

Role of Zinc supplements in children below 2 years of age in controlling pneumonia and diarrhea

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Abstract

Background: Pneumonia and diarrhea are common among infants. Diarrhea causes 1.9 million deaths among children younger than 5 years. In children zinc deficiency is common where pneumonia and diarrhea are common, and daily regimens of zinc prevent and treat pneumonia and diarrhea and reduce child mortality. The present study was conducted to assess the weekly dose of zinc in reducing clinical pneumonia, diarrhea and other morbidity in children younger than 2 years.

Materials & Methods: This study was conducted in department of pediatrics in year 2012. It included 1520 children from 2 months to 1 year old. They were divided into 2 groups. Group I consisted of 760 children who were given Zinc orally as syrup (35 mg zinc acetate per 5 mL). Group II consisted of 760 children who were given placebo identical to the zinc syrup in colour, odour and taste.

Results: Group I consisted of 760 children who were given Zinc orally as syrup. Group II consisted of 760 children who were given placebo. Children with 2-5 months age in group I was 350 and in group II was 370. Children with 6-12 months age in group I was 410 and in group II was 390. 72% in group I and 65% in group II had smoker in family. 70% in group I and 75% in group II had household gas cooker. 62% mothers in group I and 60% in group II reported vaccination upto date. The difference was non-significant ($P > 0.05$). Serum zinc (mol/L) level in group I was 9.8 and in group II was 9.6 at baseline, 11.2 in group I and 9.8 in group II at 10 months. The difference was significant at 10 months ($P < 0.05$). Haemoglobin (g/L) in group I was 97 and in group II was 99 at baseline and at 10 months in group I was 95 and in group II was 96. Serum copper (mol/L) at baseline in group I was 0.21 and in group II was 0.21, at 10 months in group I was 0.18 and in group II was 0.18. White blood cells ($10^9/L$) at baseline in group I was 11.3 and in group II was 11.4, at 10 months in group I was 11.3 and in group II was 11.2. Height at baseline in group I was 61.4 cm and in group II was 61.2 cm, in group I was 78.1 cm and in group II was 79.2 cm. Weight in group I was 6.5 Kg and in group II was 6.3 cm at baseline, 8.9 cm in group I and 8.8 cm in group II at 10 months. The difference was non-significant ($P > 0.05$). Diarrhea in group I (2) and group II (1) was seen. Other causes in group II were oral infection (1), pneumonia (10), poisoning (1) and sepsis (1) in group II. The difference was significant ($P < 0.05$). Common illnesses in group I was diarrhea (610), upper respiratory tract (URTI) (509) infection, bronchoitis (210) and pneumonia (382) and in group II was diarrhea (822), upper respiratory tract (URTI) (739) infection, bronchoitis (385) and pneumonia (487).

Conclusion: Zinc is beneficial in children in controlling diarrhea, pneumonia, suppurative otitis media and most importantly, mortality secondary to pneumonia. Zinc supplementation is safe and effective. Zinc supplementation is found to have no long-term harm.

Keywords: Diarrhea, Pneumonia, Zinc

1. Introduction

Pneumonia is an inflammatory condition of the lung affecting primarily the microscopic air sacs known as alveoli. Typical signs and symptoms include a varying severity and combination of productive or dry cough, chest pain, fever, and trouble breathing, depending on the underlying cause. Fever is not very specific, as it occurs in many other common illnesses, may be absent in those with severe disease, malnutrition or in the elderly. In addition, a cough is frequently absent in children less than 2 months old. More severe signs and symptoms in children may include blue-tinged skin, unwillingness to drink, convulsions, ongoing vomiting, extremes of temperature, or a decreased level of consciousness [1].

It is quite common in children and from 2000 to 2003, pneumonia caused about 2 million of 10.6 million deaths among children younger than 5 years, 1 more than 90% of which occurred in less developed countries. Pneumonia prevention strategies typically rely on vaccines and are complicated by inadequate efficacy of non-conjugate vaccines for children younger than 2 years, the high cost of effective

protein-conjugate vaccines, and incomplete serotype vaccine coverage for Streptococcus pneumonia [2]. An effective alternative is needed for very young children in high-risk populations. Mortality from diarrhea has decreased from 4.5 million per year in 1979, mostly as a result of the introduction of oral rehydration therapy. However, diarrhea causes 1.9 million deaths among children younger than 5 years. In children zinc deficiency is common where pneumonia and diarrhea are common, and daily regimens of zinc prevent and treat pneumonia and diarrhea and reduce child mortality. Pneumonia and diarrhea are the first and second leading causes of patient visits [3].

The present study was conducted to assess the weekly dose of zinc in reducing clinical pneumonia, diarrhea and other morbidity in children younger than 2 years.

2. Materials & Methods

This study was conducted in department of paediatrics in year 2012. It included 1520 children from 2 months to 1 year old. Those with known or suspected tuberculosis, chronic

respiratory or congenital heart disease, or severe malnutrition requiring hospital were excluded from study. Parents were informed regarding the study and written consent was obtained.

