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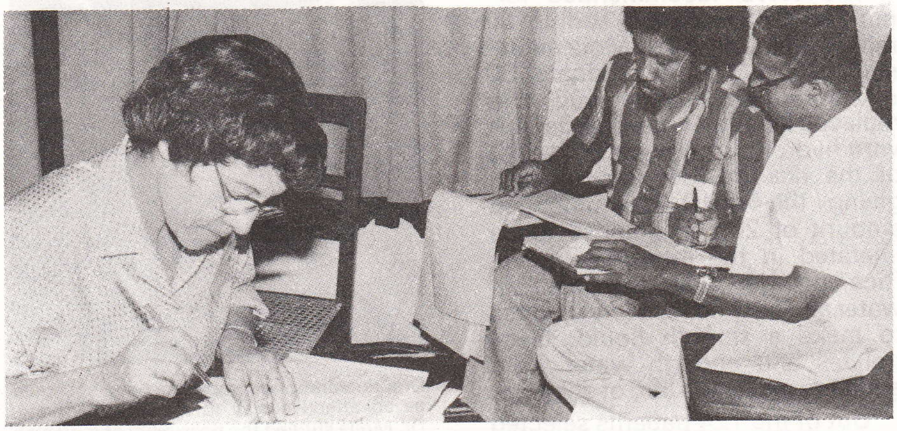
INTER-REGIONAL TRAINING COURSE– CLINICAL ASPECTS HELD

The second Inter-Regional Training Course on Diarrhoeal Diseases: Clinical Aspects was held in Dacca between 12–23 October, 1981. This course was jointly sponsored by the International Centre for Diarrhoeal Disease Research, Bangladesh and the World Health Organization. The main objectives were to improve competence of clinicians in the treatment and management of diarrhoeal diseases and thereby support two elements of National Programme of Diarrhoeal Disease Control:

1. Clinical management of cases of diarrhoea at hospital and community.
2. Training National Health Workers on Oral Rehydration Therapy.

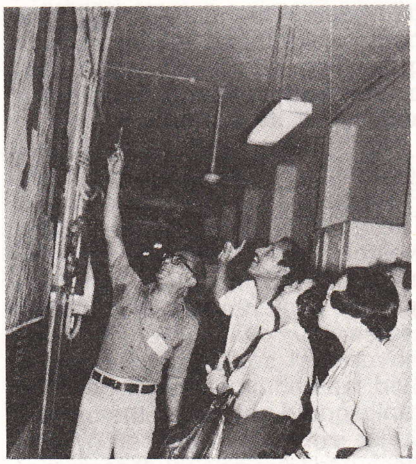
As the practical session of the Workshop, the participants work in the ICDDR,B treatment centre managing cases of diarrhoea with the doctors working here.



Participants from different countries who attend the Workshop are expected to be able to help initiate a national oral rehydration programme. Some participants are seen busy preparing their reports for the Workshop.

Doctors from Philippines, Kuwait, Sri Lanka, Syria, U.S.A., Japan, Yemen Arab Republic, Egypt, Thailand, Papua New Guinea, Kenya and Bangladesh participated in this course. The faculty members were from Geneva, U.S.A., India and Bangladesh. Different aspects of diarrhoeal diseases, such as etiology, pathophysiology, microbiology, biochemistry, epidemiology, clinical aspects and community health care, were discussed. Emphasis was given on Oral Rehydration Solution for the treatment of diarrhoeal diseases.

The participants were oriented in such a way that after going back they can start Diarrhoeal Disease Control Programme in their respective communities. They also visited one of the projects of the National Oral Rehydration Project in Daudkandi, Comilla which is jointly run by the Government of Bangladesh and the Matlab Field Station of ICDDR,B.



Some of the participants looking at the bar-graph representing cholera cases reporting to the treatment centre of the ICDDR,B.

RICE POWDER AS AN ALTERNATIVE OF SUCROSE IN ORAL REHYDRATION SOLUTION

Oral rehydration solution (ORS) has been used successfully in the management of diarrhoea. It has been found that glucose and sodium are coupled in the small intestine and glucose accelerates the absorption of solute and water. Sucrose replacing comparatively expensive glucose in the ORS for all practical purposes has been found to be equally satisfactory.

