Oral Rehydration Solution (ORS) Recipes

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The important thing to remember is that these solutions all deliver approximately the same amount of electrolytes and sugar to help both drive water into the circulation and to replace electrolytes lost with vomiting and/or diarrhea. All of the recipes are best if served chilled, but this is NOT essential.

Once the oral rehydration solution has been made, it should be given to the individual with diarrhea as a means to prevent and treat dehydration. It is often better to take very small sips of the ORS frequently, rather than attempting to drink a full glass. It is not necessary to restrict water intake as long as the child or adult with diarrhea is drinking the oral rehydration solution as well. Watch the patient's condition! Check vital signs frequently and adjust appropriately.

Recent Lessons Learned from the Literature: Suggested Features of ORS

- Osmolarity in the range of 200 to 300 mosm/L
- Sodium of 60–90 mEq/L
- Potassium of ~20 mEq/L
- Rice starch polymers preferred glucose source (see rice section appended)
  - Maximizes absorptive capacity without an osmotic load
- Carbohydrate:Sodium ratio of 1:1

I've appended Rice-based solutions to the end of this document. These solutions may provide a low-cost effective alternative to standard ORS.

G2 Gatorade™ augmented. *(Gatorade is a product of the Pepsi Corporation.)*
(add 1/2 tsp sodium chloride to increase sodium to 63 mEq)

1 liter contains 63 mEq Sodium, 32 mEq Chloride, 3mEq Potassium, 28 gm Glucose, 254mOsm. Consider adding ¼ teaspoon of salt substitute above mixture to increase delivered K^{++}.

Comparison of Commercially Available Fluids with WHO ORS				
Component	**Gatorade**	**G2 Gatorade + ½ tsp salt**	**WHO reduced osmolarity ORS**	**Pedialyte**
Sodium	23.5 Meq/L	63 mEq/L	75 mEq/L	45 mEq/L
Potassium	<1 mEq/L	3 mEq/L	20 mEq/L	20 mEq/L
Chloride	17 mEq/L	32 mEq/L	65 mEq/L	35 mEq/L
Citrate	---	---	10 mEq/L	30 mEq/L
Sugar	58 g sugar/L	156 (28gm/l)	75 (13gm/l)	25 g/L
Osmolality	280-360 mOsm/kg	254 mOsm	245 mOsm	250 mOsm
Cost	$$	$$	$	$$$$

Because it is cheap, effective, easy to make and relatively good tasting... I frequently recommend the augmented G2 formula above. The table is a

comparison of the electrolytes and sugar contained in and the cost of the G2(augmented) versus Pedialyte™ versus WHO formula.

World Health Organization Reduced Osmolality ORS Recipe

Ingredients:

- 3/8 tsp salt (sodium chloride)
- ¼ tsp Morton® Salt Substitute® (potassium chloride)
- ½ tsp baking soda (sodium bicarbonate)
- 2 tbsp + 2 tsp sugar (sucrose)
- Add tap water to make one (1) liter
- *Optional: Nutrasweet® or Splenda® based flavoring of choice, to taste*

Directions:

1. Add the dry ingredients to a 1 liter bottle.
2. Add enough water to make a final volume of 1 liter; mix well.
3. If desired, add Nutrasweet® or Splenda® to taste. Mix well.
4. Sip as directed above
5. Discard after 24 hours.

To add add potassium when salt substitute is not available or to improve taste, you may add orange juice or banana. To each liter, add

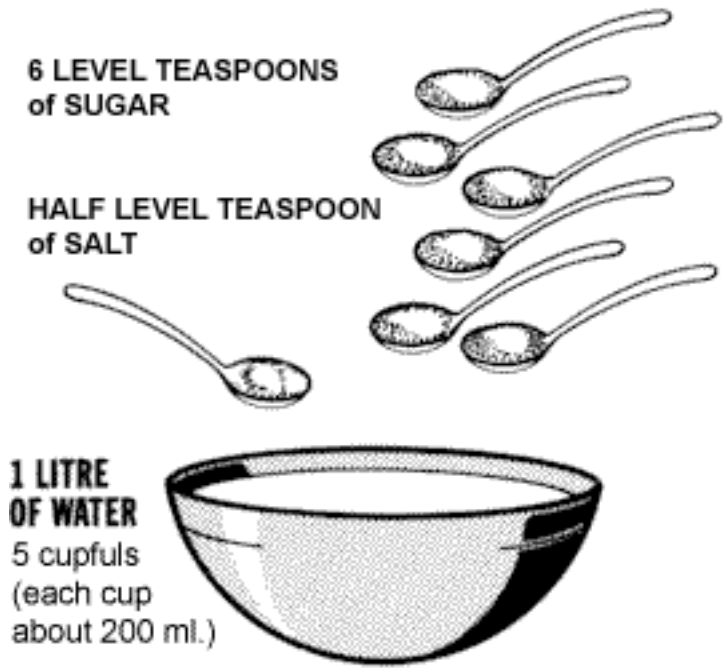
- A half cup of orange juice or
- Half of a mashed banana

