Sagodana Based Verses Rice Based Oral Rehydration Solution in the Management of Acute Diarrhoea in Pakistani Children

Pages with reference to book, From 16 To 19

Siddiqa Ibrahim,Zeenat Isani (National Institute of Child Health, Karachi.)

Abstract

This study was carried out to compare the efficacy of a cereal based ORS (prepared with 50 G of sagodana (cereal), 3.5 GIL sodium chloride, 1.5 GIL potassium chloride, 2.9 GIL trisodiu.m citrate) with rice based oral rehydration solution (using same amounts of rice and electrolytes) for treatment of diarrhoea, One hundred and twelve children aged 3 months to 2 yeais with watery diarrhoea of less than 5 days duration with mild to moderate dehydration and no sepsis, were included in the study. The amount of ORS intake, stool volume and frequency were similar in both groups. Clinical success was seen in 79% of rice ORS group and 81% in sagodana group. Both can be used as a cereal based ORS in the management of acute diarrhoea in communities where it is culturally accepted and used as a weaning diet (JPMA 47:16, 1997).

Introduction

Since orally administered glucose and electrolyte solution reduces mortality associated with diarrhoea, use of this solution is recommended internationally for the treatment of diarrhoeal dehydration in adults and children[1,2]. The standard World Health Organization (WHO) oral rehydration solution (ORS), though effective in' the treatment of' dehydration. does not reduce stool volume. stool frequency. or duration of diarrhoea[3-5]. Consequently, mothers often wish to use anti-diarrhoeal drugs to stop the diarrhoea. Various cereals have also beenused as abase for oral rehydration solutions[6-12] Rice has been most extensively studied. Cereal-based solution provides some nutrition[8-13]. Clinical trials comparing rice based ORS with standard ORS show that stool output is about 50% lower and vomiting is reduced by 60% when rice based ORS was used[11-14]. Cereal-based therapy may be locally accessible and cheap. In Pakistan, few studies have been conducted using local cereals such as, rice, wheat, a mixture of rice and a lentil called moong dat[10,15,16] which have shown encouraging results, Sagodana is a starch cereal obtained from the tropical palm tree, Metroloxon sago. The stem stores large amounts of starch. The starch pith is collected and ground. then mixed with water, strained through a sieve and dried. The paste made from dried pith is strained again to produce granules, Dried granules are known as 'pearl sago'.

Pearl sago is widely used in Pakistan, as a weaning food and for treatment of diarrhoea because it is thought to be an appropriate, light diet with a cooling effect[17]. This study was conducted to evaluate and compare the efficacy of sago based ORS with rice based ORS in the treatment of acute watery diarrhoea in children.

Patients and Methods

This study was conducted at the National Institute of Child Health (NICH), Karachi, between October, 1992 and August, 1993. NICH is a 250 beded teaching hospital with a large catchment area for patients predominantly from low socioeconomic groups. During the summer season when diarrhoea prevalence is high, about 1500- 2000 patients are seen every month. The study protocol was reviewed and

approved by the ethical committee of NICH and the Harvard School of Public Health, Boston, Massachusetts, before the study began. Informed written consent was obtained from the parents orguardianofeachchildpriorto inclusion inthe study. All children were admitted. No family refused enrollment in the study initially, but during the course of study some parents refused to continue participation. Inclusion criteria were: age 3 months 102 years, a history of acute watery diarrhoea of less than 5 days duration, mild to moderate dehydration, according to WHO criteria and prior initiation of weaning on solids. Dehydration was classified as mild, moderate and severe. Mild dehydration - on clinical assessment was a weight loss due to diarrhoea upto 5% of body weight. Moderate dehydration when weight loss was 6-9% and severe dehydrationwhenweightlosswas 10 % orabove, patientswith severe malnutrition (grade HI by Gomez classification[18] and those with clinical or laboratory evidence of intercurrent infections, for example, pneumonia, sepsis, measles or meningitis were excluded from the study. Also patients with dysentery were not included.

