

FEASIBILITY OF HOME TREATMENT OF DIARRHOEA WITH PACKAGED RICE-ORS

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Abstract

Feasibility of home treatment of diarrhoea with packaged rice-based oral rehydration salts (R-ORS) was compared, in terms of cost, with that for glucose-based oral rehydration salts (G-ORS). Packets of G-ORS (World Health Organization-recommended composition) were distributed in two Bangladeshi villages (G-ORS area). Packets of R-ORS with similar composition, except that glucose was replaced with rice flour (50 g/l), were distributed in other two villages (R-ORS area). During the 7-month study period, 1061 and 1348 diarrhoeal episodes were detected among 409 under-five children in each of the study areas. R-ORS was used, either alone or in combination with drugs, to treat 662 (62%) episodes in the R-ORS area, compared to 1101 (82%) episodes in the G-ORS area. The treatment cost per episode was more with R-ORS than with G-ORS, though fewer R-ORS packets were used per episode. Among others, the main factor for the higher cost was found to be the higher production cost of R-ORS packets. Expected early recovery from diarrhoea with use of R-ORS was not observed in this study. Under the study situation, the feasibility of home treatment of diarrhoea with packaged R-ORS was not apparent.

Key words: Oral rehydration therapy; Oral rehydration solutions; Diarrhoea, Infantile; Diarrhoea; Rice; Cereals; Cost and cost-benefit analysis; Comparative studies.

Introduction

Glucose-based oral rehydration salts (G-ORS), as recommended by the World Health Organisation (WHO), have been widely promoted for oral rehydration therapy (ORT) for diarrhoea (1-4). Alternatives for glucose were searched and sucrose-based ORS was found to be almost equally effective (5-7). Further research led to testing of rice based ORS (R-ORS), which was shown to be superior to G-ORS in reducing stool volume and duration of diarrhoea, and in reducing frequency of vomiting (8-9). It was also found to be more acceptable to rural mothers (10).

These findings led to an important ques-

tion in policy implementation: which ORS should be promoted in developing countries? Economists advocate that, "in poor countries, even the waste of doing well at high cost need to be avoided when equally well could be done at a low cost (11)". So, we examined, in rural Bangladesh, the feasibility of home treatment of diarrhoea in under-five children, in terms of relative costs of treatment with packaged G-ORS and R-ORS.

Materials and methods

The study was done from January to July 1987 in 4 villages of Chandpur Upazila in Bangladesh. Two villages, termed G-ORS area, had a population of 2510. The other two villages, having a population of 2544, were termed R-ORS area. There were 409 under-five children in each area, belonging

to 302 mothers in G-ORS area and 288 mothers in R-ORS area respectively.

The mothers in G-ORS area were shown how to prepare ½ litre oral rehydration solution from a single packet containing G-ORS (WHO formula). The demonstration was done by a project staff who dissolved all the contents of the G-ORS packet in ½ litre water measured with a familiar household pot of known volume.

The preparation of ½ litre R-ORS solution using ingredients kept in twin packets (one for 25 g of rice-powder and the other for the salts similar to those of G-ORS), was taught to all mothers in the R-ORS area. This involved cooking the rice powder for 5-7 minutes in approximately 550 ml of water to compensate for the loss by evaporation, and then dissolving the salts in it.

Respective ORS packets were distributed in each area through a selected group of mothers, 47 in G-ORS area and 49 in R-ORS area, who acted as depot-holders for ORS packets. All mothers were instructed how to use the prepared solution during diarrhoea and to continue to feed the sick child with normal food. Both types of ORS packets were procured from the same production source which also provided the costing for each type of ORS packet (Attachment 1).

Twice-weekly diarrhoea surveillance was implemented in each area with daily follow-up of detected episodes for a maximum of 14 days, if recovery, hospitalization, or death of a patient did not occur earlier. Any episode continuing beyond 14 days was followed through surveillance visits.

During surveillance and follow-up, the project staff recorded the following information:

- a. Date of onset, type of diarrhoea, frequency of stools, and presence of dehydration.
- b. Treatment received, number of ORS packets used, volume of oral rehydration solution consumed, duration of diarrhoea, and outcome of the episodes.

Success of therapy or recovery from an episode was defined as the passage of normal stool or no stool for two consecutive days. Death or hospitalisation due to diarrhoea constituted failure of therapy. The surveillance staff also checked a register for

ORS packets kept with the depot-holders and replenished their stock.

