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ELECTROLYTE REPLENISHER IS THE TARGET OF ORAL REHYDRATION THERAPY

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ABSTRACT

Electrolytes are minerals in your blood and other body fluids that carry an electric charge. Electrolytes affect how your body functions in many ways, including: The amount of water in your body. The acidity of your blood (pH) Your muscle function. An electrolyte is a medium containing ions that is electrically conducting through the movement of those ions, but not conducting electrons. This includes most soluble salts, acids, and bases dissolved in a polar solvent, such as water. Upon dissolving, the substance separates into cations and anions, which disperse uniformly throughout the solvent. Solid-state electrolytes also exist. In medicine and sometimes in chemistry, the term electrolyte refers to the substance that is dissolved. The major electrolytes: sodium, potassium, and chloride. Electrolytes are important because they help: Balance the amount of water in your body. Balance your body's acid/base (pH) level. Move nutrients into your cells.

KEYWORDS: ORS, ORT, Electrolyte, Buffers, Body fluid.

INTRODUCTION

Oral rehydration solutions (ORS) are used to treat dehydration caused by diarrhea, a common illness in travellers. Unlike other fluids, the ratio of the ingredients in an ORS matches what the body needs to recover from a diarrheal illness. Padma Vibhushan [2023] Dilip Mahalanabis [12 November 1934 – 16 October 2022], who discovered Oral Rehydration Therapy.[1]

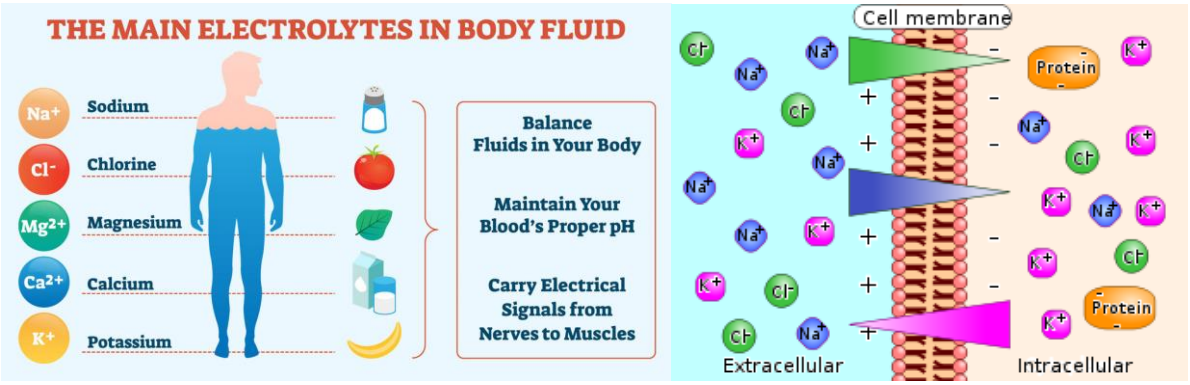

Figure-1: Electrolyte in body.

ORS consists of 4 constituents: 1. sodium chloride [3.5 grams]; 2. trisodium citrate dihydrate [2.9 grams]; 3. potassium chloride [1.5 grams]; 4. Glucose [13.5 grams]. An oral rehydration solution is used to treat moderate dehydration. It's made of water, glucose, sodium, and potassium. The combination optimizes the absorption of fluid in the intestines, which helps quickly replenish fluids. The solution is often used to treat dehydration due to diarrhea or vomiting. Oral rehydration solution (ORS) is an oral powder–containing mixture of glucose sodium chloride, potassium chloride, and sodium citrate. After being dissolved in the requisite volume of water they are intended for the prevention and treatment of dehydration due to diarrhea, including maintenance therapy.[2]

Table-1: Table of electrolyte.

Component	Standard [gms/lit]	Low-osmolar [gms/lit]
NaCl	3.5	2.6
Trisodium citrate	2.9	2.9
KCl	1.5	1.5
Glucose	20	13.5
Total	27.9	20.5

An oral rehydration solution (250ml) prepared according to WHO formula. Other names. oral rehydration solution (ORS), oral rehydration salts (ORS), glucose-salt solution. Side effects may include vomiting, high blood sodium, or high blood potassium. Oral rehydration therapy (ORT) is a type of fluid replacement used to prevent and treat dehydration, especially due to diarrhea. It involves drinking water with modest amounts of sugar and salts, specifically sodium and potassium. Oral rehydration therapy can also be given by a nasogastric tube. Therapy should routinely include the use of zinc supplements. Use of oral rehydration therapy has been estimated to decrease the risk of death from diarrhea by up to 93%. ORT is based on evidence that water continues to be absorbed from the gastrointestinal tract even while fluid is lost through diarrhea or vomiting.[3] The World Health Organization specify indications, preparations and procedures for ORT. Electrolyte is the umbrella term for particles that carry a positive or negative electric charge. In nutrition, the term refers to essential minerals in your blood, sweat, and urine. When these minerals dissolve in a fluid, they form electrolytes — positive or negative ions in metabolic processes. This can negatively affect vital body systems. Electrolytes must be evenly balanced for your body to function properly. Severe electrolyte imbalances can cause serious problems such as coma, seizures, and cardiac arrest. Confusion and irritability. Diarrhea or constipation. Fatigue. Headaches. Irregular or fast heart rate (arrhythmia). Muscle cramps, muscle spasms or weakness. Nausea and vomiting. Numbness or tingling in limbs, fingers and toes.[4]

Electrolytes found in your body include: Sodium, Potassium, Chloride, Calcium, Magnesium, Phosphate, Bicarbonate.