Clinical and laboratory evidence of complications was noted on admission and throughout the study period. Those developing systemic illness during the period of observation were dropped from the study and shifted to the general ward and treated accordingly. No patient received any antibiotic or any otherthempy duringthe study period. Bronchopneumonia was diagnosed according to acute respirators infection guidelines, i.e. tachypnoea and fever, intercostal recession or danger signs[19]. Sepsis when temperature more than 100°F, sick child, presence of sclercma and age related leucocytosis with high neutrophil count. Encephalitis/meningitis diagnosed on presence of fever, change in sensorium, convulsions, bulging anterior fontanelle and or neck rigidity, supplemented by lumbarpuncture findings. Dysentery- blood in non-watery stools and body temperature more than 100°F. Clinically severely dehydrated cases were included only after they were initially rehydrated with intravenous ringer lactate solution.

Patients were randomly allocated into two groups before the study by using permuted block randomization technique. Group A received rice ORS, containing rice powder (50 g), sodium chloride (3.5 g/l), potassium chloride (1.5 gil) and trisodium citrate (2.9 gil). Group B received sagodana ORS containing sagodana grain (50 g) and the electrolyte mix as in the rice ORS. For both groups, the cereal based ORS consisted of pm-prepared separate packets of the cereal and the salts. The cereal was boiled and cooled and then electrolytes were added. This study could not be blinded as the sagodana and rice ORS have different appearance. The observers but not the patients knew which solution they were using.

Dinitial rehydration was carried out over a period of four to six hours by using the allocated ORS. The amount of ORS was calculated on the basis of clinical judgement of weight deficit due to dehydration plus ongoing losses. Those desiring more fluids, however, were allowed to drink as much as they wanted. In the maintenance phase, fluid was replaced according to the volume lost in stools. All the patients were observed continuously in the hospital by team of research medical staff. Every hour careful measurements were recorded by physicians on observation sheets fora total period of72 hours. The staff was supervised daily by the investigator (SI). Period of 72 hours was considered enough for observation and evaluation of a patient with acute diarrhoea of less than 5 days duration. The patients also did not wish to stay for a longer period in hospital for observation alone when no injections, I/V fluids were given and hospitalization was not required. Acute watery diarrhoea usually improves within a week, The observations included body weight, temperature. ORS intake, stool types, stool weight and frequency. unne output, vomitus if any and feeding details. The diet offered to the two groups was identical and primarily consisted of wheat cereal and banana in addition to breast milk in breast fed children and fresh or formula milk in others. The ORS intake was calculated by the difference in the amount offered and that left in the container. Adhesive urine bags were used to prevent mixing with stool. An electronic digital scale (Tanita - Japan) with accuracy of 2 gm was used for weighing the diaper. The stool weight was calculated by the difference between the dry and wet diaper weight

measurements. Stool appearance was categorized as watery. semi-soft, soft, mucoid or bloody. A complete blood count, blood urea, serum electrolytes and semrn specific gravity were obtained on admission, 24 hours and 72 hours after admission. Daily stool specimens were also examined microscopically for white blood cells, red blood cells, ova and parasites. No stool cultures were done as period of observation was only 72 hours.

Successful outcome was defined as rehydration (euvolumic) in the first six hours and maintenance of rehydration throughout 72 hours of observation. Clinical failures were defined as persistence of dehydration due to excessive losses that could not be corrected by ORS intake or appearance of severe dehydration requiring intravenous fluid therapy during the period of observation. ORS acceptability was defined as ORS intake equal to or more than 50% of the amount calculated for the clinical severity of dehydration for initial correction or dehy dration and volume for volume of losses for the maintenance period.

Results

One hundred and twelve patients were included in the study. Fifty-seven patients received rice ORS and fifty-live sagodana ORS. There was no significant statistical difference on admission between the two groups for mean age. admission weight. duration and severity of diarrhoea, type of therapy received before admission, feeding history and nutritional status (Table I).

Table I. Admission characteristics of patients treated with rice and sagodana ORS.