For costing methods, the term "cost" is defined as resources spent by the family of the patient or any one else or by any organisation for the treatment of the patient. The term "relative cost" is used to compare the costs incurred for treatment of diarrhoea using either G-ORS or R-ORS. Following elements of cost, involved in treating patients with diarrhoea with any ORS, have been taken into account:

- a. Cost of training the mothers;
- b. Cost of ORS packets used;
- c. Logistic cost of supply and distribution of ORS packets;
- d. Cost of preparation of ORS solutions, if any;
- e. Cost of treatment other than ORS, if any;
- f. Cost of hospitalisation, if any.

However, some elements of cost, which are equally applicable to both ORS, have not been shown in this report. Evaluation of some elements of costs that are thought to be not dependable in the local social structure have also been excluded.

Results

During the study period, 1061 and 1348 episodes of diarrhoea were detected among the under-five children in the R-ORS and the G-ORS area respectively. Diarrhoea incidence rate per child, for the 7-month-study period, was 2.6 in R-ORS area and 3.3 in G-ORS area. In both areas, diarrhoeal episodes were treated with ORS alone, or ORS with drugs, or drugs alone; but some episodes remained untreated.

ORS alone was used mostly for simple and watery diarrhoea, whereas drugs alone were used mostly for dysenteric diarrhoea. Proportion of diarrhoeal episodes treated with ORS was higher in G-ORS area than in R-ORS area where more episodes remained untreated (Table I).

In G-ORS area, 2597 packets of G-ORS were used for 1101 episodes of diarrhoea. Similarly, 1254 packets of R-ORS were used in R-ORS area for 662 episodes. Thus, 2.35 and 1.89 packets of ORS per episode were used for treatment in G-ORS and R-ORS area respectively, regardless of diarrhoea type and whether ORS was used alone or with drugs. However, the average number of

TABLE I - TREATMENT REGIMENS FOR DIFFERENT TYPES OF DIARRHOEA IN TWO STUDY AREAS

Types of Diarrhoea	Episodes treated with			Episodes untreated	Total
	ORS only	ORS & Drug	Drug only		
Simple diarrhoea*					
R-ORS area	235 [†] (53)	35 (8)	41 (9)	132 (30)	443 (100)
G-ORS area	456 (77)	43 (7)	31 (5)	102 (16)	632 (100)
Watery diarrhoea*					
R-ORS area	147 [†] (56)	45 (17)	37 (14)	36 (14)	265 (100)
G-ORS area	221 (62)	91 (26)	19 (5)	26 (7)	357 (100)
Dysenteric diarrhoea*					
R-ORS area	76 (22)	124 ^{**} (36)	89 (26)	59 (17)	348 (100)
G-ORS area	111 (31)	179 (49)	56 (16)	16 (4)	362 (100)

* Definition of different types of diarrhoea:

Simple: Diarrhoea with loose or semi-liquid stool without blood or mucus.

Watery: Passage of liquid or watery stool without blood or mucus.

Dysenteric: Passage of blood and/or mucus with loose or semi-liquid stool.

[†] 2 episodes of simple diarrhoea and 1 episode of watery diarrhoea had G-ORS and have been excluded.

^{**} 2 episodes of dysenteric diarrhoea had G-ORS and drug and have been excluded.

Figures in parentheses indicate percentages in a row.

packets of either ORS used was less for simple diarrhoea and most for dysenteric ones, particularly when used with drugs (Table II).

In both areas, almost all the episodes were mild, over 95% of which recovered after varying periods of illness, irrespective of treatment received. The overall median duration of episodes, treated with ORS alone, was 3 days (ranging from 1 day to more than 2 weeks) in each area (Table III). There was no death due to diarrhoea; only 1 patient in R-ORS area and 3 patients in G-ORS area were hospitalised.

Applying the cost of each type of ORS packet (Attachment 1) to the average number of ORS packets used per episode, the costs of oral rehydration therapy to treat each type of diarrhoea using ORS alone are shown in Table IV. Though the number of packets used per episode was fewer with R-ORS, the average cost of treatment of any type of episode of diarrhoea was higher for R-ORS than that for G-ORS.