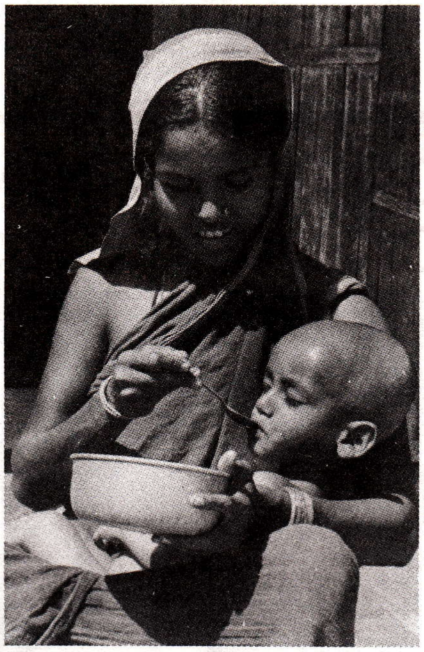
Recently Dr. A. Majid Molla of ICDDR,B carried out a study to examine the efficacy of ORS using a cereal such as rice powder, in place of sugar.

The WHO recommended formula for ORS was used, sodium 90 mMol, chloride 80 mMol, potassium 20 mMol, bicarbonate 30 mMol per litre, sucrose (40g) was replaced by 30g of rice powder. In-vitro hydrolysis converts 80 —86% of the rice powder into glucose giving the WHO recommended amount of 20g of glucose to be liberated in the intestinal lumen. Rice powder was dissolved in water and cooked for a few minutes to make a smooth liquid. Electrolytes and enough water were added to make one litre of solution.

Out of the 124 patients selected for study, 61 were in the control group receiving sucrose based ORS and 63 in the study group receiving rice powder based ORS. There were 38 adult patients and 35 aged less than 10 years with cholera, the rest (51) were adults with ETEC diarrhoea. The average age and body weight and serum specific gravity on admission were comparable in the patients of the study and the control groups.

All intake and output were recorded at 8-hourly intervals. Plain water was given on demand. The rate of purging, change in body weight, serum specific gravity, urine output and post hydrolysis glucose content were examined to assess the efficacy of the oral rehydration solution. Intravenous fluid was administered when oral intake could not match the output. Sugar content of the stool was measured from an aliquot sample of the stool collected during 24 hours and the amount of starch passed unhydrolyzed was recorded.

The findings of the study in the cholera patients are presented in Table I and ETEC patients in Table II



Oral rehydration therapy has been accepted as an effective way to manage diarrhoea. Dr. Molla studied the possibility of replacing the sugar in the ORS with rice-powder, the results are encouraging.

The stool output of the sucrose group was in general higher than the rice powder group. The success rate in the rice powder group was almost same as the sucrose group.

Most of the failures were in cases where the intake could not match the output due to excessive purging and/or vomiting. They were transferred to intravenous therapy. The degree of dehydration and the purging rate were directly related to failure of the ORS to correct dehydration. This was also true for standard ORS (ORS with sugar).

The advantages of using rice powder for the ORS are many. Starch is rapidly hydrolyzed in the intestinal lumen by (salivary and pancreatic) amylase to glucose, maltose, maltitriose and branched dextrine [1]. These carbohydrates are further hydrolyzed to glucose by the maltases of the brush border of the enterocytes [2]. Even one-month old infants can digest and absorb a large amount of starch [3] as most of the active disaccharidases are fully developed at birth [4]. Intraluminal digestion of rice powder used in the ORS liberates monosaccharide glucose slowly, it causes no osmotic diarrhoea, as seen when sucrose or glucose exceeds the recommended

TABLE—I

EFFECT OF TREATMENT BY TWO KINDS OF ORAL SOLUTIONS ON CHOLERA PATIENTS (MEAN ± SEM)

Clinical Measurement	Rice powder group		Sucrose group	
	under 10 yrs N=15	over 10 yrs N=17	under 10 yrs N=20	over 10 yrs N=21
Stool output (mls/kg/24 hrs)	130±30	123.4±36.4	184±23	100±19
Intake of oral fluid (mls/kg/24 hrs)	189±32 *	194±26	326±31 *	223±24
Urine output (mls/kg/24 hrs)	48±15	42±14	20±4	67±13
Serum sp. gr. after 24 hrs. of treatment.	1026±0.0009	1026±0.0011	1026±0.0011	1.025±.0002
Post hydrolysis sugar content (mmol/1)	13.7±3.2	7±0.70	7±0.70	9.34±2.55
% Success	80	85	85	81

* P 0.05

TABLE—II

COMPARISON OF THE *E. COLI* PATIENTS TREATED WITH TWO KINDS OF ORAL SOLUTIONS (MEAN±SEM)

Clinical measurement	Rice powder group N=27	Sucrose group N=27
Age (yrs)	37.8±3.4	32.4±4
Weight (kg)	37.9±1.7	39 ±0.9
Ser. sp. gr.	1.032±0.0006	1.033±0.0009
Stool output (mls/kg/24 hrs)	126.1±13.5	195±24
Change in serum sp. gr. (after 24 hrs)	1.025±0.0005	1.025±0.0003
% success	89	88

amount in ORS. The possibility of increasing fluid loss through osmotic diarrhoea also limits the amount of sugar used in the ORS. As starch in the ORS with rice powder releases the glucose gradually and slowly in the intestine, it negates the possibility of causing an osmotic drag of fluid from the vascular space to gut lumen. This finding opens up the possibility of using a higher concentration of carbohydrate in the ORS, which in addition to providing glucose as the vehicle for the transportation in the absorption of the electrolytes, would also provide some energy.

