



The Efficacy of Elemental Zinc on Acute Diarrhea in Egyptian Infant and Children

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Abstract

Diarrhea is a common cause of death in developing countries and the second most common cause of infant deaths worldwide. The loss of fluids through diarrhea can cause dehydration and electrolyte imbalances. Hence, the aim in the present study was to evaluate the effect of elemental zinc in treatment of diarrhea in children. 100 diarrheic patients (50 females) aged from 1-12 years old collected from the-clinics of pediatric department at Beni suef University Hospital, were divided into two equal groups. Group A received elemental Zinc in the form of Zinc Sulphate (10 mg elemental Zinc daily for infants and 20 mg for children) with the normal diarrhea treatment. Group B received the normal anti-diarrhea treatment only. There was no significant difference between the two groups regarding most of the parameters studied. However, the mean $\pm$ SD recovery time in group A was significantly higher (p -value=0.019) than in group B. However, when antibiotic alone was used as anti-diarrheal treatment the recovery time in days in group A was less than in group B but with no significant difference. The expected beneficial efficacy of elemental Zinc in the form of Zinc Sulphate on the duration and severity of acute diarrhea was not observed. However, the study showed that Zinc may be effective in diarrhea due to bacterial infections.

Key words: Diarrhea, Zinc, infant, children, anti-diarrheal treatment

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Introduction

Diarrheal diseases are the cause of almost three million deaths annually mainly among children less than 5 years of age [1-3]. About 35% of the deaths are attributable to acute non-dysenteric diarrhea and an estimated 45% occur in children with persistent diarrhea [4]. Oral rehydration salts and Zinc tablets are the treatment of choice and have been estimated to have saved 50 million children in the past 25 years [5].

The results of the previous studies highlight strong evidence that Zinc supplementation may have an evident beneficial effect on the clinical course of acute diarrhea [6, 7]. Therefore, the use of Zinc as an adjunct to standard diarrheal treatment in developing countries, where Zinc deficiency is prevalent, worth further consideration and investigation.

On the other hand large community-based, cluster-randomized, double-masked, placebo-controlled trials of daily prophylactic supplements of 10 mg of Zinc found no significant difference in frequency of diarrhea, duration, all-cause hospitalization rates or overall mortality, in Nepal, India and Zanzibar. [8-10] Also the expected beneficial effects of Zinc supplementation for acute diarrhea were not observed in a study on Zinc and Copper supplementation in acute diarrhea in children [11]. Also a therapeutic study from Bangladesh on infants Showed that age can modify the beneficial effect of Zinc supplementation. [12]

Hence, the aim of the present study was to investigate the effect of using the standard diarrhea therapy with or without Zinc supplementation on the clinical course of diarrhea.

Material and Method

Local hospital research ethical committee approval was obtained for the study. Patients were collected in this study from pediatric department at Beni suef University hospital with diarrhea. All parents or guardians of eligible infants were informed of the purpose of the study, expected procedures and potential risks and benefits. An informed consent was obtained from those parents or guardians. 100 (50 females) patients with reported episodes of acute diarrhea from pediatric clinic at Beni suef University hospital were recruited. Patients were divided into two equal groups A, B. Group B represents 50 (25 females) patients who received only their standard anti-diarrheal treatment. Group A represents 50 (25 females) patients who received Zinc Sulphate supplementation with their standard anti-diarrheal treatment until cessation of diarrhea

and after discharge from the hospital for a total period of 10-14 days. Infants under 6 months: 10 mg elemental zinc (5 ml) daily. Children above 6 months: 20 mg elemental zinc (10 ml) daily in two divided doses [13].

1. Inclusion criteria:

Children with episodes of acute diarrhea from pediatric clinic at Beni suef University hospital

2. Exclusion criteria:

Children were excluded if:

- 1- They used Zinc Sulphate supplementation for less than 14 days
- 2- Children younger than 1 month
- 3- A child was discontinued from the study for any reasons preventing the child from taking oral fluids or medications e.g. complications (e.g. electrolyte imbalance, azotemia, convulsion or acidosis....etc); occurrence of a serious adverse event; parent or guardian withdrawal of consent; or if the patient opposed medical advice.
- 4- Patients with congestive heart failure, hemolytic uremic syndrome, septicemia or loss of consciousness

A full clinical evaluation was accomplished for all children including taking a full detailed history of each patients and achieving a thorough clinical examination. Thorough clinical examination included; name, age, weight, sex, frequency of defecation, rates of recovery, presence of vomiting, mucus, fever, colour and odour of stool. Children were also evaluated based on the type of anti-diarrheal treatment used with Zinc supplementation. In addition, the children serum Zinc levels were measured before using Zinc supplementation for predicting the percentage of zinc deficiency in the study.

Statistical methods:

The following tests were used:

Descriptive analysis of the results in the form of percentage distribution for qualitative data (minimum, maximum, mean and standard deviation) calculation for quantitative data was calculated.

Student t-test was used for comparison between means of two groups.

Fisher's exact test: was used to calculate an exact p-value for a 2x2 frequency table with small number of expected frequencies, for which the Chi-square test is not appropriate.

Mann-Whitney U test was used for two independent samples

The Mann–Whitney U test is a nonparametric test was used for a between-subjects design using two levels of an independent variable and scores that are measured at least at the ordinal level.

p value > 0.05 (NS) Not significant

For statistical analysis, Statistical package for social science (SPSS) software version 17 was used.

