82.5
Mild	27	40.9
Moderate	27	40.9
Severe	12	18.2
ICU admission	9	11.3
VVS Score:		
Mild <7	0	0
Moderate 7-10	10	12.5
Severe ≥ 11	70	87.5

Dehydration degree ranged from mild to

severe. Out of 80 studied cases, 66 children (82.5%) suffered from dehydration. Out of them, 27 (40.9%) child as a mild dehydration, 27 (40.9%) child as a moderate degree of dehydration while 12 children (18.2%) suffered from a severe degree of dehydration with 9 cases with ICU admission. The duration of hospitalization ranged from 1 to 6 days.

The VSS was applied to all cases; 10 (12.5%) cases were scored as moderate, and 70 (87.5%) cases were scored as severe.

Zinc level ranged from 50 – 101 µg/dl with the mean 65.0 ± 13.5 µg/dl. The studied cases were then subdivided into two groups according to the cutoff value of serum zinc level which is 60 µg/dl. Zinc deficiency was present in 45 (56.2%) cases (Table 3).

Table 3: Zinc level in studied children

	Range	Mean \pm SD
Serum Zinc level (µg/dl)	50 – 101	65.0 \pm 13.5
Zinc level:	No	%
< 60 µg/dl	45	56.2
> 60 µg/dl	35	43.8

A significant negative correlation was noticed between zinc level and the diarrhoea severity parameters as the severity of dehydration ($p < 0.001$), duration of hospitalization ($p < 0.01$) and VSS scoring ($p < 0.001$) as shown in (Table 4).

Table 4: Correlations between serum zinc and diarrheal severity parameters

		Age in months	Dehydration severity	Duration of hospitalization	VSS score
Zinc level	Pearson Correlation	0.593**	-0.429**	-0.269*	-0.496**
	Sig. (2-tailed)	0.000	0.000	0.016	0.000

* Correlation is significant at the 0.01 level (2-tailed). ** Correlation is highly significant at the 0.001 level (2-tailed).

Discussion

Acute diarrhoea considered as a leading cause of childhood mortality despite the remarkable achievement of oral rehydration therapy (ORT) in acute diarrheal diseases treatment over the years [1].

Oral rehydration salts (ORS) solution and ORT were adopted by the World Health Organization (WHO) and the United Nations Children's Fund (UNICEF) since 1978 as the first line tool in dehydration management, causing reduction in the mortality rate of children aged five and less diagnosed as acute diarrhea from 4.5 million to 1.8 million every year. However, in spite of this undeniable achievement, acute diarrhoea remains a leading cause of death in children in developing countries [14, 18].

Frequent episodes of acute diarrhoea can

compromise zinc level due to increased faecal zinc loses during the episode that could be associated with negative zinc balance. Additionally, zinc stores are limited and rapidly depleted by acute intestinal illness [19]. In the developing countries, the high prevalence of diarrheal episodes was reported to increase the risk of zinc deficiency [20].

In the present study, zinc deficiency was detected in 45 (56.2%) cases of the studied children. A significant negative correlation was noticed between zinc level and the severity of the disease measured by VSS.

This finding is in favour to many studies that reviewed the degree of diarrhoea control and treatment achieved by zinc supplementation. Some studies focused on the mechanisms by which zinc might contribute to the pathogenesis of acute diarrhoea [21-26].

Zinc deficiency has been linked to the severity of diarrheal episodes [21]. Moreover, Zinc supplement significantly reduced the duration of illness [22].

The current WHO/UNICEF Joint Statement on Clinical Management of Acute Diarrhea recommends 10–20 mg zinc/d (dependent on age) for 10–14 d for a reduction in diarrhoea duration and severity (the therapeutic benefit) and prevention of subsequent episodes (the “secondary prevention” benefit) [18].

Unfortunately, the WHO/UNICEF strategy for zinc supplementation as adjunctive therapy for diarrhoea is poorly implemented [27].

A significant negative correlation was noticed between zinc level and the diarrhoea severity parameters as the severity of dehydration ($p < 0.001$), duration of hospitalization ($p < 0.01$) and VSS scoring ($p < 0.001$).

These findings are in favour to the finding of a systematic review by Lamberti et al., [28] that confirm and highlight the benefits of therapeutic zinc supplementation for diarrhoea among children aged five and less in low- and middle-income countries. The effects of zinc treatment, which include reductions in episode duration, stool output, stool frequency and length of hospitalization.

In conclusion, zinc level has an essential role in acute pediatric diarrhoea. For maximum impact on diarrheal diseases, improvement zinc therapy should be considered beside ORS. Clinical trials are recommended to support the zinc supplementation in developing countries.

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