Rice is an unique starch containing the mixture of two different polyglucoses, amylose and amylopectin. It has 7–10% protein and very little electrolyte. As mentioned earlier, acid hydrolysis converts 80–86% of the rice powder into glucose. There are important amino acids in the protein content of rice: glycine 30–36 mg; lysine 30–34 mg; leucine isoleucine 30–40 mg per 100 gm of rice[5]. Glycine has been known to promote transportation of sodium from the intestinal lumen[6]. (Despite the protein content of rice, rice is not a rich source of protein in the diet and the amount of glycine may not be sufficient to promote the absorption of sodium).

The efficiency of the specific intestinal enzymes to hydrolyze rice powder remains at a satisfactory level during diarrhoea due to *V. cholerae* and *E. coli*[7] post hydrolysis sugar content in stools passed in 24 hours remained similar. Studies on assimilation of nutrients have demonstrated that carbohydrate absorption from a rice meal is least affected during diarrhoea caused by cholera and enterotoxigenic *E. coli;* even in case of invasive organisms like rotavirus or shigella, this remains excellent.

Rice is the staple food of 60% of the world's population. In all the countries of Asia, where 50% of the world's population live, rice is grown and eaten[8]. In addition, rice is also the staple food to millions of people in Africa and Latin America. Most of the developing countries, where diarrhoea is a big problem are located in these areas.

In Bangladesh one of the traditional treatments of diarrhoea is to feed the patient soaked flattened rice *(Chira)* to which salt and sugar has been added.

Rice is readily available even in the poorest homes. It is also a traditionally familiar component of treatment of diarrhoea, hence would pose no cultural barrier in its acceptance. Since there is no adverse effect like osmotic drag in the intestine, it is desirable to place more than 30 grams of rice powder per litre into the ORS. The patient should drink enough fluid to match the output. The higher starch content poses no hazard and actually has a potential benefit of added caloric density.

ANOTHER ALTERNATIVE

In all the areas where rice is eaten as a staple food, it is mostly boiled in water until tender, then the excess water is drained off. Rice is cooked at least twice a day if not thrice. This rice-water, which is generally fed to cattle, may also provide a good source of base for the ORS. 30 samples of rice-water were analyzed and the findings are listed in Table III.

The advantages of using rice water for ORS are many. This costs no additional money and is already boiled so requires no additional effort or fuel. It is boiled for a length of time and is safe from contamination.

(Continued on page 4)

TABLE—III

COMPOSITION (MEAN ± ISD) OF THE RICE WATER AFTER INVITRO HYDROLYSIS

COMPONENTS	MEAN ± ISD	RANGE
GLOCOSE (G/L)	23.5 ± 8	10.4–39
PROTEIN (G/L)	1.3 ± 0.5	0.8–2.4
ELECTROLYTES (MMOL/L)		
Na^+	2.7 ± 1.1	1.2–5.0
K^+	7.3 ± 2.0	4.2–13.6
Cl^-	2.5 ± 1.1	1.2–5.0
WATER CONTENT	97.11 ± 0.92	95.2–98.8

References:

1. Auricchio S, Della Pietra D, Vegnente A. Studies on intestinal digestion of starch in man. II. Intestinal hydrolysis of amylopectin in infants and children. Pediatrics 39:853, 1967.
2. Eggermont E. The hydrolysis of the naturally occuring a–glucosides by the human intestinal mucosa. Europ J Biochem 9: 483, 1969.
3. De Vizia B, Ciccimarra F, De Cicco N, Auricchio S. Digestibility of starches in infants and children J Pediatr 86:50, 1975.
4. Auricchio S, Rubino A, Murset G. Intestinal glycosidase activities in the human embryo, fetus, and newborn. Pediatrics 35:944, 1965.
5. Houston DF, Kohler CO. Nutritional properties of rice. Washington, DC, National Academy of Sciences, 1970.
6. Nalin DR, Cash RA, Rahman M, Yunus M. Effect of glycine and glucose on sodium and water absorption in patients with cholera, Gut 11:768, 1970.
7. Molla A, Molla AM. Effects of diarrhoea on absorption of macronutrients during acute stage and after recovery. New York, Plenum Publishing Corporation, 1981.
8. International Rice Research Institute. Annual report for 1974.

