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# THE MANAGEMENT OF DIARRHOEA AND USE OF ORAL REHYDRATION THERAPY

A Joint WHO/UNICEF Statement



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**WORLD HEALTH ORGANIZATION**

Geneva

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"The discovery that sodium transport and glucose transport are coupled in the small intestine so that glucose accelerates absorption of solute and water was potentially the most important medical advance this century" (Lancet, 1978, ii, 300).

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## DEFINITIONS

Dehydration. Loss of water and dissolved salts from the body, occurring, for instance, as a result of diarrhoea.

Rehydration. The correction of dehydration.

Oral rehydration therapy (ORT). The administration of fluid by mouth to prevent or correct the dehydration that is a consequence of diarrhoea.

Oral rehydration salts (ORS). Specifically, the standard WHO/UNICEF recommended formula, consisting of:

Sodium chloride	3.5 grams
Sodium hydrogen carbonate (Sodium bicarbonate)	2.5 grams
Potassium chloride	1.5 grams
Glucose	20.0 grams

to be dissolved in one litre of clean drinking water

ORS is generally provided pre-packaged in a dry form to be reconstituted when required.

## INTRODUCTION

In 1980 in the developing countries, an estimated five million children under 5 years of age - about 10 every minute - died as a consequence of diarrhoeal disease. These deaths were an outcome of the some 1 000 million episodes that occurred among the 338 million children in this age group and were undoubtedly more frequent in poorer families.

An estimated 60-70% of diarrhoeal deaths are caused by dehydration. Oral rehydration therapy (ORT) can prevent and correct this dehydration and thus prevent many of these diarrhoea-associated deaths. This technological breakthrough offers important new possibilities for reducing the number of deaths in children because it can be used throughout the health care system and can even be administered in the home by family members.

ORT can be provided in the form of prepackaged salts or as home-prepared solutions; both have important roles to play in the management of diarrhoea. The present annual supply of ORS packets (about 40 million) is only enough to treat some 2% of all childhood diarrhoeal episodes. There is an urgent need to accelerate the production of ORS and to disseminate more information about the early treatment of diarrhoea in the home.

Diarrhoea is also a major factor in the causation or aggravation of malnutrition. This is because the diarrhoea patient loses his appetite and is unable to absorb food properly, and because it is a common practice to withhold fluids and food (including breast-milk) from him. Such malnutrition is itself a contributing cause to the high number of deaths associated with diarrhoea in childhood. Thus, continued feeding, both during and after a diarrhoea episode, is an important part of the proper management of diarrhoea, complementing ORT.



ORT is a simple, inexpensive, and effective therapy; ensuring that it is widely available and widely used is a major public health challenge. WHO and UNICEF, as well as numerous international, bilateral, and voluntary agencies are now collaborating with many countries in establishing national primary health care services which include diarrhoeal disease control programmes with ORT as their cornerstone. As more and more experience is gained with ORT, the best types of solution to use in different situations are becoming clearer.

This statement presents WHO's and UNICEF's joint views on ORT in the light of experience to date. It should be borne in mind that it has been written at a time when new scientific knowledge and practical experience are being acquired at a rapid rate. The paper deals in particular with scientific, programmatic, and operational issues in relation to ORT which are important in the development and strengthening of national diarrhoeal disease control programmes. It is not intended as operational guidelines for the implementation of these programmes; such guidelines would need to address many other issues, such as the provision of information to a wide range of audiences, the training of health and other workers at various levels, the nutritional aspects of diarrhoea management and prevention, and the use of water supply and sanitation facilities and good hygiene practices.

This statement views ORT in the context of wider national diarrhoeal disease control programmes, which are themselves an integral component of primary health care and need to be linked with other essential elements such as immunization, other maternal and child care activities, including nutrition and birth spacing, and the provision of essential drugs. These activities have in common the need to reach the family and strengthen community responsibility, and

require supporting referral and other services. Making ORT, along with these other essential primary health care interventions, accessible to all families requires managerial, organizational, and financial support. Because diarrhoea is so frequent, the implementation of ORT delivery services offers an excellent entry point for the strengthening of primary health care.

## THE SCIENTIFIC BASIS OF ORAL REHYDRATION THERAPY

### Principles of therapy

A person with acute diarrhoea<sup>1</sup> begins to lose essential water and salts from the onset of illness. Unless these are adequately replaced, dehydration will develop. Prevention of dehydration is therefore the first appropriate response to diarrhoea. Once a person is dehydrated<sup>2</sup> he needs to be treated in two phases:

- (1) the rehydration phase - replacement of the accumulated deficit due to fluid and salt losses in stools and vomitus.
- (2) the maintenance phase - replacement of ongoing abnormal losses due to continuing diarrhoea and vomiting, and replacement of normal losses due to respiration, sweating, and urination, which are particularly high in infants.

