ORIGINAL ARTICLE

An Oral Electrolyte Solution without Glucose for Oral Rehydration in Diarrhea with mild and moderate dehydration

by

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Abstract

For rural areas in Indonesia
been done to prevent severe dehydration and death from diarrhea with an oral electrolyte solution without glucose.

The efficacy of oral electrolyte solution without glucose was not different from oral glucose electrolyte solution in a double blind study on 60 children with mild and moderate dehydration due to diarrhea.

Electrolyte solution without glucose can act as a substitute for glucose electrolyte solution in the therapy of mild and moderate dehydration due to diarrhea.

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TABLE 1 : *The grouping of age and degree of dehydration*

Group	Number of patients	Age (months)			Degree of dehydration	
		2 - 6	7 - 12	13 - 30	Mild	Moderate
A	30	8	13	4	2	28
B	30	6	13	6	1	29

TABLE 2 : *Solution composition (g/l)*

Group	NaCl	$NaHCO_3$	KCl	Glucose
A	3.5	2.5	1.5	—
B	3.5	2.5	1.5	20

TABLE 3 : *The dehydration score*

Where to look	Points to score for the signs you find		
	0	1	2
The whole child (well or ill)	Well	Restless, irritable or abnormally quiet drowsy, or floppy	Delirious, comatose or shocked, very ill
Skin	Normal elasticity	Moderately reduced elasticity	Severely reduced elasticity
Eyes	Normal	Moderately sunken	Severely sunken
Respiration	20 - 30	30 - 40	40 - 60
Mouth	Normal	Dry	Dry and Cyanosed
Pulse	Strong less than 120	120 - 140	Over 140

Introduction

In 1963 oral sugar electrolyte fluid was used with good results for rehydration in some areas of Latin America.

Oral glucose-electrolyte solution has been used in Yogyakarta, Indonesia, for 4 years with excellent results in all age groups. In an effort to extend rehydration to rural areas, glucose electrolyte packets have been distributed
Centres in our Province along with extensive training of para-medical personnel in the principle and practice of rehydration (Moenginah, 1975). Oral sucrose-electrolyte solution has been used with good results for rehydration in Yogyakarta (Moenginah et al., 1975). Oral sugar-electrolyte solution can be used for rehydration to prevent dehydration in diarrhea (Moenginah et al., 1977).

In Mexico oral electrolyte packets without glucose or sucrose were distributed by the Ministry of Health and Welfare to community members for the early treatment of diarrheal
village in 1963 (Jankauer and Ordway, 1968).

The use of glucose-electrolyte solution in the oral maintenance therapy for cholera was studied in Pakistan in 1968, 1970 and in Calcuta in 1970 (Nalin et al., 1968; Cash et al., 1970; Mahalanabis et al., 1974). It was successfully used in refugees from East Pakistan with cholera in 1971 and in acute diarrhea in 1973 in Apache Indian Children, and was proven to be enough for volume replacement and maintenance in the hospital and in the out-patient Department (Editor, 1975; Hirchhorn and Denny, 1973; Hirschhorn et al., 1973).

The monovalent electrolyte-sodium, potassium, chloride, nitrate and bicarbonate are easily absorbed by the intestinal membrane. Sodium is actively absorbed in large quantity by the mucosa of the small intestine, and at least some chloride is also actively absorbed. As the electrolytes are absorbed, the intestinal fluid becomes hypotonic, which then causes water to be absorbed by osmosis (Guyton, 1971).

In our investigation we compared the results of oral rehydration between glucose-electrolyte solution and electrolyte solution without glucose in the therapy of mild and moderate dehydration due to childhood diarrhea.

Material and methods

Sixty children aged between two and thirty months with diarrhea were admitted to the Department of Child Health, Gadjah Mada, Hospital, during 1977 showing mild and moderate dehydration (table 1). None had cholera. They were not suffering from other serious illnesses such as severe malnutrition, pneumonia, meningitis, encephalitis, etc.