PUBLICATIONS

Salmonella Food Poisoning in Bangladesh/*Md. Yunus, Susan Zimicki, A.H. Baqui, K.M.B. Hossain, Martin J. Blaser.* August 1981. *(Scientific Report No.* 51)

Food poisoning in a family was investigated in March 1980, 10 of 11 members of a family who ate a food called jalar jao experienced acute gastroenteritis within 4 to 12 hours. All 10 patients were hospitalized at the International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR,B) field hospital at Matlab. *Salmonella java* was isolated from rectal swabs from 4 patients. The technique of preparation and the history of eating the jalar jao, the short interval between eating and the onset of the illness, and the culture results suggest that the jalar jao was the vehicle.

Salmonella food poisoning in Bangladesh is unusual because food is usually cooked well and eaten hot. The jalar jao, partially cooked and eaten cold, could be an important vehicle for spread of *Salmonella* and other bacterial infections in rural communities.

Epidemiology of El Tor Cholera in Rural Bangladesh: Importance of Surface Water in Transmission/*James M. Hughes, John M. Boyce, Richard J. Levine, Moslemuddin Khan, K.M.A. Aziz, M.I. Huq, George T. Curlin.* September 1981. *(Scientific Report No.* 52)

This study was designed to define the role of water used for drinking, cooking, bathing, and washing in the transmission of *V. cholerae* biotype El Tor infections in Matlab Bazar Thana, a rural area in Bangladesh. Longitudinal studies were conducted in neighbourhoods of culture-confirmed cholera index cases and controls with non-cholera diarrhoea. During daily visits to the households in the neighbourhoods, histories of diarrhoea and rectal swab cultures were obtained from residents, and specimens were obtained from water sources used by neighbourhood residents for culture for *V. cholerae*.

In neighbourhoods with cholera infection, 44 percent of surface water sources were positive for *V. cholerae* as were only 2 percent of surface sources in control neighbourhoods. Canals, rivers, and tanks were most frequently positive. Although similar types of water sources were available in cholera and control neighbourhoods, families in cholera infected neighbourhoods were more likely to use canal and river water for drinking, cooking, bathing, and washing than families in control neighbourhoods.

Increased risk of infection in families was associated with use of water from culture-positive sources for drinking, cooking, bathing, or washing; infection rates were similar for families using culture-positive sources for drinking and other purposes and for families using culture-negative sources for drinking but culture-positive sources for cooking, bathing, or washing. Infection rates for both groups were higher than for families using culture-negative sources for all purposes. Increased risk of infection in families was also associated with use of water sources used by index families for drink ing, cooking, or bathing. Increased risk of infection for individuals was associated with using water from culture-positive sources for cooking, bathing, or washing, but not with using water from culture-positive sources for drinking. Individuals who used the same water source as an index family for bathing were more likely to be infected than those using different sources. For families drinking from a culture-negative source, there was an association between infection and bathing in a positive source. For families with a bathing source different from the index family, there was an association between infection and drinking from the same source as the index family, and for families with a drinking source different from the index family, there was an association between infection and bathing in the same source as the index family.

These data suggest that use of surface water is important in the transmission of *V. cholerae* and that, in addition to providing safe drinking water, educating persons regarding the risk of transmission of infection by water from potentially contaminated sources used for other purposes, especially bathing, may also be necessary to control transmission in areas where El Tor cholera is endemic.

RICE POWDER

(Continued from page 3)

One disadvantage of using rice-water for making ORS is that the starch content has a wide variation. As is clear from table III. the carbohydrate content varies greatly (from 10.4gm–39gms per litre) and would pose a serious problem to ensure the 30 gm of starch in 1 litre of solution. However this can be overcome by asking to use thick rice-water or to boil it further if it is not thick enough, before adding the electrolytes—this should not be a big problem as a higher starch concentration would pose no hazard. Whatever the thickness of rice-water, when proper amounts of electrolytes are added, it provides a satisfactory ORS for combating mild to moderate dehydration.

The use of rice-water in ORS has not yet been extensively studied. It is a possibility which is worth examining, as this may be a cheap, easily available and safe base for ORS which will not only correct dehydration in diarrhoea, but will also help in combating nutritional wasting. Perhaps in future the use of other cereals depending upon the geographical location and the cereal production in the area could be tested for their efficacy in diarrhoea.

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