	Rice ORS (n=57)	Sagodana (n=55)
Age (months)*	9.9±4.2	10.8±4.9
Sex (male/female)+	32/25	45/10
Weight on admission (kg)*	7.1±1.3	7.2±1.3
Duration of diarrhoea (days)*	2.6±1.5	2.6±1.5
No. of stools in last 24 hours*	16.0±7.7	14.4±6.1
No. of vomiting in last 24 hours*	4.7±5.3	3.7±3.4
Stool size (small/large)+	17/40	14/41
Serum specific gravity*	1.025±0.003	1.025±0.003
Therapy received #		
before admission		
ORS alone	27 (47.4%)	21 (38.2%)
ORS drugs	27 (47.4%)	24 (43.6%)
Drugs	1 (1.8%)	5 (9.1%)
None	2 (3.5%)	5 (9.1%0
Feeding history #		
Breastfeed+Weaning	23 (40.4%)	23 (41.8%)
Bottlefeed+Weaning	25 (43.8%)	20 (36.4%)
Breast+Bottle+Weaning	9 (15.8%)	12 (21.8%)
Nutritional status#$		
Normal	31 (54.4%)	31 (56.4%)
Grade I	15 (26.3%)	15 (27.3%)
Grade II	11 (9.3%)	9 (16.4%)

* Mean±Standard deviation
Number of cases
Number of cases with parenthesis showing percentages.
#$ Gomez classification.
Small stools upto 60ml.
Large stools more than 60 ml.

Eighty -seven (78%) cases showed improvement and successfully completed the study. Ten (9%) were labelled as clinical failures. Nine (8.O%) patients were dropped from the study as they developed unrelated complications (dysentery 3, bronchopneumonia 3, encephalitis 2 and septicaemia 1). Six (5%) patients left against medical advice either due to domestic problems, or because no specific

therapy was being given (Table II).

Table II. Clinical outcome.

	Total	Rice ORS	Sagodana ORS
Number of patients included in study	112	57	52
Completed period of 72 hours	97	51	46
Successful	87	45	42
Clinical failures	10	6	4
Dropped*	9	4	5
LAMA **	6	2	4

* Patients who developed unrelated complications e.g. dysentery, encephalitis, pneumonia, etc.

** LAMA: Left against medical advice before completion of 72 hours of observation.

The success rate was 79% in the rice and 81% inthe sagodana ORS groups. Comparison of ORS intake, stool output, stool frequency and weight gain for patients who completed study period of 72 hours is shown in Table III.

Table III. Comparison of various characteristics after treatment with rice and sagodana ORS.

	Rice ORS (n=45)	Sagodana ORS (n=42)	P.value
ORS Intake ml/kg/day	Mean±SD	Mean±SD	
0-24 hours	199.1±89.1	164.0±56.2	<0.005
25-48 hours	70.4±73.9	66.8±52.8	n.s.
49-72 hours	31.5±53.4	30.6±43.3	n.s.
Stool output (ml/kg/day)			
0-24 hours	123.4±78.9	94.2±50.2	<0.005
25-48 hours	66.3±62.8	63.6±44.3	n.s.
49-72 hours	43.7±49.3	41.7±36.4	n.s.
Stool frequency (number/day)			
0-24 hours	15.8±8.4	13.4±4.8	n.s.
25-48 hours	8.7±6.9	9.2±4.9	n.s.
49-72 hours	5.7±5.2	5.8±3.9	n.s.
Weight (kg)			
Admission	7.07±1.41	7.45±1.2	n.s.
6 hours	7.22±1.41	7.60±1.30	n.s.
72 hours	7.34±1.42	7.62±1.23	n.s.

Though the ORS intake and stool output was less in the sagodana group for the initial 24 hours, no such difference was noted in the rest of observation period, in stool frequency or in weight gain. Of the ten failures, six were in the rice and four in the sagodana ORS group. No significant difference was noted between the successes and failures. ORS intake and stool output was similar in both groups. Two failures, one from each group, met the criteria of poor acceptability because they received less than 50% of the required amount of ORS and had a high purging rate and developed severe dehydmtion. The remaining eight had persistent vomiting leading to severe dehydration. The vomiting frequency in the failures was high in the first 6 hours and persisted through out 24 hours (Table IV).

