

Role of Oral Zinc Supplementation in treatment of Acute Dehydrating Diarrhea in children aged 6 months to 5 years

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ABSTRACT

Background: Oral Rehydration Salt (ORS) is the standard recommended treatment for acute dehydrating diarrhea but it has very little role in decreasing stool frequency and volume. Current studies recommend oral supplementation of zinc as an adjunct to ORS in treating acute dehydrating diarrhea of children especially those who are at risk of zinc deficiency and malnutrition.

Aim: To determine the effect of oral zinc supplementation on duration of acute diarrhea and intake of ORS in children between 6 months and 5 years of age.

Settings: Tehsil Head Quarters Hospital, Besham District Shangla, Khyber Pakhtunkhwa from October 2019 to September 2020.

Methodology: The study was double blinded Randomized Control Clinical Trial in children aged between 6 months to 5 years of age. A total of 90 children were included in the study. In addition to rehydration, 45 children were given oral zinc (20mg daily) while 45 children were given placebo.

Results: All 45(100%) patients in zinc group and 39(86.6%) patients in placebo group recovered after 5 days of treatment. Zinc group had significantly reduced duration of diarrhea (68.3±9.4 vs. 99.8±15.2 hours) and consumed less ORS solution (2.3±0.8 vs. 3.4±1.1 liters) as compared to placebo group.

Conclusion: It is concluded from this study that oral zinc supplementation in addition to ORS in treating acute dehydrating diarrhea of children has better effect on the clinical course of disease.

Key words: Diarrhea, ORS, Zinc, Dehydration.

INTRODUCTION

Diarrhea is a major killer of children in developing world¹ where annually 0.5 million children die of diarrhea². The mainstay of treatment of acute dehydrating diarrhea is Oral Rehydration Salt (ORS) and proper nutrition³. Along with rehydration the World Health Organization (WHO) and The United Nations Children's Fund (UNICEF) also recommend oral supplementation of zinc to the children between 6 months to 5 years of age in a dosage of 20 mg daily for 14 days⁴. These guidelines were issued after collecting strong proofs indicating significant role of oral zinc for two weeks on reducing the duration and frequency of acute diarrhea^{5,6}.

But ORS has no role in decreasing stool volume and frequency⁷. In developing countries like Pakistan, the major cause associated with diarrhea is malnutrition and various deficiencies⁸. Zinc deficiency is one of them and diarrhea in children with malnutrition further deteriorates this deficiency. Studies from recent past have proved that oral zinc supplementation has significantly reduced the duration and frequency of acute diarrhea in children with malnutrition⁹⁻¹¹.

The objective of the study was to determine the effect of oral zinc supplementation on duration of acute diarrhea and intake of ORS in children between 6 months and 5 years of age.

PATIENTS AND METHODS

This double blinded Randomized Control Clinical Trial was conducted at Tehsil Head Quarters Hospital, Besham District Shangla, Khyber Pakhtunkhwa from October 2019 to September 2020 after getting permission from IRB.

Children having age between 6 months and 5 years with history of acute diarrhea of less than 7 days duration, 3 or more loose stools in last 24 hours and having sign and symptoms of at least mild dehydration were included in the study. Children with history of antibiotic treatment in last 2 weeks, having underlying systemic diseases like cystic fibrosis and tuberculosis, those with suspected or confirmed other systemic infections e.g. septicemia, meningitis, otitis media etc. and those who needed intensive care unit were excluded from the study.

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Approval from the ethical committee was taken for the study. Patients meeting the inclusion criteria were admitted to paediatric unit of Tehsil Head Quarters Hospital Besham District Shangla. Informed written consent from parents or guardian was obtained before admission. Detailed clinical history was taken and physical examination was done and findings were noted on a designed questionnaire. All patients were rehydrated according to WHO guidelines with ORS and intravenous Ringer's lactate solution (in case of severe dehydration). A total of 90 children were included in the study. All patients were randomized using lottery method into two equal groups labeled as "group A" and "group B", each group having 45 children. In addition to rehydration, children in group A were given oral zinc (20mg once daily) while children in group B were given placebo (once daily). In case the child vomited within 1 hour of taking the treatment, full dose was repeated.

