Zinc and child health
Roy S K, Ireen S

Zinc deficiency is a common public health problem, with nearly half of the world's population at risk of inadequate zinc intake. The malnourished children have been identified as zinc deficient in Bangladesh and other developing countries. Zinc deficiency is associated with impaired immunity, growth retardation, and hypoguesia and causes diarrhoea in experimental animals. Morphological studies have shown that zinc supplementation improves the structure of the intestinal mucosa in zinc deficient animals as well as in the patients with acrodermatitis enteropathica. It has been estimated that diarrhoeal diseases cause about 3 million deaths of children in the developing countries each year and causes malnutrition in surviving children.

High amount of zinc such as 270 µg/kg/day has been reported to be lost through stool during persistent diarrhoea in Bangladeshi children. In Bangladesh the overall diarrhoeal incidence rate is 3-4 episodes per child per year and about 9% of the acute diarrhoeal episodes become persistent in this country. A significant proportion of children who suffer from diarrhoea are malnourished which may further contribute to increased severity and duration of diarrhoea in such children. Studies conducted in Bangladesh have shown that supplementation of 20 mg elemental zinc/day for two weeks during acute and persistent diarrhoea reduced diarrhoeal duration (14%, P=NS and 33%, P<0.03 respectively) and stool output in malnourished children. Zinc supplementation significantly reduced diarrhoeal duration (22%, P<0.04) and median stool weight (279 vs. 326 g/kg, P<0.04) in children with a lower serum zinc (<14 µmol/l) with acute diarrhoea. Zinc supplemented children with acute diarrhoea gained weight (P=0.03) and children with persistent diarrhoea maintained their body weight and serum zinc level whereas there was a reduction in both body weight (P<0.05) and serum zinc level (P<0.03) in the un-supplemented group during hospitalization. Studies from India showed that supplementation of 40 mg elemental zinc/kg/day resulted in significantly shorter duration of diarrhoea (P<0.0001), zinc supplemented children passed less liquid stool (P<0.0001), consumed less ORS (P<0.0001) and other liquids (P<0.0001) compared to the placebo group. Roy et al. have found that supplementation of 30 mg elemental zinc/day for 7 days in children with cholera, significantly reduced duration of recovery (14%, P=0.03) and stool output (26%, P=0.03) and body weight of zinc supplemented children increased (P=0.05) significantly than the control group.

Studies have also shown that zinc supplementation has residual benefits beyond the acute stage of diarrhoea. Zinc supplemented malnourished Bangladeshi children (W/A <70% of NCHS standard) with acute and persistent diarrhoea had 30% (P<0.05) and 24% (P<0.03) greater length gain during 8 weeks and 3 months of follow up respectively after diarrhoea. Zinc supplemented children with persistent diarrhoea also experienced fewer diarrhoeal attack (P<0.05). Studies in Bangladesh and elsewhere have shown that zinc supplementation reduced the incidence of diarrhoea and acute lower respiratory tract infection. Hospitalization of children with diarrhoea was also lower in the zinc supplementation group. The non-injury death rate was 51% lower in the zinc supplementation group. Death in children with persistent diarrhoea was one fifth in zinc group compared to controls. A randomized trial from India found a large reduction in overall mortality in 1.

**Dr. S. K. Roy**, MBBS, MSc Nut (UK), Dip-in- Biotech (UNU), PhD (UK), Scientist, Clinical Sciences Division, ICDDR,B.

2. **S. Ireen**, Research Assistant, Clinical Sciences Division, ICDDR,B.

The ORION Medical Journal 2003 Jan;14:34
infants who were small for gestational age and supplemented with zinc from 1 to 3 years of age.

Results of studies suggest that zinc supplementation may provide significant clinical, nutritional and immunological benefits to children during and after the episodes of acute and persistent diarrhoea and cholera. The mechanism through which zinc may influence diarrhoeal episodes or intestinal function include improved electrolyte transport, early epithelial regeneration, rapid synthesis of digestive enzymes, improving intestinal permeability, reduction in osmotic diarrhoea and improvement in immunity limiting bacterial overgrowth and early clearance of intestinal pathogens. Moreover zinc used as a treatment for diarrhoea reduces mortality in children. The impact of zinc on mortality and morbidity can be achieved in a realistic large-scale public health program. Strategies for the alleviation of zinc deficiency include dietary diversification or modification, supplementation, along with general health program to reduce infections that contribute to poor absorption or excess loss of zinc.

References
Editorial