Results

The mean±SD demographic data and the serum Zinc level of groups A and B are shown in Table 1. There was a significant difference (p-value=0.019) between means of recovery time in favour of group B. Table 2 showed the Distribution of patients and control according to of anti-diarrheal treatment used. Table 3 shows the age distribution of Groups A and B. Table 4 shows Mean±SD recovery time in Groups A and B according to age categories. There was a significant difference (p-value=0.014) between mean of recovery times in infants, however no significance was found in children.

Table 5 shows a Mean±SD of recovery time in days in groups A and B according to treatment of diarrhea. There was a high significant difference (p-value=0.005) in favour of group B between mean of recovery times when anti-amoebic was used as anti-diarrheal treatment. Also a significant difference (p-value=0.027) in favour of group B when anti-amoebic with antibiotic were used together as ant-diarrheal treatment. When antibiotic alone was used as anti-diarrheal treatment the recovery time in days in group A was less than in group B but with no significant difference.

Table 1. Mean±SD demographic data and the serum Zinc level of groups A and B

	Group A	Group B	p-value
Age (year)	1.6±1.9	1.7±1.7	0.649
Number of defecations daily	5.0±2.3	4.5±2.4	0.355
Recovery time	4.7±3.4	3.2±2.7	0.019*
Weight	8.5±3.4	10.0±4.5	0.065
Serum Zinc before using Zinc therapy	79.2±33.9	-	-

Table 2. Distribution of patients and control according to of anti-diarrheal treatment used

Treatment	Patient No. (%)	Control No. (%)
Anti amoebic	35(70)	29(58)
Anti amoebic antibiotics	5(10)	8(16)
Antibiotic	7(14)	5(10)
Antidiarrheal	1(2)	3(6)
ORS	1(2)	2(4)
Antiemetic	1(2)	3(6)

Table 3. Age distribution in Groups A and B represented as Number of patients and percentage [No. (%)]

Age	Group A	Group B
Infants (1m: ≤2y)	38(76)	36(72)
Early childhood (>2y: ≤6y)	11(22)	12(24)
Late childhood (>6y: ≤12y)	1(2)	2(4)

Table 4. Mean±SD recovery time in Groups A and B according to age categories

Age	Group A	Group B	p-value
Infants (1m: ≤2y)	5.0±3.5	3.1±3.1	0.014*
Early childhood (>2y: ≤6y)	3.1±1.9	2.8±1.2	0.695

Table (5): Mean±SD of recovery time (days) in groups A and B according to anti-diarrheal treatment used

Treatment	Group A	Group B	p-value
Anti-amoebic	4.9±3.1	2.9±1.8	0.005**
Anti-amoebic and antibiotics	6.0±4.9	1.5±1.1	0.027*
Antibiotic	2.4±2.5	4.3±3.3	0.326

Discussion

The expected beneficial effect of Zinc was not observed except when used with antibiotic alone as anti-diarrheal treatment. However this difference in recovery time with not significant and that may be due to the small number in groups A and B that took antibiotic alone as shown in Table 2.

Hence, it could be assumed that Zinc may be effective in bacterial infections alone. However this needs further investigation with larger number of patients.. Serum Zinc analysis showed that 15% of group A had Zinc deficiency (serum Zinc less than 60 µg/dl), 60% had serum Zinc (from 60 µg/dl to 80 µg/dl) and 25% had no Zinc deficiency.

The data presented here showed that Zinc has no effect on acute diarrhea in children even in those with low plasma or serum Zinc levels. Three large studies from Nepal, Zanzibar and India of prophylactic Zinc supplementation also, found no difference in morbidity and mortality of children aged 1 to 48 months between placebo and supplemented groups [9, 10].

In the present study the expected beneficial effects of Zinc supplementation for acute diarrhea were not observed in which the mean baseline serum Zinc level was from 60µg/dl to 80µg/dl with the highest proportion of children. A limitation of this study, common to many existing studies of therapeutic and prophylactic Zinc supplementation, is that serum Zinc concentrations are not a reliable measure of body Zinc status. Instead, measurement of dietary Zinc intake and tissue Zinc status could perhaps explain the differential impact of Zinc. Furthermore Brooks et al observed a non-significant benefit of Zinc supplementation for 5 mg/day, but not 20 mg/day, on the duration or severity of the diarrheal episode [12]. In the present study, the infants who were up to 2 years of age of group A were 76% and of group B were 72%. There was significant difference between mean±SD of recovery times of group A and B infants and no significance in children. This support the previously discussed hypothesis that age can modify the beneficial effect of Zinc supplementation where Zinc may be less effective in infants than in children [12].

The current WHO/UNICEF recommendations for the treatment of diarrhea suggest Zinc supplementation in addition to ORS and continued feeding for all children younger than 5 years [14]. All available trial results, including this trial needed to be taken in consideration by WHO that should consider reevaluating this policy for infants younger than 6 months.

Conclusions:

The expected beneficial efficacy of elemental Zinc in the form of Zinc Sulphate on the duration and severity of acute diarrhea was not observed but Zinc may be effective in bacterial infections.

Author Disclosure Statement

No Conflict of Interest and no competing financial interests exist.

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