They were divided into 2 groups. Group I consisted of 760 children who were given Zinc orally as syrup (35 mg zinc acetate per 5 mL). Group II consisted of 760 children who were given placebo identical to the zinc syrup in colour, odour and taste.

Field research assistants (FRAs) did active surveillance, visiting every enrolled child at home once weekly. They collected information about specific signs of respiratory disease and diarrhoea for each day. FRAs also inspected any diarrhoeal - stool samples.

Vital signs such as respiratory rate, axillary temperature, pulse rate and blood pressure were measured. Fever was also checked. Danger signs, such as chest indrawing, cyanosis, lethargy, or inability to drink, were recorded. Dehydration was assessed with WHO criteria.

The medical officer diagnosed pneumonia if crepitations were heard on inspiration with a respiratory rate greater than 50 breaths per minute. Diarrhea was diagnosed if the child had three or more watery stools or one bloody stool in a 24-h period.

For pneumonia, tablet Co-trimoxazole (10 mg/kg trimethoprim, B.D daily for 5 days was given. If oral treatment failed, or if they had severe pneumonia, we referred them to hospital for parenteral treatment (ceftriaxone 75 mg/kg intramuscularly per day). FRAs followed up patients who were home and taking antibiotics within 72 h to document compliance (asking the caretaker to explain the dosing regimen, and checking the remaining volume) and the end of the illness episode. The end of an episode of respiratory illness was defined as 7 disease-free days after the last day of illness; for diarrhoea, the disease-free interval was 3 days. "Disease-free" for pneumonia meant a respiratory rate less than 50 breaths per min without danger signs or fever, for suppurative otitis media no ear discharge, and for diarrhea no watery or bloody stool. Medical officers collected blood (3 mL) at baseline before zinc or placebo was given and again during the 10th month. Serum samples (150 mL) in polypropylene tubes were diluted 1/12 with HNO₃ and Brij35, a non-ionic detergent. Flame atomic absorption spectrophotometry was used to assess zinc and copper concentration. Similarly, measurements taken at baseline and at 10 months assessed

growth; the mean of two consecutive measures of nude bodyweight and length were recorded. Results thus obtained were subjected to statistical analysis. P value < 0.05 was considered significant.

3. Results

They were divided into 2 groups. Group I consisted of 760 children who were given Zinc orally as syrup. Group II consisted of 760 children who were given placebo. Table I shows that children with 2-5 months age in group I was 350 and in group II was 370. Children with 6-12 months age in group I was 410 and in group II was 390. 72% in group I and 65% in group II had smoker in family. 70% in group I and 75% in group II had household gas cooker. 62% mothers in group I and 60% in group II reported vaccination upto date. The difference was non - significant (P > 0.05). Table III shows that Serum zinc (mol/L) level in group I was 9.8 and in group II was 9.6 at baseline, 11.2 in group I and 9.8 in group II at 10 months. The difference was significant at 10 months (P- 0.05). Hemoglobin (g/L) in group I was 97 and in group II was 99 at baseline and at 10 months in group I was 95 and in group II was 96. Serum copper (mol/L) at baseline in group I was 0.21 and in group II was 0.21, at 10 months in group I was 0.18 and in group II was 0.18. White blood cells (10⁹/L) at baseline in group I was 11.3 and in group II was 11.4, at 10 months in group I was 11.3 and in group II was 11.2. Height at baseline in group I was 61.4 cm and in group II was 61.2 cm, in group II was 78.1 cm and in group II was 79.2 cm. Weight in group I was 6.5 Kg and in group II was 6.3 cm at baseline, 8.9 cm in group I and 8.8 cm in group II at 10 months. The difference was non - significant (P > 0.05).

Graph I shows that diarrhea in group I (2) and group II (1) was seen. Other causes in group II were oral infection (1), pneumonia (10), poisoning (1) and sepsis (1) in group II. The difference was significant (P < 0.05). Graph II shows that common illnesses in group 1 was diarrhea (610), upper respiratory tract (URTI) (509) infection, bronchitis (210) and pneumonia (382) and in group 2 was diarrhea (822), upper respiratory tract (URTI) (739) infection, bronchitis (385) and pneumonia (487).

Table 1: Distribution of children

Total - 1520		
Group	Group I (Zinc)	Group II (Placebo)
Number	760	760

Table 2: Demographic data of children

	Group I	Group II	P value
Children 2-5 month	350	370	0.231
Children 6-12 month	410	390	0.31
Number with smoker in family	72%	65%	0.176
Number using household gas cooker	70%	75%	0.50
Number of mother who reported vaccination upto date	62%	60%	1

Table 3: Clinical and laboratory results before treatment and after 10 months of treatment

	Baseline			10 months		
	Group I	Group II	P value	Group I	Group II	P value
Serum zinc (mol/L)	9.8	9.6	0.4	11.2	9.8	0.005
Haemoglobin (g/L)	97	99	0.1	95	96	0.2
Serum copper (mol/L)	0.21	0.21	1	0.18	0.18	1
White blood cells (10 ⁹ /L)	11.3	11.4	0.1	11.3	11.2	0.1