Fluid replacement by injection into the veins (intravenous therapy) was first used for the treatment of dehydration from diarrhoea in the mid-nineteenth century. This technique, however, requires sophisticated equipment, is costly, and

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<sup>1</sup>"Acute" diarrhoea is an attack of sudden onset, which usually lasts 3 to 7 days but may last for up to 10 to 14 days.

<sup>2</sup>The signs and symptoms that allow one to assess the degree of dehydration and fluid deficit are described in "A Manual for the Treatment of Acute Diarrhoea", unpublished document WHO/CDD/SER/80.2, pp. 4-6

calls for specially trained workers. The concept of replacing fluid losses by mouth began to receive attention in the 1960s, when a major breakthrough was made with the successful use of an oral solution containing glucose and essential salts to treat cholera cases with very severe diarrhoea. The scientific evidence to explain the success of ORT included the demonstration that the presence of the sugar in ORT solution (glucose) made it easier for the intestine to absorb water and sodium, a process that remained unimpaired during acute diarrhoea.

Some 25 pathogenic bacteria, viruses, and parasites have so far been identified as causes of diarrhoea. The mechanisms by which they produce diarrhoea are varied: some cause little or no change in the lining of the walls of the intestine, while others cause considerable damage to some areas of the wall. However, it is now firmly established that, regardless of the causative agent or the age of the patient, an ORT solution containing glucose and essential salts is adequately absorbed and replaces both previous and continuing fluid and salt losses. ORT does not stop the diarrhoea, but the diarrhoea usually continues for only a limited time.

#### Composition and use of ORT

A rational response to diarrhoea is as follows:

- (a) To prevent dehydration using solutions prepared from ingredients commonly found in the home ("home remedies"); this should be the first response.
- (b) To correct dehydration using a balanced, more complete, glucose-salt solution; ORS is the universal solution of this type recommended by WHO and UNICEF;

- (c) To correct severe dehydration (usually defined as loss of 10% or more of body weight) by intravenous therapy; this method should also be used in patients who are unconscious or unable to drink.

Prevention of dehydration. Intensive promotion by health and other workers of the use of home remedies for the early treatment of diarrhoea can be expected to result in fewer cases developing dehydration during diarrhoea. The use of such remedies should thus decrease the number of visits to health facilities and community health workers and the need for ORS packets. Further studies are needed to clarify the extent of these benefits.

There are two groups of home remedies:

(a) "Household food" solutions - fluids or liquids that are normally available in the home and are appropriate for the early home treatment of acute diarrhoea. Such solutions are often prepared from boiled water, thus ensuring safety for drinking, and contain sodium, sometimes potassium, and a source of glucose - such as starches - that can facilitate the absorption of salts in the intestine; they also may contain other sources of energy. Two examples are rice water, often found in homes in Asia, and various soups - e.g., carrot soup, often found in homes in North Africa; other less robust examples include juices, coconut water, and weak tea. There is a need to identify other appropriate "household food" fluids in different regions of the world.

(b) "Salt and sugar" solutions - consisting of white sugar (sucrose) and cooking salt (sodium chloride). In a few countries molasses or unrefined sugar is used in place of white sugar; it has the advantage of containing also potassium chloride and sodium bicarbonate. More than 20 different recipes

have so far been suggested for these solutions, and methods for their preparation include hand measures (e.g., "pinch and scoop"), household spoons (metallic or home-made), and specially manufactured double-ended plastic measuring spoons. Each of these methods has advantages and disadvantages, but the proper use of all of them requires considerable training of health workers and mothers and the availability of sugar and salt, which may not be affordable in the poorest homes. Costs, seasonal shortages, and varying quality of sugar or salt have made it difficult to promote and implement the use of "salt and sugar" solutions in the home in some areas; in such cases the use of "household food" solutions should be considered.

The comparative safety and efficacy of "household food" and "salt and sugar" solutions in the prevention of dehydration are important subjects that require further intensive study.

As these home remedies may have a varied composition and usually lack or have insufficient amounts of the ingredients in ORS (particularly potassium and bicarbonate - see below), they are not ideal for the treatment of dehydration at any age. However, they certainly should be used at the onset of diarrhoea to prevent dehydration and in situations where the complete formula is needed but is not available.