TABLE II - AVERAGE NUMBER OF ORS PACKETS USED PER EPISODE OF DIARRHOEA TREATED WITH EACH TYPE OF ORS

Types of diarrhoea	ORS alone		ORS and drug		Overall	
	R-ORS	G-ORS	R-ORS	G-ORS	R-ORS	G-ORS
Simple	1.47	1.63	1.13	2.49	1.45	1.70
Watery	1.87	2.24	2.13	3.38	1.93	2.57
Dysenteric	2.25	2.92	2.58	3.46	2.45	3.25
All types	1.72	1.98	2.26	3.30	1.89	2.35

Discussion

Three of the 4 study villages were used as the control area in a previous study comparing rice-ORS and glucose-ORS (12). The fourth village was an adjacent one with simi-

TABLE III - DURATION OF DIARRHOEAL EPISODES TREATED WITH ORS ALONE (Excluding episodes hospitalised and outcome unknown)

Types of diarrhoea	Duration of diarrhoea (Days)		
	Median	Mean	SD
Simple diarrhoea:			
R-ORS (N - 234)	2	2.88	2.46
G-ORS (N - 434)	2	2.97	2.26
Watery diarrhoea:			
R-ORS (N - 147)	3	3.93	2.73
G-ORS (N - 219)	3	3.67	2.52
Dysenteric diarrhoea:			
R-ORS (N - 74)	5	7.10	4.19
G-ORS (N - 110)	5	6.68	4.21
All Types:			
R-ORS (N - 455)	3	3.90	3.25
G-ORS (N - 763)	3	3.71	2.97

lar characteristics as the other three. None of the villages were previously exposed to the use of any type of ORS and were comparable.

The difference in the diarrhoea incidence rates did not influence the study results, because our objective was to compare the feasibility in terms of treatment cost per episode of diarrhoea, using two types of ORS.

The intensive twice-weekly surveillance possibly detected many mild episodes, a large section of which could have been self-limiting without ORT. The mothers might have been reluctant to use R-ORS, but not G-ORS, for such episodes due to the extra effort needed to cook R-ORS. This may explain why fewer episodes were treated with R-ORS and more episodes remained untreated in the R-ORS area. These observations are contrary to earlier reports (10,12). It may be assumed that acceptance and use of rice-ORS in its present form may vary with the severity of diarrhoea.

Previous clinical studies have shown R-ORS to be more effective than G-ORS in reducing the stool volume and the duration of diarrhoea (8,9). R-ORS was shown to reduce the duration of diarrhoea in a community study also (12). So it is likely that less R-ORS packets would be needed

TABLE IV - COST OF ORAL REHYDRATION THERAPY PER EPISODE OF DIARRHOEA USING ORS ALONE

Types of Diarrhoea	R-ORS	G-ORS
Simple	Tk. 3.67 (Tk. 2.50)	Tk. 2.28
Watery	Tk. 4.67 (Tk. 3.18)	Tk. 3.13
Dysenteric	Tk. 5.62 (Tk. 3.82)	Tk. 4.00
All types	Tk. 4.30 (Tk. 2.92)	Tk. 2.77

Figures in the parentheses are revised cost estimates for ORT per episode of diarrhoea with rice-ORS, using the revised cost structure for rice-ORS packets as discussed in the text and shown in the Attachment 1.

for recovery from diarrhoea as compared with G-ORS packets. In this study, less R-ORS packets per episode, than G-ORS packets, were used for treatment; but the reduction in the duration of diarrhoea using R-ORS as compared with using G-ORS was not shown. The use of fewer packets of R-ORS per episode may, thus, be ascribed to the reluctance of mothers to prepare R-ORS. However, the effect of rice-ORS on the duration of diarrhoea could have been more obvious if most of the episodes were not so mild.

Logically, the number of ORS packets used per episode will vary with the duration of diarrhoea, and so will the cost. Thus, patients with dysentery, which is known to have a longer duration, required more ORS. In about one-third of all episodes and in more than 50% of the episodes of dysentery, drugs were used either alone or with ORS. Similar practice of using drugs was noted in other studies (12-14).

The main factor responsible for the higher treatment cost with R-ORS, despite the use of fewer packets per episode, was the 5-fold higher man-power cost for production of R-ORS packets (Attachment 1). Two problems were identified as causes for the higher cost:

- (i) Rice-flour and the salts did not mix in bulk to produce a homogeneous mixture. So, twin packets were used for

R-ORS, one for rice-flour and the other for the salts, instead of only one packet as was used for all the ingredients of G-ORS. This doubled the need for packaging material and manpower for R-ORS packets.