Table IV. Outcome variable of patients who successfully completed the study and those with clinical failures.

Admission Characteristics	Successful (n=87)	Failure (n=10)
Treatment group (Rice/Sago)	45/42	8/4
Age (months)*	10.4±4.8	12.3±5.1
Admission Weight (kg)*	7.19±1.3	7.74±1.5
Duration of diarrhoea (day)*	2.65±1.4	2.60±1.7
Not receiving breastfeeding+	34 (39.0%)	7 (70%)
Outcome variables		
ORS Intake (ml/kg/hour)		
0-6 hours*	16.98±6.6	15.5±9.3
0-24 hours*	7.58±3.2	9.0±3.2
Stool output(ml/kg/hour)		
0-6 hours*	6.02±4.5	6.0±5.0
0-24 hours*	4.54±2.8	5.16±3.4
Vomiting frequency (no./day)		
0-6 hours	0.27±0.78	1.3±1.4
0-24 hours	1.1±2.2	4.5±4.0

* Values are means±Standard deviation.
+ Number of cases with parenthesis showing percentage.

Two of these also had high purging rate, thus increasing degree of dehydration and needing intmvenous fluid therapy.

Discussion

In this small study. sagodana ORS was found to be as effective as rice ORS in the management of acute diarrhoea with dehydration. Since food based ORS can be prepared by the mothers, it is accessible and likely to be less costly than conimercially prepared ORS. Compliance with use of food based ORS may be greater than commercial ORS. Food based ORS has been shown to be adequately prepared by the mothers12 and most importantly, it is more effective in managing diarrhoea[8,13,15,19-22]. Rice powder was first used effectively in 1982[20,22]. Other local cereals such as wheat[8,9,16]. peptilose and sorghum have been used to treat diarrhoea effectively.

Sagodana is another household cereal that is widely used across the Indian subcontinent as a weaning food and for treatment of upset stomach in all age groups[17]. This is the first study using sagodana as substrate for oral rehydration solution. Our results are encouraging although we were not able to demonstrate the superiority of this treatment. A comparison of sagodana ORS was made with rice ORS

in this study. There are many previous studies showing rice ORS to be more effective than glucose ORS[11,15,21-23]. In a similar study comparing rice and glucose ORS Molla" showed glucose ORS intake 379.6±17 ml and stool output 203.8±13.9 ml in the first 24 hours and for next 24 hours ORS intake was 316.0±17.6 nil and stool output 235.5±20.3 nil in acute diarrhoea patients. All these figures are higherthan our results of both cereals. There was no significant weight loss despite high purging in some cases. We need to reinforce the belief that maintenance of hydration and continued feeding prevents weight loss during acute diarrhoea. Failures were primarily because of persistent vomiting which was higher in these than in the successful group. Within the limitations of this small study, the efficacy of sagodana ORS was comparable to the rice ORS forthe treatment of acute watery diarrhoea. Thus this locally accessible and culturally acceptable cereal can be promoted alongwith rice ORS for the home management of acute watery diarrhoea.

Acknowledgement

Financial support for this research was provided by the Applied Diarrhoeal Diseases Research Project at Harvard University by means of a co-operative agreement with the U.S. Agency for International Development.

