



Dr Mujibur Rahaman

# A SAVING SOLUTION

INTERVIEW BY NEILL MCKEE

*Oral rehydration therapy (ORT) is a simple and inexpensive way of treating the loss of essential fluids and minerals that accompanies diarrhea — the major complication of diarrhea and a principal cause of an estimated 5 million deaths a year of children under five years of age. UNICEF, in its State of the world's children 1982-83 report, estimated that widespread acceptance of ORT "could save the lives of up to 13 000 children every day."*

*Dr Mujibur Rahaman, senior scientist at the International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR,B) in Dhaka has been closely involved with the development of ORT. IDRC film producer-director Neill McKee interviewed Dr Rahaman in Teknaf, Bangladesh, recently.*

**IDRC:** What is the history of oral rehydration therapy (ORT)?

**Rahaman:** Well, ORT was developed quite a while ago, but recently it is getting more and more publicity and wider acceptance as a simple and relatively inexpensive way of replacing the water and electrolytes lost during acute diarrheal attack. If the loss of fluid and electrolytes is reversed, life can be saved without use of expensive intravenous fluid. The scientific fact on which this method is based was discovered some decades ago. It was observed that glucose facilitates the absorption of sodium and water — reversing the process of fluid and electrolyte loss caused by toxins attacking cells. We considered that this action could be used as a technique for increasing the fluid absorption in the small intestine of people who had cholera. In 1976, the former Cholera Research Laboratory in Bangladesh [now the International Centre for Diarrhoeal Disease Research, Bangladesh

(ICDDR,B)] observed that when a solution with the necessary electrolytes was introduced into the intestine of cholera patients for a period of perfusion, as the method was called, and glucose was added, there was net increase in the absorption rate of fluids from the small intestinal lumen into the gut mucus membrane. So there was positive absorption of fluid. Instead of the cholera patients losing fluid, they were absorbing it. Now, following that experiment, we carried out a series of clinical investigations. They proved that, indeed, a solution containing electrolytes, if it has 2-3 percent glucose, can be used to replace the fluid and electrolytes lost during cholera. Subsequently, it was further simplified by replacing glucose with ordinary sugar, sucrose. Glucose is not universally available; sugar was found to be working almost... almost as well as glucose. We were not the only persons involved in developing ORT. The former International Centre for

Medical Research and Training in Calcutta run by the John Hopkins University (U.S.A.) also played a crucial role.

**IDRC:** What then, are the standard ingredients of the ORT mixture?

**Rahaman:** As it is used in Bangladesh, the mix is 3.5 g of sodium chloride, or common salt, 2.5 g sodium bicarbonate, and 1 g of potassium chloride. To this one should add either 20 g of glucose, or, if you don't have glucose, 40 g of sugar. This mixture should be dissolved in one litre of plain drinking water. Plain sugar — table sugar or sucrose — is good enough. We have found that acceptability of the ORT is somewhat better if you have sugar rather than glucose, because sugar tastes a little sweeter than glucose and children seem to accept it better.

**IDRC:** How much is usually needed?

**Rahaman:** That depends on the severity and the duration of diarrhea. Our calculations have shown that, as a rule of thumb, a child of 10-12 kg may require little more than a litre in about 24 hours. If the child has diarrhea of sufficient severity, it might require more than a litre. If the diarrhea is prolonged, it might require 2 litres. But children who require more are the ones who are in danger of dying from dehydration — we always warn parents to be watchful, because further treatment and follow-up, like intravenous fluid administration or examination by a physician, may be required.

**IDRC:** How widely used in Bangladesh is ORT?

**Rahaman:** A national program is currently providing the ORT in remote rural areas, and I think at present one-third of Bangladesh is covered — about 30 million people.

**IDRC:** Is this program working through government health services or other agencies?

**Rahaman:** The national health service is distributing the solution free of cost in the villages where they have health volunteers. However, ORT is also available in the rural health centres or health posts. Recently, several private manufacturers have marketed ORT, but they are using glucose rather than sugar. The price is quite reasonable, it is about 2.5 taka (about CA\$0.13) per package, which makes one litre.

**IDRC:** What needs to be done to have ORT more widely accepted?

**Rahaman:** Although ORT is simple to make and simple to administer, one has to exercise some degree of caution with it in order to prevent infants getting dangerous symptoms like hypernatremia. It is extremely rare, but can be a rather serious complication, leading to brain

swelling and convulsions. Hypernatremia means too much sodium in the blood serum. If the ORT solution is not made properly — if it is made too strong or given with too little water — and if the child had some other illnesses along with diarrhea, like high fever, and is losing a lot of water through sweating, then the child may retain too much sodium. But this is easy to diagnose: The child is very thirsty and usually refuses ORT. If plain water is given, or breast-feeding is continued — which should be done for all diarrheal infants — then the danger is minimal.