The proper management of diarrhoea in the home also includes, along with the administration of ORT, the promotion of appropriate child feeding, both during and after a diarrhoea episode, to prevent excessive and uncompensated loss of nutrients. In many societies the parent's remedial response to diarrhoea is to withhold food and fluid, including breast-milk, in the mistaken belief that this will stop the diarrhoea and ease the strain on the intestine. This "treatment" only adds to the dehydration and malnutrition caused by the illness.

Treatment of dehydration. The treatment of dehydration requires the use of a balanced glucose-salt solution. Much experience has been gained in the use of ORS for the treatment of dehydration in hospitals, clinics, and homes. This solution (see definitions for composition), which WHO and UNICEF began to recommend and make available in 1971, was selected because it is universal - i.e., it can be used to treat dehydration from diarrhoea of any cause, including cholera, in all age groups. The adoption of a universal solution simplifies the production and distribution of the solution (or its ingredients) as well as the training of health care personnel at all levels. This increases the availability and assures safer use of ORT. From the outset, ORS was envisaged for use both to correct dehydration (the rehydration phase) and to maintain hydration during continuing diarrhoea (the maintenance phase). Extensive experience has repeatedly demonstrated the safety and efficacy of ORS as a universal ORT solution when used correctly.

Some doctors have expressed concern about the sodium concentration of the ORS solution because it is substantially higher than that of some commercial solutions marketed primarily in the industrialized countries. Many of these commercial solutions are, however, recommended for maintenance phase therapy only, and not for rehydration. Experience has shown that the use of ORS very rarely causes a blood level of sodium above normal and that even when it does; it is usually very brief and of no clinical importance. Even in the newborn, ORS has been proved safe provided that additional fluid is given during the maintenance phase of treatment. Thus, young infants receiving ORS solution should be fed breast-milk, juices, weak tea, or plain water. While ORS with a substantially lower sodium concentration can be used for treating most cases of diarrhoea in infants, it is not suitable for use as

a universal solution; for example, it cannot be used for rehydration treatment in cholera.

The presence of potassium in ORS is particularly important for the treatment of dehydrated children, in whom potassium losses in diarrhoea are relatively high. Studies have shown that undernourished children who have suffered repeated bouts of diarrhoea are especially likely to develop a blood level of potassium below normal if the potassium is not replaced during rehydration.

The bicarbonate in ORS is needed for the treatment of acidosis, which occurs frequently with dehydration. The possibility that citrate can be substituted for bicarbonate with equal efficacy is at present under study.

Glucose is included in the solution principally to help the absorption of sodium and not as a source of energy. Ordinary sugar (sucrose) can be substituted for glucose with near equal efficacy, though twice the amount of sugar is needed. Increasing the amount of sugar in the formula as a means of improving palatability or increasing its nutritive value is potentially dangerous as it can worsen the diarrhoea.

Because ORS is sometimes considered by mothers or health workers to have an unpleasant taste, a number of other substances have been proposed as additions to ORS to improve its flavour. The addition of any of these would substantially raise the cost of manufacturing the product without increasing its efficacy. Unflavoured ORS tastes rather like tears, though a little less salty, and is acceptable to almost all infants, whereas flavoured solutions do not have a universal taste appeal.



Use of ORS at treatment centres. From studies during the past decade, the following conclusions may be drawn about the use of ORS in hospitals and clinics:

- (a) About 90-95% of all patients with acute watery diarrhoea, including infants, can be treated with ORS alone; in the remainder, most of whom have severe dehydration or are unable to take fluids orally, intravenous therapy is required to replace the deficits rapidly. Hospitals and health centres that have introduced ORS have substantially reduced the costs of treating diarrhoea cases, due to a large decrease in the use of intravenous fluid and in the number of hospital admissions. The average cost of treating one patient with intravenous therapy can be more than \$5 as compared with less than \$0.50 with ORS. In contrast to intravenous therapy, ORS can be given under simple conditions and does not require any special equipment or highly skilled personnel; thus there is increased access to rehydration therapy.
- (b) In some hospitals, the use of ORS has resulted in a substantial decrease in the number of deaths from diarrhoea; this is probably due to an increase in overall concern regarding diarrhoea management and a decline in the use of intravenous therapy and its associated risks.
- (c) While the use of ORS may initially require more health workers' time to train mothers to give ORS to their children, in the long term it frees hospital and health centre staff for other duties. Of greater importance, ORS involves parents directly

in the care of their children and presents an excellent opportunity for health workers to communicate important health education messages on diarrhoea prevention and nutrition.

