

Oral rehydration solution safely used in breast-fed children without additional water

S. K. Roy, G. H. Rabbani* and R. E. Black†

International Centre for Diarrhoeal Disease Research, Bangladesh, Dacca-2, Bangladesh

Summary

Sixty-four children of age 3 months to 2 years were treated for diarrhoea in a rural treatment centre with oral rehydration solution (90 mmol/l Na⁺); plain water was not supplied during rehydration. All children continued breast-feeding during the therapy. Serum sodium levels after 24 h of intake indicated that 61 children had serum sodium level below 148 mmol/l and three were above (range 150–151). None of the children developed clinical signs or symptoms of hypernatremia. The use of additional water may not be necessary during rehydration therapy of breast-fed children.

Introduction

Since the introduction of oral rehydration therapy in the early 1970s as an effective form of fluid replacement in infantile diarrhoea, there has been debate about the optimum sodium concentration in the solution. Presently, an oral rehydration solution (ORS) containing 90 mmol/l of sodium has been recommended by the World Health Organization (World Health Organization 1980); however, some are still concerned that severe hypernatraemia will occur if the solution is used in infants who have diarrhoea with a lower concentration of sodium (Finberg 1980). To minimize the potential risk of hypernatraemia, the use of ORS with provision of additional water has been suggested and later used with success in treatment centre studies that alternately provided ORS and water

in a 2:1 ratio (Nalin *et al.* 1978, Pizarro *et al.* 1980, Clements *et al.* 1981). It is currently recommended that after the first 4 h of rehydration with ORS, a non-breast-fed child should receive a volume of plain water equal to half the volume of ORS already taken by the infant and he/she should continue to receive water during maintenance therapy (World Health Organization 1980, Finberg *et al.* 1982).

It has been noted that breast-fed children could be given ORS with no additional water during therapy of diarrhoea without developing clinical complications indicative of hypernatraemia (Taylor *et al.* 1980, Black *et al.* 1981). Because of this successful experience in breast-fed children, it has been recommended that breast-feeding should be started after the first 4 h of rehydration with ORS and continued thereafter as the infant desires (World Health Organization 1980). To evaluate these recommendations we studied breast-fed young children who received ORS without supplemental water for rehydration and maintenance therapy of diarrhoeal dehydration.

Materials and methods

The study was conducted in the Matlab rural diarrhoeal treatment centre of the International Centre for Diarrhoeal Disease Research, Bangladesh. Sixty-four children, aged 3 months to 2 years, who reported to the treatment centre with a history of watery diarrhoea of less than a week's duration, mild to moderate dehydration (according to WHO guidelines) and no prior treatment were selected. Informed consent was obtained from the legal guardian of the children before admitting them into the study. Children were weighed on admission.

*Current address: Center for Vaccine Development, University of Maryland, USA.

†Correspondence: R. E. Black, Center for Vaccine Development, University of Maryland School of Medicine, 10 South Pine Street, Baltimore, Maryland 21201, USA.

Table 1. Clinical characteristics of children on admission, after 24 h of therapy and after recovery according to aetiology of diarrhoea

Aetiology of diarrhoea	Number of children	Age (months)	Pre-admission duration of diarrhoea (days)	After 24 h of Therapy			
				Rate of stool loss (ml/kg/day)	Rate of ORS intake (ml/kg/day)	Serum sodium level (mmol/l)	Weight gain at recovery (%)
Unknown	40	18±8	2.0±1.5	80±28	156±76	139±5	4.0±1.2
Rotavirus	15	9±6	3.0±1.0	78±29	150±74	140±4	4.3±0.3
<i>Shigella</i>	6	18±4	3.0±2.0	73±31	135±31	135±5	5.2±1.3
<i>Vibrio cholerae</i>	3	14±3	1.5±0.5	100±18	225±15	141±4	6.8±1.8

Values are mean ± SD.

The children were rehydrated and maintained by ORS (composition in mmol/l: Na⁺ 90, K⁺ 20, Cl⁻ 80, HCO⁻ 30, glucose 111) only. The attending mothers were instructed to give ORS *ad libitum* in frequent small feeds; water was not provided to the children. Breast-feeding was encouraged *after* the first 4-h rehydration period. Patients were treated on cholera cots to determine accurately the stool volume. Eight-hourly intake and output of fluids, body weight and clinical signs were recorded. Venous blood samples were obtained after 24 h of ORS intake and serum sodiums were done by flame photometer. Success of rehydration was determined by return of urine flow, restoration of moist mucous membranes, normal skin turgor, normal heart rate and volume of pulse and blood pressure and by weight gain. Rectal swabs were collected on admission and tested for *Vibrio cholerae*, *Shigella*, and *Salmonella* as previously reported (Black *et al.* 1980). Rotavirus was detected using the ELISA technique (Yolken *et al.* 1977).

Results

The mean gain of body weight after rehydration was 6.2%. There was no substantial difference in the illness associated with different aetiological agents, although children with rotavirus diarrhoea were younger than the other groups of children (Table 1). All children were successfully rehydrated with the ORS and breast milk regimen.

After 2 hours of ad-libitum ORS and breast milk intake, 61 children had serum sodium levels in the range of 128–148 mmol/l and three children had marginal hypernatraemia with sodium levels of 150, 151, and 151 mmol/l, respectively (Table 2). All three had had mild dehydration on admission. The two children with sodium levels of 151 who had diarrhoea of unknown aetiology had greater than average purging rates ($P < 0.01$) for children with this type of diarrhoea. None of these children had clinical manifestations of hypernatraemia.

Discussion

This study indicates that ORS containing 90 mmol/l of sodium can be used safely without additional water for rehydration and maintenance of breast-feeding children with dehydrating diarrhoeas of different aetiologies. After 24 h of ORS intake only 5% of children showed marginal hypernatraemia and these had no clinical manifestations.

It is an almost universal practice of mothers in this region to continue breast-feeding up to 30 months after childbirth and studies of other mothers and children from this area indicate that 12–17-month-old children receive nearly 600 ml of breast milk per day; younger children receive even more (Brown *et al.* 1982). This was approximately half of the treated children's daily intake of ORS. It could be expected that breast milk would be equivalent to water for physiologic needs because of its low sodium content (7–10 mmol/l).

Table 2. Characteristics of 3 children with marginal hypernatraemia (serum Na \geq 150 mmol/l)

Aetiology	Age (months)	Serum sodium level at 24 h (mmol/l)	Rate of ORS intake at 24 h (ml/kg/day)	Rate of stool loss at 24 h (ml/kg/day)
Rotavirus	9	150	111	62
Unknown	12	151	205	176
Unknown	17	151	248	135

The use of ORS with plain water in a 2:1 ratio may complicate the instructions for provision of therapy, especially when it is given by rural mothers in the home. It appears from our study that this instruction is unnecessary for children who are receiving substantial volumes of breast milk. The use of ORS therapy must be modified in different geographical or cultural setting, depending on the specific feeding practices present.

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