However, the main constraint to the universal acceptance of ORT that we see is that some training is necessary either to the intelligent mother or to some neighbourhood agent to demonstrate how to make ORT in appropriate strength and how to administer it to the child. Once this is done, the therapy could be recommended universally. The health service here in Bangladesh is quite appropriately exercising caution, because universal availability without training may be dangerous.

**IDRC:** Would you say then that hygiene education is the necessary "software" for the ORT "hardware"?

**Rahaman:** The ORT makes it possible for health educators to enter into the family, so to speak. It is an entry point. When you treat a child at a very crucial period when life may be in danger, the whole family will listen to the person who is providing this life-saving therapy. And health education is retained in that situation. The family is in a very receptive mood. Giving them hygiene education at the same time as providing oral rehydration therapy is an extremely effective way of approaching this particular problem of diarrhea and its high endemicity in poor societies.

**IDRC:** Can the therapy be refined further, by the addition of water purification chemicals, for instance — or is this necessary?

**Rahaman:** Well, there is some controversy on this point. We follow the WHO advice: Use the best possible drinking water. If we tell mothers to boil water, then there may be some problem in accepting ORT, because fuel is scarce, and boiling involves making additional efforts. That is one reason. The other is that we think that ORT should not be used after twelve hours, it should be thrown away, or at maximum, kept 24 hours. Some experiments have shown that the ORT can become highly contaminated with bacteria. But this is a minimal risk, because the children who have diarrhea are usually accustomed to drinking water that is not absolutely pure.

I would not routinely recommend boiling of water, because of the fuelwood scarcity. In some situations

water should be boiled, then cooled. If you add the ORT mixture to boiling water, then the sodium bicarbonate will lose its carbon dioxide and will become sodium carbonate, which is toxic. So there is a danger in boiling water and using it hot.

**IDRC:** What about chemical water purification?

**Rahaman:** The commonest water purification is the chlorine tablet. We have not experimented ourselves on the effects of adding chlorine tablets. If it is available, and the mother knows how to use it, I can see no reason why it can not be used. But I would not, again, routinely recommend it in case mothers begin to think that without chlorine ORT is going to be useless. I think this would really be an impediment to the program.

**IDRC:** But if diarrhea is caused primarily by impure water, how can you expect ORT to be effective if made with the same sort of water source?



*Oral rehydration in progress in Bangladesh: a technology to save millions of lives and dollars.*

**Rahaman:** It is not entirely correct to say water is the main problem or causative factor in producing diarrhea. In infantile diarrhea, diarrheas during the first 6 to 18 months of life, we think that the cause is most often a virus. Viral transmission is not associated with water. This is one of the most vulnerable periods for diarrhea. And in the subsequent period, that is, from 18 months to about three years, the disease is mainly due to shigellosis or *E. coli* bacteria.

Now, water can affect the incidence of diarrhea in various ways. The mother's hygiene can be affected by the availability of water, not just the quality but also the quantity. Water purity may not be the most crucial factor in producing diarrhea. It's the large volume of water that allows the mother to maintain hygiene at a high level that may be more important than the exact bacterial count in the water. In

shigellosis, for example, washing the hands repeatedly if there is a good source of water — when I say good, that means a plentiful source of available water — is a way mothers can help to cut down the transmission of shigellosis from one child to another. So water may be playing an important role, but only indirectly, not as the main vehicle of transmission. Although cholera is caused by water, some enterotoxigenic *E. coli* diarrheas, as we know now, are caused by both water and food. So it's not just water alone. Lack of water is far more detrimental than water that may be slightly contaminated.

**IDRC:** What is in the future for ORT and research on diarrheal diseases?

**Rahaman:** I think the most exciting study going on is in Teknaf right now, measuring the impact of water and sanitation on diarrheal diseases. This study is principally supported by IDRC, and partly supported by UNICEF and of course, the ICDDR,B. This study will compare the efficacy of availability of large volumes of relatively high-quality water close to the home. And at the same time, we are providing health education to promote the use of this water as carefully as possible so it will not become contaminated. We are also providing latrines, and education to support their introduction and proper use.

Previously, the criteria used for evaluating the impact of water and sanitation was the broad category of incidence of diarrheal disease. As I have mentioned, diarrhea can be caused by a variety of bacteria and viruses. As recently as 10 years ago, the technologies were not available to determine the causes of specific diarrheas in children. Now, our study has incorporated a method which will diagnose most of the causes of diarrhea. The reason why this is important is because a viral diarrhea may have a different way of transmission, probably by air. The *shigella* organism, which is another cause of diarrhea (shigellosis), is probably transmitted person-to-person, from hand to mouth. And then, you have other categories of diarrhea like enterotoxigenic *E. coli*, which is transmitted both by water as well as by food. So through our experimental design, it will be possible to determine the various causes of diarrhea and, at the same time, as long as we know the cause of diarrhea, we can tell which particular technique worked best against it. Was it the good water from a handpump that worked, or the large volume of water that worked, or the acceptability of simple health education measures and ORT? So it should be possible in future to identify the effectiveness of specific health education measures or technologies independently and in combination.