

# FREQUENCY OF HYPONATREMIA IN CHILDREN WITH ACUTE DIARRHEA TAKING LOW SMOLAR ORAL REHYDRATION SOLUTION

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**ABSTRACT... Introduction:** Acute diarrhea is defined as passage of three or more stools in a day, of consistency softer than usual for the child, or one watery stool. Acute diarrhea is the major cause of morbidity and mortality in developing countries. It accounts for approximately 25% of total admissions in children ward and causes mortality of 5-10% in community. As dehydration is the main complication of diarrhea, treatment focuses upon rehydration through fluid replacement. Oral Rehydration solution (ORS) is the recommended treatment in children with acute diarrhea and some dehydration. Now WHO has recommended Low Osmolarity ORS which contains less sodium and glucose than standard ORS. One of the side effect of use of ORS solution with reduced sodium level is the development of hyponatremia ( i.e. serum sodium level less than 130 meq/L) in some of children with acute diarrhea and results in adverse clinical events. **Objective:** To determine the frequency of hyponatremia in children taking low osmolarity ORS for management of acute diarrhea with some dehydration. **Study design:** Descriptive case series. **Place and Duration of Study:** Study was conducted in Department of Pediatrics, Children ward-2 Bahawal Victoria Hospital Bahawal Pur and Department of Pathology Quaid-e-Azam medical college Bahawal Pur from 7th August 2010 to 22nd September 2010. **Subjects and methods:** Total 32 children with age between 3 months to 60 months with acute diarrhoea and some dehydration with normal initial serum sodium were included. An informed consent was taken from the parents to include their children in the study. Proforma was filled at the time of admission and after 4 hours. Blood sample was taken to measure serum sodium level. Criteria of hyponatremia was serum sodium level below 130 meq/l after giving low osmolarity ORS at a dose of 75 ml/kg to drink. **Results:** A total of 32 children with acute diarrhea were included in study with age ranging from 3 months to 60 months. Male to female ratio was 1.1:1. Hyponatremia was seen in 2 (6.3%) of patients. **Conclusions:** The risk of hyponatremia in patients treated with the low osmolarity ORS was minimal.

**Key words:** Acute diarrhea, low osmolarity O.R.S., hyponatremia.

## INTRODUCTION

Acute diarrhea is defined as the passage of three or more stools per day with consistency softer than usual for a child or one watery stool per day. The normal consistency and frequency of bowel movements varies with a child's age and diet, and the definition of diarrhea varies accordingly<sup>1</sup>. Diarrhea is a leading cause of illness and death among children in developing countries, where an estimated 1.3 thousand million episodes and 3.2 million deaths occur in those under five years of age. About 80% of the deaths due to diarrhea occur in the first 2 years of life<sup>2</sup>.

World Health Organization (WHO) estimated that worldwide one child dies of diarrhea every 6 seconds<sup>3</sup>. The high incidence of diarrhoeal disorder in developing countries is related to environmental contamination and increased exposure to enteropathogens<sup>4</sup>. The main complication of diarrhoea is dehydration. Dehydration must be evaluated rapidly and corrected in 4-6 hours

according to degree of dehydration and estimated daily requirements<sup>5</sup>.

For more than two decades, WHO has recommended a standard formulation of glucose based ORS with 90 mmol/l of sodium and 111 mmol/l of glucose and a total osmolarity of 311 mmol/l. It remains unclear, however, if this is the optimum sodium concentration<sup>6</sup>. In recent years, low osmolarity oral rehydration solution (ORS) has been recommended for rehydration<sup>7</sup>.

Laboratory work suggests that lower concentrations of sodium and glucose enhance solute induced water absorption<sup>8</sup>. The Journal of the American Medical Association in 2004 carried two opinion regarding use of low osmolarity ORS, one defending the change in ORS to low osmolarity solution, and the other showing the potential problem of hyponatremia that may occur with recommending a low osmolarity solution for use in all forms of diarrhea<sup>9,10</sup>.

The rationale of this study is to provide data regarding frequency of hyponatremia in children who are prescribed low osmolarity ORS, as recommended by WHO. To my knowledge no local study has yet been done on this subject and this study may prove beneficial and helpful in assessing the safety of low osmolarity ORS.

**OBJECTIVE**

To find out the frequency of hyponatremia in children with acute diarrhea taking Low osmolarity ORS.

**MATERIALS AND METHODS**

This descriptive case series study was done at the Department of Paediatric medicine and the pathology department of Bahawal Victoria Hospital and Quaid-e-Azam Medical college Bahawalpur from 7th August to 30 September 2010. Thirty two children with acute diarrhoea in age range of 3-60 months having some dehydration with normal initial serum sodium were studied with non-probability purposive sampling technique while children having severe dehydration requiring intravenous fluids, patients with associated systemic illness e.g. Pneumonia, persistent diarrhoea with duration more than 14 days, patients who have already started using ORS before reporting to us were excluded from the study.

An informed consent was taken from the parents to include their children in the study. The following information was recorded in a pre-designed Proforma: bio data of patient was noted. Then from each child's caretaker history was taken regarding duration of diarrhoea in days. Children were examined to determine their state of hydration and to rule out other systemic illness on the basis of history and examination. Patients were given low osmolarity ORS in a dose of 75ml/kg to drink. After 4 hours blood sample was taken by duty doctor and transported to laboratory to measure serum sodium level. The following confounding factors were noted in data collection.