Children in both groups were followed up daily and assessed for frequency of diarrhea and changes in stool character. Any child developing severe dehydration in follow up period he was given intravenous Ringer's Lactate solution as per WHO recommendations¹². Daily records of number of stools and vomits, stool output, body weight and intake of ORS and other fluids like milk, water etc. were maintained. Children were discharged from hospital when the attending paediatrician after assessment thought that diarrhea is recovered. Recovery was defined as the passage of normal stool or no stool since last 18 hours. The parents as well as the attending paediatrician were unaware of the oral supplementation allocated to the children. At the time of discharge from hospital, all parents were advised to continue oral supplementation once daily for 14 days.

Data was collected, compiled and analysed using SPSS version 26.0. Comparability of the study and control groups and the differences in proportion of the two groups were done using Chi-squared test. The means of outcome variables of the two groups were compared by applying t-test.

RESULTS

The study was double blinded Randomized Control Clinical Trial in children aged between 6 months to 5 years of age. A total of 90 children were included in the study. In addition to rehydration, 45 children were given oral zinc (20mg daily) while 45 children were given placebo. Table 1 shows main characteristics of children on

admission. The average values of age, duration and frequency of diarrhea before admission and degree of dehydration were comparable between the two groups.

Table 2 shows the results of both groups after treatment. All the forty-five (100%) patients in zinc group and 39(86.6%) patients in placebo group recovered after 5 days of treatment. The

observed difference in the treatment rate of both the groups was significant ($p = 0.04$). Zinc group had significantly reduced duration of diarrhea (68.3 ± 9.4 vs. 99.8 ± 15.2 hours; $p = 0.001$), and consumed less ORS solution (2.3 ± 0.8 vs. 3.4 ± 1.1 liters; $p = 0.001$) in comparison to placebo group.

Table 1: Characteristics of children on admission.

Features	Zinc Group $n = 45$	Placebo Group $n = 45$
Mean age \pm SD (months)	14.6 \pm 5.4	16.3 \pm 7.2
Male/female (%male)	28/17 (62.2)	25/20 (55.5)
Mean body weight \pm SD (kg)	6.8 \pm 1.6	7.1 \pm 1.4
Character of stool\pmSD		
Watery	39 (86.6%)	41 (91.1%)
Loose	6 (13.4%)	4 (8.9%)
Mean duration of diarrhoea before admission (hours) \pm SD	21.3 \pm 3.7	19.9 \pm 4.3
Stool frequency in last 24 hrs before admission \pm SD	8.5 \pm 2.8	8.8 \pm 3.2
Degree of dehydration	Some	Some
Vomiting frequency in last24hrs \pm SD	4.4 \pm 2.7	3.6 \pm 2.7

Table 2: Outcome Variables

Features	Zinc Group ($n=45$)	Placebo Group ($n=45$)	p value
No. (%) of patients recovered	45 (100)	39 (86.6)	0.04
Mean recovery \pm SD in hours	68.3 \pm 9.4	99.8 \pm 15.2	0.001
Total Consumption of ORS and other fluids in liters	2.3 \pm 0.8	3.4 \pm 1.1	0.001

DISCUSSION

This study shows the beneficial role of oral zinc in treating acute dehydrating diarrhea of children having 6 months to five years of age. In past, studies have proven the role of oral zinc supplementation on the duration and frequency of diarrhea with decrease of 13-23% in duration and 18-39% in stool frequency.¹³⁻¹⁷ Our results are in accordance to studies conducted in collaboration with the World Health Organization.¹⁸ Children who were given zinc treatment showed a high improvement. The exact mechanism of zinc in treating diarrhea is not known but it is thought that more than one mechanism is involved. Zinc has a structural and catalytic function in about 200 enzymes. It has role in membrane stability, T cell response and delayed immunological response. Many studies have showed its role in preventing different infections including diarrhea. It is also important in maintaining stability of brush border of villi of intestine. Literature suggests that the beneficial impact of zinc supplementation in diarrhea is irrespective of the aetiology of diarrhea.

CONCLUSION

In a nutshell, majority of children in our country have low level of zinc in their serum which is associated with longer duration and increased frequency of diarrhea which further exacerbates the dehydration in these children. Daily oral zinc supplementation resulted in a marked improvement. Further studies are required to establish the role of zinc when used in combination with other micronutrients like vitamin A and copper.