- (d) ORS is associated with very few side effects. Stool losses have been observed to increase by up to 10% in severe cholera cases (though this is of no major medical significance), but are not usually increased in diarrhoea from other causes. Vomiting, when it occurs, usually does not prevent the successful use of ORS. Over-hydration may occur occasionally, but probably much more rarely than with intravenous therapy. Thus, ORS has been found to be remarkably safe.

Use of ORS at the community and household level. Since all the ingredients of ORS can be readily packaged, it became apparent during the 1970s that ORS was extremely suitable for use as part of primary health care services in the community and in the home. The reasons are as follows:

- (a) Community health workers and mothers readily accept ORS for the treatment of acute diarrhoea. This has been shown in many settings where standard diarrhoea treatment practices had previously involved only the administration of often useless drugs and referral to clinics and hospitals for intravenous therapy.
- (b) In a number of research studies the use of ORS for treating dehydrated children at the community level has decreased the number of deaths from diarrhoea by as much

as 50-60% over a one-year period. (The rates for longer time periods are not yet known.)

- (c) The delivery of messages recommending early and continued feeding together with the administration of ORS by community health workers has been associated, in some settings, with the prevention of weight loss and with better weight gain in young children. It is not certain whether this is because of more rapid correction of the salt deficits by the ORS, resulting in improved appetite and a sense of well-being, or is a consequence of the improved nutritional practices resulting from the advice provided at the time ORS is distributed.

## PROGRAMME RECOMMENDATIONS

### Comprehensive programme approach

Successful prevention and treatment of dehydration from acute diarrhoea requires a comprehensive programme approach at the national level which includes efforts on three fronts:

- (a) improving the outreach and effectiveness of diarrhoea management throughout the health system;
- (b) using all available channels to disseminate knowledge, impart skills, and encourage the practice of better management of diarrhoea; and
- (c) producing and distributing appropriate supplies and equipment for the management of diarrhoea.

### Use of health system for delivery of ORT

Efforts need to be directed at three levels: the household, the community, and the clinic or hospital. Early home therapy is important to prevent dehydration, ORS is needed to treat most cases of dehydration, and intravenous therapy is required to treat severely dehydrated cases. Efforts must be directed at strengthening health delivery services and enlisting community participation to support activities at all three levels. More specifically:

- (a) In the home, mothers and other members of the family should be informed and trained (i) to recognize diarrhoea in infants and children as an illness requiring early treatment; (ii) to prepare and give a "home remedy" by mouth; and (iii) to recognize when they should seek additional care,

including ORS. The type of household solution to be used and its method of preparation must inevitably vary from country to country and even within regions in the same country, depending on such factors as cultural practices, the food normally used in the home, the price and availability of salt and sugar, the ability of mothers to prepare a solution accurately, the presence of standard measuring utensils, and the extent of outreach of the health delivery system. Any of the approaches indicated above for the preparation and use of home remedies can be adopted, though in most areas some operational research may be needed to determine which of the approaches is most feasible, safe, and effective. It is recommended that, if possible, the home remedy should have sodium and glucose concentrations that are between 50-100 mmol/l. The presence of even a small amount of potassium (e.g., that provided by fruit juices) can be beneficial. Making ORS packets routinely available for home use is probably feasible and desirable in only a few (usually small) countries; in the majority of countries the goal should be to have ORS packets readily accessible in the community for those who need them and who have had instruction in their use, which means distribution to the most peripheral level of the health services as possible.

b) The first-level health worker, e.g., a community health worker, has a crucial role to play in disseminating knowledge and skills for the management of diarrhoea, as regards the use of both home remedies and ORS. ORS packets should be available in adequate supply at this level and throughout the entire health system. If this is not possible, maximum efforts should continue towards this end and, in the meantime, as complete a formulation as possible should be used, recognizing its limitations. When potassium is a missing ingredient, patients should be encouraged to drink fluids that are rich in potassium (e.g., juices).

For the preparation of ORS solution the safest water available should be used.

(c) In clinics and hospitals having the appropriate equipment and trained staff, intravenous fluids should be used to rehydrate severely dehydrated cases and the few other diarrhoea patients (e.g., those with vomiting that is not responding to treatment) for whom it is required. Efforts are needed to improve the use and quality of intravenous therapy, especially for young children.