1. Age
2. Duration of diarrhoea

Information about these factors was collected in data collection and stratification for these factors was done in data analysis. All the data was noted down in a specially

designed proforma. Data analysis was done by using Statistical Package for Social Sciences version 11. Mean and standard deviations were calculated for numerical data i.e. age and duration of diarrhea. Frequencies were analysed for categorical data i.e. gender and hyponatremia. During analysis, age was stratified as 3 to 24 months and 24 to 60 months. Duration of diarrhoea was stratified to less than three days and more than three days. Serum sodium level after rehydration was analysed. Frequency of hyponatremia (serum sodium less than 130meq/L) in total sample was noted.

**RESULTS**

There were total (n) 32 patients in my study. Mean age was 16.37 ± 12.93 months ranging from 3 months to 60 months. Of these 28 patients(87.5%) were from range 3 months to 24 months and 4 patients(12.5%) were from range 25 months to 60 months (Figure 8). Of these 32 patients male were 17(53.1%) and female were 15(46.9%) with Male: Female ratio 1.1:1 (Figure 9). Hyponatremia was seen in 2 (6.2%) out of 32 patient. Rest 30(93.8%) patients do not show hyponatremia (Figure 10). Mean duration of diarrhea was 3.1±1.46 days out of which minimum was 1 day and maximum was of 6 days duration.18 patient(56.25%) were having diarrhea less than 3 days duration and 14 patients(43.75%) were having diarrhea more than 3 days.

Table-I. Distribution of cases by age (n=32)		
Age (months)	No.	%age
03-24	28	87.5
25-60	04	12.5
Total	32	100
Mean & SD	16.37±12.93	

Table-II. Distribution of cases by gender (n=32)		
Gender	No.	%age
Male	17	53.1
Female	15	46.9
Total	32	100

Table-III. Frequency of hyponatremia (n=32)

Hyponatremia	No.	%age
Present	02	6.2
Not present	30	93.8
Total	32	100

## DISCUSSION

For more than 25 Years WHO & UNICEF have recommended single formulation of glucose based ORS to prevent or treat dehydration from diarrhea irrespective of cause or age group affected. This product has proven effective & contributed substantially to the dramatic global reduction in mortality from diarrhea during the period.

Based on more than two decades of research & recommendations by an expert group, WHO & UNICEF received the effectiveness of a new ORS formula with reduced concentration of glucose & salts. Reduced osmolarity rehydration solution was associated with reduced need for unscheduled intravenous infusions, lower stool volume, and less vomiting compared with standard WHO rehydration solution<sup>11</sup>. Because of the improved effectiveness of this new ORS solution, WHO & UNICEF recommended that countries use and manufacture this new formulation in place of old one. While recommending this new ORS it is desirable to monitor the risk of hyponatremia in patient with acute diarrhea.

This study was designed to see the frequency of hyponatremia in children with acute diarrhea taking low Osmolarity ORS. There was no significant hyponatremia seen in our study (only 2 of patient out of 32). In a multicentre double blind clinical trial to evaluate the efficacy & safety of reduced osmolarity ORS in children with acute watery diarrhea, there was no difference in the incidence of hyponatremia between the 2 treatment groups (11% in reduced osmolarity ORS vs 9% in the WHO ORS solution group<sup>11</sup>. Similarly work done by Hahn S, Kin Y, Garner P on "Reduced osmolarity ORS for treating dehydration caused by acute diarrhea children" (Review) published in the COCHRANE COLLABORATION showed six trials reported for the

presence of hyponatremia three of these six trials did not observe hyponatremia in any participant. The meta analysis of three trials during which participants developed hyponatremia showed no significant difference between the groups (odd ratio 1.45, 95% C.I 0.93 to 2.26)<sup>12</sup>. Another study done at Dhaka hospital & Matlab hospital of International Centre for Diarrhoeal Disease Research Bangladesh i.e. "Symptomatic Hyponatremia during Treatment of Dehydrating Diarrheal Disease with Reduced Osmolarity ORS " Showed that overall incident of symptomatic hyponatremia was 0.05% at Dhaka hospital and 0.03% at Matlab Hospital. All patients were children less than 36 months of age who develop hyponatremia<sup>13</sup>.

There are also some limitations in our study. We did not compare the serum sodium level between patients taking standard WHO ORS & low osmolarity ORS. Another limitation of our study was that we selected patients with acute diarrhea irrespective of its etiology. A meta-analysis of studies of reduced osmolarity ORS in patients with cholera concluded that its use is associated with biochemical hyponatremia when compared with standard ORS, although there were similar benefits in terms of outcomes; and that under wider practice conditions, where monitoring is likely to be difficult, caution is warranted in the use of reduced osmolarity ORS in cholera or other severe diarrhea<sup>14</sup>. Therefore it may be useful to have one solution (with low sodium and low osmolarity) for use in children with diarrhea, while another solution (the old WHO formula) may be more appropriate for adults with cholera.

We also did not include state of nutrition in children as in malnourished patient with multiple diarrheal episodes, use of low osmolarity ORS in these patient is relatively contraindicated<sup>15</sup> but the new recommendations do not address this point.

## CONCLUSIONS

We conclude that the use of low osmolarity ORS in acute diarrhea in children do not cause significant hyponatremia. So low osmolarity ORS can be prescribed safely to children. However like any good study, it has raised further questions on the issue, which should be addressed by longer trials including comparison of

efficacy of low osmolarity ORS with WHO ORS, nutritional status of children, etiology of diarrhea, interaction with other drugs and possible other adverse effects by use of low osmolarity ORS in diarrhea of longer duration.

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