Conflict of interest: Nil

REFERENCES

- World Health Organization. Programme for control of diarrhoeal diseases: readings on diarrhea Student manual. Geneva: WHO, 1992; 532-8.
- Liu L, Black RE, Cousens S, Mathers C, Lawn JE, Hogan DR. Causes of child death: comparison of MCEE and GBD 2013 estimates. *The Lancet*. 2015 ;385(9986):2461-2.
- World Health Organization (WHO). The treatment of diarrhea. a manual for physicians and other senior health workers. Geneva: WHO press, World Health Organization; 2005; http://www.int.maternal_child_adolescent/documents/9241593180/en/. [Accessed 30 March 2021]
- The United Nations Children's Fund (UNICEF)/World Health Organization (WHO). Clinical management of acute diarrhea. WHO/UNICEF joint statement. The United Nations Children's

- Fund/World Health Organization, 2004. http://www.int.maternal_child_adolescent/documents/who_fch_cah_04_7/en/. [Accessed 30 March 2021]
- Lazzerini M. Effect of zinc supplementation on child mortality. *Lancet* (London, England). 2007;370 (9594):1194-5.
- Mayo-Wilson E, Junior JA, Imdad A, Dean S, Chan XH, Chan ES, et al. Zinc supplementation for preventing mortality, morbidity, and growth failure in children aged 6 months to 12 years of age. *Cochrane Database of Systematic Reviews*. 2014 (5).
- Mahalanabis D, Marson M. Development of an improved formulation of oral rehydration salt (ORS) with antidiarrhoeal and nutritional prospective: a super ORS. In: Holmgrane J, Lindberg A, Mollby R (eds), *Development of Vaccine and drug against diarrhoea*. Studentlitteratur, Sweden, 1986; 240-56.
- Synder JD, Marson MH. Magnitude of global problems of acute diarrhoeal diseases- a review of active surveillances data. *Bull. WHO* 1982; 60: 605-13.
- Sachdev HPS, Mittal NK, Mittal SK, et al. a controlled trial on utility of oral zinc supplementation in acute dehydrating diarrhea in infants. *J Pediatr Gastroenterol Nutr* 1988; 7: 877-81.
- Behran RH, Tomkin AM, Roy SK. Zinc supplementation during diarrhea, a fortification against malnutrition? *Lancet* 1990; 336: 422-43.
- Roy SK, Behran RH, Haider R et al. impact of zinc supplementation on intestinal permeability in Bangladeshi children with acute and persistent diarrhoea syndrome. *J Pediatr Gastroenterol Nutr*. 1992; 15: 289-96.
- World Health Organization. Programme for control diarrhoeal diseases: a manual for treatment of diarrhea. WHO/CDD/SER/80.2 Rev 2. WHO. Geneva, 1990.
- Al-Sonboli NA, Gurgel RQ, Shenkin A, Hart CA, Cuevas LE. Zinc supplementation in Brazilian children with acute diarrhoea. *Annals of tropical paediatrics*. 2003 Mar 1;23(1):3-8.
- Dutta P, Datta A, Niyogi SK, Dutta S, Manna B, Basak M, Mahapatra TS, Bhattacharaya SK. Impact of zinc supplementation in malnourished children with acute watery diarrhoea. *Journal of Tropical Pediatrics*. 2000 Oct 1;46(5):259-63.
- Faruque ASG, Mabalabis D, Haque SS, Fuchs GJ, Habte D. Double-blind, randomized controlled trial of zinc or vitamin A supplementation in young children with acute diarrhoea. *Acta Paediatr*. 1999;88: 154-60.
- Sachdev HPS, Mittal SK, Yadav HS. A controlled trial on utility of oral zinc supplementation in acute dehydrating diarrhoea in infants. *J Pediatr Gastroenterol Nutr*. 1988; 7:877-81.
- Sazawal S, Black RE, Bhan MK, Bhandari N, Sinha A, Jalla S. Zinc supplementation in young children with acute diarrhoea in India. *N Engl J Med*. 1995; 333:839-44.
- Effect of zinc supplementation on clinical course of acute diarrhoea. Report of a Meeting, New Delhi, 7-8May, 2001. *J Health Popul Nutr*. 2001; 19:338-46.