Contains 27 grams of sucrose, 70 mEq per liter of sodium, 20 mEq per liter of potassium and 30 mEq per liter of bicarbonate. The final osmolarity is approximately 245 mOsm per liter.

Commercially made packets of WHO ORS formula are available in camping stores, on the internet, and from Amazon. Advantages include simplicity, convenient packaging, and stable storage containers. This convenience comes at a significant mark-up.

The "Field Formula"

Preparing One (1) Liter Oral Rehydration Solution [ORS] using Salt, Sugar and Water at Home (Some field alternative measures are given in parenthesis)
Ingredients:



Half (1/2) level teaspoon of Salt (2 pop bottle cap full)

Six (6) level teaspoons of Sugar (8 pop bottle caps full)

One (1) Litre of clean drinking or boiled water and then
Cooled [5 cupfuls of water (each cup is about 200 ml.)]

Consider adding about ¼ teaspoon of salt substitute – Potassium chloride – KCl for the potassium K+ and/or ¼ teaspoon of baking soda if you have/can get it to augment the potassium and sodium. If you add these two, you essentially have the WHO formula

Preparation Method: Stir the mixture till the salt and sugar dissolve.

For another Field Formula, Dr. Jan Gurley made a video that shows you how to make Oral Rehydration Therapy (ORT) in the sheet camps, using salt, sugar, and bottlecaps to measure. 4 caps sugar, 1 cap salt, 500ml clean water = life. Direct link to video here: http://www.youtube.com/watch?v=yPrqgZL7G6E

One of my 'projects' for a rainy day is to figure out how many McDonald's (or similar fast food) salt and sugar packages would be used to make the formula above. It's just a matter of measuring how much is in each package. Just to describe another field formula…

Patients typically report that the ORS electrolyte solution tastes REALLY good ... when you actually need it. ORS is the preferred oral rehydration fluid because the potassium (which gives it the 'flavor') and sodium in it cause 'active transport' of fluid across the small bowel wall and into the blood stream

Why use oral rehydration?

WHO sums it up: In the late 1970s, acute diarrhea was killing around 5 million children each year. The obvious response to dehydration -- giving the patient water to drink -- did not work because the liquid rushed through the digestive tract too quickly to be absorbed by the body tissues. Over the years, two other techniques were developed to replace liquids lost in dehydration (from any cause):

> ***Intravenous Rehydration:*** *The quick technical answer seems to be to bypass the digestive system altogether and rehydrate the body using an intravenous drip of an appropriate sterile electrolyte solution. The physiological paradigm under which Western physicians operate is that intravenous therapy is superior to all others. Intravenous therapy appears more scientific, there is an apparatus, and the physician can have precise control over the intake of a patient. It is also a significant 'cash generator' for the hospital, since they can bill for the care, the supplies, and the overnight stay.*
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> *This is an invasive and traumatic procedure for a child (and often for a dehydrated adult). It must be started and administered by someone with medical training. When the IV is too difficult to start, either a 'central vein' is used or the needle is inserted into the marrow of a long bone (intraosseous infusion). This increases the danger and the pain associated with the IV start and requires additional training and practice. When disasters occur, such as the cholera epidemic in Haiti, medical attention may not be available in many parts of the affected area. Intravenous solutions may not be available or the medical providers who know how to initiate and maintain IV's may not be able to provide the care needed.*
>
> *ORS is often criticized and ridiculed because Western medicine has surpassed this simplistic (and therefore inferior) solution to cholera. Oral therapy appears primitive and less controlled. It is also cost efficient and proven to be clinically effective.*
>
> ***Hypodermoclysis****, the subcutaneous infusion of fluids, is another useful hydration technique suitable for mildly to moderately dehydrated patients, especially the elderly. The method is considered easy and safe and does not pose any serious complications. The most frequent adverse effect is mild subcutaneous edema that can be treated by local massage or systemic diuretics. Approximately 3 L can be given in a 24-hour period at two separate sites in adults. Common infusion sites are the chest, abdomen, thighs and upper arms. Hypodermoclysis can be used for children, but much less fluid can be delivered to their smaller body surfaces. Hypodermoclysis does require medical training and most providers are not familiar with the technique. It is a technique that predates intravenous fluid administration. It does require sterile fluids and medical equipment to administer.*

In 1968, researchers in Bangladesh and India discovered that adding glucose to water and salt in the right proportions enabled the liquid to be absorbed through the intestinal wall. So anyone suffering from diarrhea (or mild vomiting) could replace the lost fluids and salts simply by drinking a solution that contained both sugar and salt.

