International Journal of Science and Research (IJSR)
ISSN: 2319-7064
SJIF (2022): 7.942

A Comprehensive Review on Oral Rehydration Salt

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Abstract: ***Diarrhea is reason for 7, 600, 000 deaths, worldwide, among children aged 5 years. The survival of children affects from hypovolemic shock depends highly on the promptness of the treatment. Poorly managed cases have been reported with organ damage, acidosis, kidney failure, and death. Diarrhea associated hypovolemia is the second leading cause of death among the children aged in between of 5 years. Oral rehydration therapy was first introduced in 1960 it is a standard for treating fluid loss as a result of acute diarrhea including cholera. Oral rehydration solution is collected for glucose electrolyte balance along with base and citrate is managed to treat dehydration and metabolic acidosis. The use of ORS has reduced the incidence of combined treatment of mortality.*** [1] [2]

Keywords: Oral rehydration therapy, Diarrhea, Cholera, Hypovolemic shock, Mortality, rehydration, electrolyte.

1. Introduction

Oral Rehydration Solution was used to replace the water and electrolyte losses in diarrhea patients including cholera. It is mixed with a combination of sugar and electrolyte solutions. ORS is simple, less and used to treat fluid loss as a result of diarrhea and can be given at home by mothers or caregivers during occurrence of diarrhea. Previous studies have shown that the deaths from diarrhea diseases have significantly declined after the implementation of ORS. For the last two decades, results shows that under - five mortality due to diarrhea diseases has declined from 2.7 million in 2000 to 0.5 million in 2015 and 0.48 million in 2020. It is caused by pathogenic bacteria ingested with contaminated food or water and is commonly found where sanitation measures are poor. It causes severe diarrhea and vomiting, which can lead to profound dehydration and potentially death. Oral rehydration solution is an effective treatment for diarrhea, and ORS which has a lower electrolyte content than the earlier electrolyte content is safe and more effective in people with non - choleradiarrhea. This review revealed that ORS appears to be as effective for rehydrating people with cholera, but may cause at low blood salt levels. More research is needed to better understand these potential safety concerns. [2] [3]

Figure 1: Oral Rehydration Salt BP

History of Oral Rehydration Therapy

Almost 2, 500 years ago, Shushruta narrate the treatment of acute diarrhea with rice water, coconut juice and carrot soup. In 1817, the first cholera pandemic was emerged out of Ganges delta with an outbreak in Jessore, India which then spreaded worldwide. William Brooke treated patients with IV fluids lowers mortality from 70% to 40%. The intravenous fluid therapy was the mainstay for diarrheal dehydration. A group of physiologists observed that glucose enhances the absorption of sodium and water across the intestinal brush - border membrane of experimental animals and that no morphological upgrades occur in the gut epithelium of cholera patients for the development of modern oral rehydration salt (ORS) solution. [3] the results showed the efficacy of ORS in cholera cases among Bangladeshi refugees (1971 - 72) and Sircar et al in 1978 demonstrated the efficacy of ORS in a cholera epidemic in Manipur. De et al in 1974 and Chatterjee et al in 1978 convincingly showed the efficacy of ORS in children with diarrhea including cholera. Based on this data provided that, the World Health Organization (WHO) in 1978 launched the global diarrheal diseases control program with ORS at its

heart and the short - term objective of reducing mortality due to diarrhea. [4] [5]

Diarrhea:

Diarrhea is defined as the quick transit of gastric contents through the bowel. The repetition of defecation is variable in childhood and bowel movement in a day. The WHO describing diarrhea as three or more loose or watery stools per day. The absorption and secretion of water and electrolytes in to the gut is a lately balanced, dynamic process and, when there is loss of this balance, diarrhea results. [6] [7]

Categorization of Diarrheas: -

- Acute watery diarrhea.
- Acute bloody diarrhea.
- Persistent diarrhea. [8]