#### Other aspects of the management of diarrhoea

Two other aspects must complement ORT:

Feeding. Experience shows that food should not be withheld from infants and children with acute diarrhoea. Depending on their feeding status, children should first receive breast-milk or diluted milk feeds; in cases of dehydration, these should be offered as soon as initial rehydration therapy has been completed. Appropriate locally available foods (e.g., cereals) should be offered as soon as the appetite returns. After the diarrhoea ceases, more than the usual amount of food should be given for a short period. The routine use of any special infant formulae (e.g., lactose-free products) for diarrhoea cases should be strongly discouraged as they are only rarely necessary and are costly.

Other drugs. Selected antibiotics should be judiciously used for the treatment of severe dysentery and cholera; otherwise, there is no need for other pharmaceuticals in the routine treatment of acute diarrhoea.

#### Use of communication channels

Often a contributory cause of childhood dehydration and consequent death is the objection of

the mother to providing fluids to her child suffering from diarrhoea. There is an urgent need to understand her present attitudes, perceptions, and practices regarding diarrhoea as well as those of health and other community workers. Sociocultural research, group interviews and proper pretesting are indispensable tools for the design of messages that will motivate her to a more appropriate and timely response at the first sign of diarrhoea. To change her attitude to the management of diarrhoea, and enhance her capacity for it requires a considerable but sensitive effort in effective person-to-person and mass media communication.

Appropriate educational and training materials need to be prepared to transmit priority messages on the preparation and administration of ORT solutions, the importance of continued feeding, and the need for referral if the child's condition worsens. Lessons on the causes and treatment of diarrhoea should also be given in primary schools.

Mothers require individual instruction and often need to observe a practical demonstration and practise mixing a number of times in order to prepare ORS or "salt and sugar" solutions correctly.

Separate guidelines for the management of acute diarrhoea need to be prepared for first-line, mid-level, and senior-level health workers. These should be based on well-established practices, but adapted to meet local needs.

#### Production and distribution of appropriate supplies

There is a need for prepacked ORS in a suitable quantity for mixing in an appropriate, "universally" available measuring container. Such packets can be manufactured industrially on a large

scale by government or private pharmaceutical companies using laminated aluminum foil to prolong their shelf-life, or produced by a "cottage industry" approach using less expensive packaging material. The seasonal character of diarrhoea in the country should be borne in mind when timing both the production and distribution of packets. The development of more stable ingredients for ORS, such as sodium citrate to replace sodium bicarbonate, holds promise of further reducing the cost of packaging materials. Any packets produced locally should bear instructions for their use in the local language(s), and preferably be accompanied by inexpensive pictorial and printed material.

In clinics and hospitals with even the simplest pharmacies, ORS can be prepared in bulk for administration to visiting patients, and in simply made packets for immediate use at home. In view of the need for greatly increased supplies of ORS, such cost-saving measures should be implemented whenever possible, and efforts should be made to develop appropriate small-scale production technology.

The marketing and distribution of supplies of prepacked ORS through commercial and non-governmental channels should also be promoted. Where a large enough demand can be generated through widespread promotional efforts, it will be possible to distribute ORS on a commercial basis, as has been demonstrated in some countries.

In establishing programmes the production and distribution of other supplies besides ORS, such as intravenous fluids, weighing scales, containers, measuring spoons, and educational materials also need to be considered.



## NATIONAL RESPONSIBILITY AND EXTERNAL SUPPORT

The promotion of the proper management of diarrhoea with emphasis on ORT depends on the government's decision and support in each country. While the health services are the major instrument for implementation, educational channels, communications media, non-governmental organizations (especially women's organizations), and other sectors and agencies will also need to be involved.

External cooperation, both technical and material, from international, bilateral, professional, and other non-governmental sources has been an important factor in the progress made so far. If the goal of a much wider application of ORT technology is to be achieved, this cooperation will need to be increased and coordinated, especially in view of the present very difficult financial situation in the developing countries.

At the international level, WHO will

- promote an exchange of views with doctors and the diffusion of technical information;
- support and encourage research to find new drugs and vaccines and to develop, if possible, a less costly and even more effective and stable ORS product; and
- organize managerial and technical training courses.

At the country level, WHO and UNICEF will work together in their respective spheres to support

- planning and evaluation of national diarrhoeal diseases control programmes, bearing in mind their importance and relationship to the development of primary health care services;

- training of community-based workers;
- development of communication and information materials on ORT, including diarrhoeal management at home; and
- establishment of ORS production at cottage industry or manufacturing level, development of appropriate production technology, and provision of ingredients for ORS in bulk supplies or packets.

Both agencies will continue to support operational research, including social and behavioural studies, to identify the most suitable and effective approaches for promoting the administration of ORT at the household and community level. This remains one of the most important and pressing issues relating to research on primary health care systems.

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