> *When glucose is present within the small intestine, sodium and water absorption is increased. This transport is stimulated up to a glucose concentration of about 50 mM, a level at which jejunal sodium absorption is increased by fourfold and water absorption by six fold.*

Too much sugar, however, will actually increase the diarrhea. The bowel will absorb fluids from the body to equalize the osmotic pressure and a high osmotic load (too much sugar) causes transfer of fluid INTO the bowel. (Think of the effects of prune juice with an osmotic load of ~1200 mOsm [far higher than the solutions discussed in this paper.]).

One of the first large-scale field applications of oral rehydration salts took place in 1971 during the Bangladesh war of independence when outbreaks of cholera swept through refugee camps. Of the 3,700 victims treated with ORS, over 96 per cent survived. As one gastroenterologist has put it: "The discovery that sodium transport and glucose transport are coupled in the small intestine so that glucose accelerates absorption of solute and water is potentially the most important medical advance this century."

Short-term vomiting is not a contraindication to receiving oral rehydration therapy. In persons who are vomiting, drinking oral rehydration solution at a slow and continuous pace will help the person not vomit. Even when vomiting actively, about 1/2 of the fluid consumed IS absorbed even though it 'looks like nothing stayed down." So keep taking fluids frequently in small amounts. I recommend starting with 1 teaspoon of clear liquids every 5-10 minutes. Increase the amount of fluid by 1 teaspoon at at time every 1/2 to 1 hour. If you get nauseous or vomit, back off to the last volume that worked and keep going. Over a few hours one can get up to taking an ounce or more at a time, which will effectively provide 180-360 ml of fluid per hour - as much or more than a physician would prescribe by intravenous route.

Recent Changes: The European Society of Paediatric Gastroenterology and Nutrition in 1992 recommended an ORS containing 60 mEq/L of sodium and an osmolarity between 200 and 250 for children in developed countries who are not malnourished. The World Health Organization revised their formula to more closely approximate these recommendations using a new lower osmolality formulation containing 60–75 mEq/L sodium and glucose ranging from 75-90 mmol/L.

Rice-Based Solutions:

Rice powder has been shown to effectively replace the standard glucose in ORS, decreasing stool output, duration of diarrhea, and requirements for intravenous fluids compared to the WHO ORS formula. Although there isn't nearly as much research about rice-based solutions (or other starch containing solutions), it appears to be promising for the treatment of diarrhea and possibly vomiting.

Rice-powder ORS appears to be better than glucose ORS in several ways.

- The mixture has been shown to reduce the volume of stool in acute cholera cases by 40-50 per cent and therefore reduces the amount of fluid which has to be drunk by almost half
- There is also less vomiting noted with rice-powder solution than with ORS solution.
- The rice-powder fluid is more of a food than simply a fluid. It contains much more energy (or calories) and other nutrients than ORS solutions which contain glucose or sucrose.

What is the difference between rice-water and rice-powder ORS?

- Rice-water is the fluid drained from rice after cooking, and although this can be used as early home therapy, the amount of fluid may be quite small. **The composition of rice-water is also generally unsuitable for active rehydration because it contains very little salt and a variable amount of rice starch.**

- Rice-powder ORS solution is a fluid in which the glucose in the ordinary WHO/UNICEF formulation has been replaced by a standardized amount of rice-powder, giving the correct balance of carbohydrate and electrolytes.

How much rice-powder should be used and how do you make up the rehydration drink? Multiple authors recommend 50g of rice-powder cooked in a little more than a litre of water for 5-7 minutes with frequent stirring. Then the other ingredients (the electrolyte salts) of ORS can be mixed in. (50 grams of rice flour is approximately 5 tablespoons)

What sort of rice should be used and how should you grind it?
Ordinary raw rice can be ground and cooked to make rice-powder ORS. Roasted or puffed rice can also be used, but ordinary raw rice is the cheapest and most available. This can be ground before cooking in a mechanical flour-mill or using traditional mortar and pestle. Rice flour is the same as rice powder and is readily available. In an emergency, potatoes, corn, wheat, or barley could possibly be used, but there is no research available using these starches.