A double blind study on rehydration using oral glucose electrolyte solution (group B) or electrolyte solution witho-

TABLE 4 : *Response to therapy during 6 hours*

Group	Numbers of patients	Mean body weight (gram)	Mean oral input of solution (cc)	Mean oral input of solution (kg/Bw)
A	30	8553 SD = ± 1864	880 SD = ± 271	92 SD = ± 20
B	30	8885 SD = ± 1762	837 SD = ± 167	96 SD = ± 20
		$p > 0.05$	$p > 0.05$	$p > 0.05$

TABLE 5 : *Results of rehydration*

Group	Numbers of patients	Degree of dehydration		Results	
		Mild	Moderate	Good	Failure
A	30	2	—	2	—
		—	28	22	6
B	30	1	—	1	—
		—	29	24	5

$p > 0.05$; $p > 0.05$

TABLE 6 : *Evaluation during 24 hours*

Group	Number of patients		Needs I.V.F.D.	Without I.V.F.D.
	Good	Failure		
A	24	—	—	24
	—	6	—	6
B	25	—	—	25
	—	5	—	5

ut glucose (group A) was done in these patients (table 2).

Alternately the children received glucose or non-glucose solution and were evaluated after 6 hours, for scoring of dehydration and input of solution and were observed during 24 hours for vital signs and scoring of dehydration.

The severity of dehydration was determined by scoring the objective signs such as general appearance, elasticity of the skin, presence of sunken eyes, the frequency of respiration, dry mouth, and rapid pulse (see table 3). A score of 0 to 2 means mild dehydration and 3 to 6 means moderate dehydration (Lembaga Kesehatan Nasional, 1974).

The oral solution was given ad libitum to an amount of about 5 — 10% of body weight during six hours from a bottle or with a spoon if vomitus occurred.

No antibiotic was given.

If the patients fell into severe dehydration with continous objective signs of dehydration (rapid pulse, poor skin turgor, or urine specific gravity above 1,028) for over six hours they were considered as failures of oral treatment and were given intravenous fluid therapy.

Results

The patients are compared in tables 4 and 5. The oral electrolyte solution was acceptable for all children in two groups, the mean body weight and the mean oral input of solution for two groups are not significantly different ($p < 0,05$) (table 4). In group A, consisting of 30 patients, 24 patients (80%) were rehydrated with good results and 6 patients (20%) with poor results. In group B, consisting of 30 patients, 25 patients (83.3%) were rehydrated with good results and 5 patients (16.7%) with poor results. The two groups showed no significant difference ($p > 0.05$) (table 5).

After evaluation during 24 hours, six out of 30 patients in group A and 5 out of 30 patients in group B were considered failures of oral treatment, but they did not need intravenous fluid drips (I.V.F.D.) (table 6).

Discussion

The results of this study in the 60 children clearly indicate that there is little difference between glucose containing oral electrolyte solution and only electrolyte solution in moderate dehydration due to diarrhea in children.

The continuation of positive fluid balance in the two groups shows that electrolyte and water absorption can occur without glucose in the intestine.

It has long been known that glucose increases sodium absorption from small intestine (Schultz and Curran, 1970), and the transport of glucose is directly related to the increase of sodium transport (Schultz and Zalusky, 1964). Transport of monosaccharides will not occur when active transport of sodium is blocked. Because of this, it is believed that active transport of sodium ions by me-

ans of coupled reactions with glucose transport mechanism, provides the energy required to move the monosaccharides through the membrane. Therefore, it is stated that monosaccharides transport is a secondary active transport, in contrast to primary active transport of sodium through the membrane (Guyton, 1971).

Water is absorbed by simple diffusion that is by osmosis. When glucose or electrolyte is actively absorbed through the membrane, thereby reducing the osmolality of the intestinal fluids and increasing the osmolality on the opposite side of the membrane, water "follows" through the membrane to maintain isotonicity between the two fluids (Guyton, 1971).

In childhood diarrhea, we have shown that oral electrolyte without glucose solution if not available provides a useful and cheap alternative for rehydration and maintenance treatment of diarrheal fluid losses.

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