Height (cm)	61.4	61.2	0.1	78.1	79.2	0.2
Weight (kg)	6.5	6.3	0.13	8.9	8.8	0.12

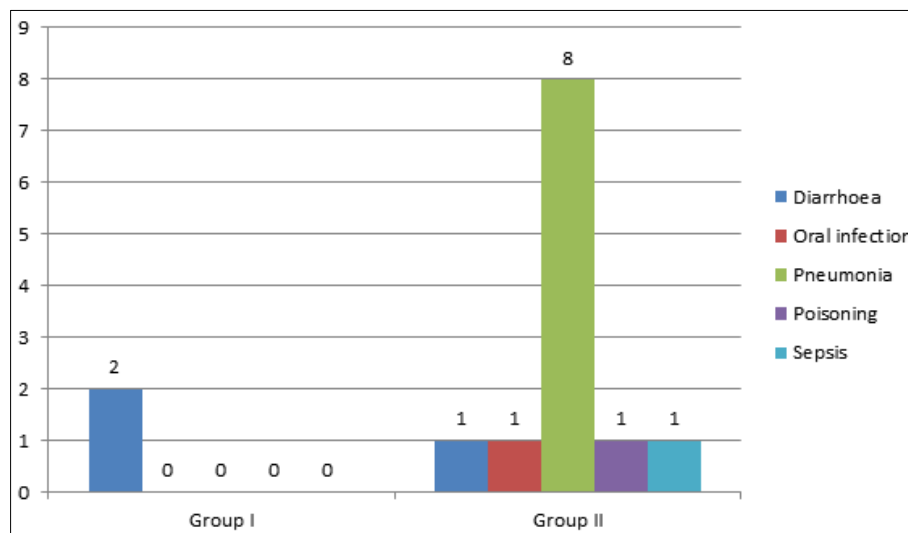


Fig 1: Causes of death

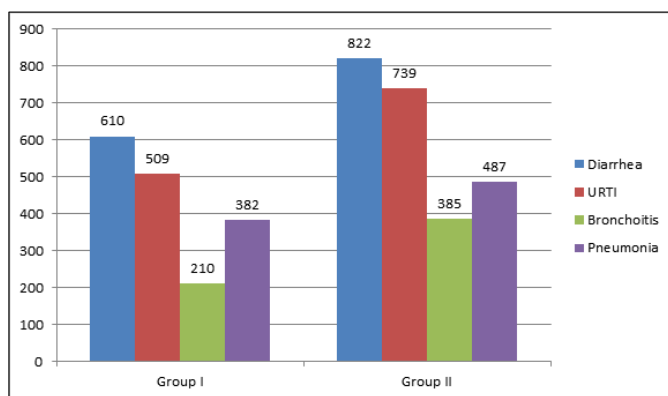


Fig 2: Illnesses in children

4. Discussion

The use of zinc tablets along with oral rehydration therapy (ORT) decreases the severity and duration of diarrhea. Zinc administration during diarrhea decreases hospital admission rates by 15-20% and child mortality by 3-5%. It can decrease the incidence of subsequent episodes of diarrhea and possibly also pneumonia over next 3 months. Children aged between 2-6 months should be given 10 mg of elemental zinc per day for a total period of 14 days from the day of onset of diarrhea [4]. A tablet of zinc contains 20 mg of elemental zinc. Therefore half tablet should be given to the children in this age group. One full tablet should be given to all children with diarrhea above 6 months of age. It should be started when diarrhea starts and continued for a total period of 14 days [5].

The present study was conducted to assess the weekly dose of zinc in reducing clinical pneumonia, diarrhea and other morbidity in children younger than 2 years. We found that Children with 6-12 months age in group I was 410 and in group II was 390. 72% in group I and 65% in group II had smoker in family. 70% in group I and 75% in group II had household gas cooker. 62% mothers in group I and 60% in group II reported vaccination upto date. Our results are in agreement with Bhandari *et al.* [6].

We found that Serum zinc (mol/L) level in group I was significantly higher at 10 months in group II children. This is in agreement with Bhutta ZA *et al.* [7]. We also assessed Haemoglobin level, Serum copper level, White blood cells, height and weight in both groups. The difference was non-significant ($P > 0.05$). Similar results were seen in study by Roy SK *et al.* [8]. We found that number of illnesses like oral infection, pneumonia, poisoning and sepsis was higher in group II than group I. We found that number of deaths due to diarrhea was 8 in group II. Our results are in agreement with Brooks WA *et al.* [9].

In diet zinc is available to our body mainly from animal food. India being predominantly vegetarian country, so deficiency of zinc is very common in our country especially among children who usually do not consume enough food. India comes in the zone of 'high risk' for zinc deficiency in children under 5 years. [10] Zinc supplementation is safe and effective. Zinc supplementation is found to have no long-term harm. Some children experienced vomiting and a slight decrease in copper status after consuming zinc.

5. Conclusion

Zinc is beneficial in children in controlling diarrhea, pneumonia, suppurative otitis media and most importantly, mortality secondary to pneumonia. Zinc supplementation is safe and effective. Zinc supplementation is found to have no long-term harm.

6. References

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