References

1. Cash, R.A., Forrest, J.N., Nalin, D.R. ct al. Rapid correction of acidosis and dehydration of cholera with an oral electrolyte and glucose solution. Lanect, 1970,ii:549-90.
2. Pierce, N.F., Sack, RB., Mitra, R.C. ct al. Replacement orwatcr and electrolyte losses in cholcra by an oral glucose-electrolyte solution. Ann. Intern. Med.. 1970;69:1173-1181.
3. World Health Organization. A manual for the trcatmcnt of diarrhoea, CDD programme; for thc control ofdiarrhoeal diseases. WHO/CDD/SER/80,2 Rev. 2, 1990.
4. Palmer, D.L., Kosier, FT., tslam, A.F.M.R. et al. Comparison of sucrose and glucose in the oral eleetrolyie therapy of cholera and other severe dehydration. N.Engl.J.Med.. 1977;297:1107- 1110.
5. World Health Organization Diarrhoeal Dia. Control Programme. WHO/CKK/Res/86;8:1 986.
6. Molla, AM., Molla, A., Nath, SR. et al. Food based oral rehydration salt solution for acute childhood diarrhoea. Laneet, 1989;ii 429-431.
7. Lepage, P., Hitimana, DO. and Geothem, C V. Food based oral rehydration salt solution for acute childhood diarrhoea.Laneet, 1989;it:868-9.
8. Alam, AN., Sarkar, S.A., Molla, AM. et al. Hydrolysed wheat based oral rehydration solution for acute diarrhoea. Arch. Dis. Child., 1987;62:440-4.
9. Mazumder, A., Tisfaye, 0. and Mazumder, 3. The effectiveness of wheat flour hased oral rehydration fluid in the early treatmentof infantile diarrhoea. Ethiop. Med. 3., 1987;2:59.
10. Murtaza, A., Zulfiqar, I., Khan, SR. et al. The benefits of the very early introduction of powdered rice and dried edible seeds (Dalmoong) in the oral rehydration solution during the treatment of acute infectious diarrhoea of infancy. Acts Paediatr. Seand., 1987;76: 8614.
11. Molla, A.M., Ahmed, SM. and Greengrough, W.B. Rice based oral rehydration solution decrease the stool volume in acute diarrhoea. Bull. WHO, 1985;43:751-756.
12. Rehman, A.S.M.M., Ban. A., Molla, AM. et al. Mothers can prepare and use rice salt oral rehydrauon solution in rural Bangladesh. Laneet, 1985:ii 539-40.
13. Mahalanahis, D. and Patra, EC. In search of a super oral rehydration solution. Can optimum use of organic solute mediated sodium absorption lead to the development of an absorption prompting drug. 3. Diarrhoel. Dis. Res., 1913;1:76-81.
14. Molla, AM., Molla, A. and Sarkar, S.A. The management of acute infectious diarrhoea. Baillier\'s

Clin. Gastroenterol., 1987; 1:337-95.
15 . Islam, A., Molla, AM., Molla, A. et al. Is rice based oral dehydration therapy effective in young infant? Arch. Dis. Child, 1994;71:19-23.
16. Sinner, K. Wheat based ORS for Afghan International Rescue Committee, Peshawar. Pakistan (Poster presentation, Int Symp. On cereal based ORT 12-14 Nov., 89)Pub. in Cereal based oral rehydrationtherapy fordiarrhoea. Ed. byElliott and Katherine, Karachi, Aga Khan Int Child Health Foundation, 1990, p. 91.
17. Awan, M.H. Kitabul Mufradat Khawasul Adwis - Nazriya-e-Jaddid (Urdu). IBook of pharmacology: properties of medicines, modem concepts]. Labore, Shaikh Ghulam Ali and Sons, 1989, p. 279.
18. Reddy, v. Protein eisergy malnutrition, Diseases of children in the subtropics and tropics, Edinburg. Paget Standfield, Edward Arnold, 1991, pp. 335-57. Reproduced from Comes, F 3. Trop. Paediatries, 1956;5:77.
19. Acute respiratory infections in children. Case management in small hospitals in developing countries. A manual for doctors and other senior health workers, Ministry of Health, Government of Pakistan, ARI cell, Islamabad, Children Hospital, PIMS, Islamabad, 1991, pp. 13-18.
20. Molla, AM., Ssrkar, S.A., Hossain, NI. et a!. Rice powder electrolyte solution as oral therapy in diarrhoea due to vibrio eholerse and eseheriehia eoli. Laneet, 1982;i:1317-9.
21. Pairs, F.C., Mahalanabis, 0., Jalan, K.N. ci al. Is oral rice electrolyte solution superior to glucose electrolyte solution in infantile diarrhoea. Arch. Dis. Child., 1982;57:910-23.
22. Pizaro, D., Posada, 0., Sandi, L. et al. Rice based oral electrolyte solution for the management of infantile diarrhoea. N. EngI. J. Med., 1991 324:417-21.