These electrolytes are required for various bodily processes, including proper nerve and muscle function, maintaining acid-base balance and keeping you hydrated. Electrolytes are minerals that carry an electric charge. They're found in your blood, urine and sweat and are vital to specific processes that keep your body functioning as it should.[5]

Figure-2: Padma Vibhushan [2023] Dilip Mahalanabis who discovered Oral Rehydration Therapy.

Electrolytes are of four types: Salt of weak acid and weak base [pH: neutral], Salt of weak acid an strong base [pH: basic], Salt of strong acid and weak base [pH: acidic] & Salt of strong acid and strong base [pH: neutral]. A buffer is a chemical system that prevents a radical change in fluid pH by dampening the change in hydrogen ion concentrations in the case of excess acid or base. Most commonly, the substance that absorbs the ions is either a weak acid, which takes up hydroxyl ions, or a weak base, which takes up hydrogen ions. Strong electrolytes fall into three categories: strong acids, strong bases, and salts. (Salts are sometimes also called ionic compounds, but really strong bases are ionic compounds as well.) The weak electrolytes include weak acids and weak bases. One way to determine the pH of a buffer is by using the Henderson–Hasselbalch equation, which is $pH = pK_a + \log([A^-]/[HA])$. In this equation, [HA] and [A-] refer to the equilibrium concentrations of the conjugate acid–base pair used to create the buffer solution. The Henderson-Hasselbalch equation provides a relationship between the pH of acids (in aqueous solutions) and their pKa (acid dissociation constant).

Figure-3: ORT formulations.

WHO/UNICEF guidelines suggest ORT should begin at the first sign of diarrhea in order to prevent dehydration. Babies may be given ORS with a dropper or a syringe. Infants under two may be given a teaspoon of ORS fluid every one to two minutes. Older children and adults should take frequent sips from a cup, with a recommended intake of 200–400 mL of solution after every loose movement. The WHO recommends giving children under two a quarter- to a half-cup of fluid following each loose bowel movement and older children a half- to a full cup. If the person vomits, the caregiver should wait 5–10 minutes and then resume giving ORS which may be given by aid workers or health care workers in refugee camps, health clinics and hospital settings.[6] Mothers should remain with their children and be taught how to give ORS. This will help to prepare them to give ORT at home in the future. Breastfeeding should be continued throughout ORT. ORS DAY & ORS WEEK" is being celebrated from July 25th to 31st (Slogan 2023 - 'Oral rehydration. No dehydration') and ORS day on July 29th (Theme 2023 – O Only R Rational S Solution for Diarrhoea).[7]

Solutions for Oral Rehydration: Standard WHO ORS: Sodium 90, potassium 20, chloride 80, citrate 10, and glucose 111. WHO reduced-osmolarity ORS: Sodium 75, potassium 20, chloride 65, citrate 10, and glucose 75.

A historical turning point occurred in the treatment of diarrhea when it was discovered that glucose could enhance intestinal sodium and water absorption. Adding glucose to salt water (oral rehydration solution, ORS) more efficiently replaced intestinal water and salt losses. The results are consistent with the hypothesis that addition of Zn to an ORS may contribute to improving the physiologic status of the small intestine and potentially reduce the risks of recurrent diarrhea episodes.[8]

CONCLUSION

In physiology, the primary ions of electrolytes are sodium (Na^+), potassium (K^+), calcium (Ca^{2+}), magnesium (Mg^{2+}), chloride (Cl^-), hydrogen phosphate (HPO_4^{2-}), and hydrogen carbonate (HCO_3^-). The electric charge symbols of plus (+) and minus (−) indicate that the substance is ionic in nature and has an imbalanced distribution of electrons, the result of chemical dissociation. Sodium is the main electrolyte found in extracellular fluid and potassium is the main intracellular electrolyte; both are involved in fluid balance and blood pressure control. All known multicellular lifeforms require a subtle and complex electrolyte balance between the intracellular and extracellular environments. In particular, the maintenance of precise osmotic gradients of electrolytes is important. Such gradients affect and regulate the hydration of the body as well as blood pH, and are critical for nerve and muscle function. Various mechanisms exist in living species that keep the concentrations of different electrolytes under tight control. Both muscle tissue and neurons are considered electric tissues of the body. Muscles and neurons are activated by electrolyte activity between the extracellular fluid or interstitial fluid, and intracellular fluid. Electrolytes may enter or leave the cell membrane through specialized protein structures embedded in the plasma membrane called "ion channels". For example, muscle contraction is dependent upon the presence of calcium (Ca^{2+}), sodium (Na^+), and potassium (K^+). Without sufficient levels of these key electrolytes, muscle weakness or severe muscle contractions may occur. Electrolyte balance is maintained by oral, or in emergencies, intravenous (IV) intake of electrolyte-containing substances, and is regulated by hormones, in general with the kidneys flushing out excess levels. In humans, electrolyte homeostasis is regulated by hormones such as antidiuretic hormones, aldosterone and parathyroid hormones. Serious electrolyte disturbances, such as dehydration and overhydration, may lead to cardiac and neurological complications and, unless they are rapidly resolved, will result in a medical emergency.

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