- (ii) Rice-flour was measured for each packet with a pre-measured container, but the other salts were weighed individually, instead of mixing in bulk and measuring with a pre-measured container, as was the case in making G-ORS packets. This slowed down the production rate of R-ORS packets and increased its production cost by 3-folds.

The first problem was unavoidable, but the second could be corrected. If the net cost for a R-ORS packet is recalculated after the correction, it comes down from Tk.2.50 to Tk.1.70 (Attachment 1), and a 32% reduction in the cost to treat an episode of diarrhoea can be achieved (Table IV).

Three elements of indirect cost were not considered in the estimate: (a) the cost of mother's time to prepare each type of ORS solution, (b) the cost of fuel needed to prepare R-ORS solution, and (c) the cost to train the mothers. Time needed to prepare ORS solution varied from 3-5 minutes for G-ORS and 7-10 minutes for R-ORS. In the rural society, it was difficult to assign a cost for the time spent by mothers. Moreover, fewer R-ORS packets used per episode might have evened out the total time spent per episode for both types of ORS. Rural mothers used leaves, hay, twigs and, in some cases, jute-sticks to cook. The quantity of these objects needed to cook 0.5 litre of R-ORS solution was so small that fuel cost was omitted in the present study.

Nevertheless, the extra effort of a mother to prepare R-ORS is likely to deter its use specially when a large volume of ORS is needed in a severe diarrhoea, such as cholera, and the cost of time spent by the mother and the fuel required to prepare R-ORS could be noteworthy. In addition, the cost for training the mothers was also found to be little higher in case of R-ORS, mainly because more man-hours were needed.

It appears from the study that home treatment of diarrhoea with packaged rice-ORS may not be a feasible proposition in its present form. However, further studies, using better methods in varying situations and in

different communities, will be needed to reach a consensus on the issue.

Acknowledgements

This study was supported by the International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR,B), UNICEF, and the Aga Khan Foundation. Current major donors giving assistance to ICDDR,B are: Arab Gulf Programme, Australia, Bangladesh, Belgium, Canada (Canadian International Development Agency, the International Development Research Centre and World University Service of Canada), the Ford Foundation, Japan, Norwegian Agency for International Development, Saudi Arabia, Swedish Agency for Research Co-operation with Developing Countries, Switzerland, United Kingdom, United Nations Children's Fund, United Nations Development Programme, United States Agency for International Development and World Bank.

The authors also gratefully acknowledge the advice and suggestions received from Prof. Saroj Kumar Saha, Ph.D, Department of Accounting, Dhaka University, on costing methods and cost analysis for the study.

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ATTACHMENT 1

Cost breakdown for ORS Packets produced by the Employees' Co-operative Society, ICDDR,B
(Based on costing done in 1986 - 1987)

Costing elements	Rice - ORS		Glucose - ORS	
	Quantity for 100 Pkts	Price in taka	Quantity for 100 Pkts	Price in taka
A. Ingredients:				
Sodium chloride	0.175 kg	3.50	0.175 kg	3.50
Sodium bicarbonate	0.125 kg	2.50	0.125 kg	2.50
Potassium chloride	0.075 kg	1.50	0.075 kg	1.50
Rice - flour	2.50 kg	30.00	-	-
Glucose	-	-	1.00 kg	40.00
Polythene bag	1.00 lb	25.00	0.50 lb	12.50
Sub - Total		62.50		60.00
B. Production:				
Wages		120.00		25.00
Incidental charges		40.00		40.00
Total		222.50		125.00
C. Profit (12.5%)		27.81		15.60
D. Grand Total (For 100 Pkts)		250.31		140.60
E. Net cost per packet		2.50		1.40

N.B. If wages for production of rice - ORS is taken to be Tk.50.00 (i.e. double the amount for G - ORS) as discussed in the text, then the cost breakdown for rice - ORS would be as follows:

Ingredients:	Tk. 62.50
Wages:	Tk. 50.00
Incidental charges:	Tk. 40.00
Total:	Tk. 152.50
Profit (12.5%):	Tk. 19.00
Grand total: (For 100 pkts)	Tk. 171.50

Net cost per packet: Tk. 1.70