Malabsorptive Diarrhea: -

Absorption of water in the intestines is depends upon the adequate absorption of solutes. If more amounts of solutes are retained in the intestinal lumen, the water will not be absorbed and resulting in diarrhea. Malabsorptive diarrheausually arises from either situation

- Ingestion of poorly absorbed substrate
- Malabsorption. [9]

Travelers Diarrhea

Large volumes of water are normally released into the small intestinal lumen, but a large quantity of this water is efficiently absorbed before reaching the large intestine. Diarrhea happens when secretion of water into the intestinal lumen exceeds absorption. This mostly affect adult population

Infectious Diarrhea

The epithelium of the digestive tube is protected by a number of mechanisms constituting the gastrointestinal barrier, but like many barriers, it can be breached. Upset of the epithelium of the intestine is a very common cause of diarrhea in all species. [10] [11].

Epidemiology: -

A study was conducted in an urban slum settlement in Kibera, a division within the city of Nairobi, Kenya. The population of Kibera is estimated at 250, 000, and is ethnically heterogenous. The study was performed from the age of 3 to 37 months has greatest risk of diarrhea. Combined 920 children were recruited for 14 months study and an average of 483 children were followed up each month. Diarrhea was defined as the passage of liquid or semisolid stools more than three times a day, and 1st day of diarrhea reported by the mother that met this definition was considered as the beginning of an episode. The objective of the study was to identify risk factor for longer duration diarrhea. In this study it was found out that in 843 male children, 49.5% were affected by prolonged diarrheal illness were 22.2% children of 2 - 5 months followed by 32.1% of 6 - 11 months, 21.4% of 12 - 17 months, 17.4% of 18 - 23 months and 6.9% of children who are more than 24 months. In the case study conducted out of which 837 children were breastfed in which 98.4% of children aged 2 - 5 months, 95.2% of children aged 6 - 11 months, 77.2% of 12 - 17 months, 49% of 18 - 23 months and 21.1% of 24 or more than 24 months aged children were affected by diarrheal illness. The nutritional status is by Z - score of the children implies 39.2% of children with height - for - age is less than or equal to - 2, 19.7% children with weight - for - age is less than or equal to - 2 and 2% children with weight - for - height is less than or equal to are affected by diarrheal illness. [12]

Physiological Basis of Efficacy of Oral Rehydration Solution

There is a continuous exchange of water through the intestinal wall - up to 20 litres of water is secreted and very nearly as much is reabsorbed every 24 hours - this mechanism allows the absorption into the bloodstream of soluble metabolites from digested food. In a state of diarrhea disease, the balance is upset and much more water is secreted than is reabsorbed causing a net loss to the body which can be as high as several litres a day. In addition to water, sodium is also lost [13]. However, in a state of dehydration water is conserved by anuria and the sodium regulation cannot work effectively. Thus, continued diarrhea causes rapid depletion of water and sodium, which is to say, a state of dehydration. imply giving a saline solution (water plus Na^+) by mouth has no beneficial effect because the normal mechanism by which Na^+ is absorbed by the healthy intestinal wall is impaired in the diarrhea state and if the Na^+ is not absorbed neither can the water be absorbed. In fact, excess Na^+ in the lumen of the intestine causes increased secretion of water and the diarrhea worsens. If glucose (also called dextrose) is added to a saline solution a new mechanism comes into play. The glucose molecules are absorbed through the intestinal wall - unaffected by the diarrhea disease state - and in conjunction sodium is carried through by a co - transport coupling mechanism. This occurs in a 1: 1 ratio, one molecule of glucose co - transporting one sodium ion (Na^+). It was the discovery of this mechanism of co - transport of sodium and glucose which the Lancet described as "potentially the most important medical advance this century" In fact. It should be noted that glucose does not co - transport water - rather it is the now increased relative concentration of Na^+ across the intestinal wall which pulls water through after it. [14] [15]

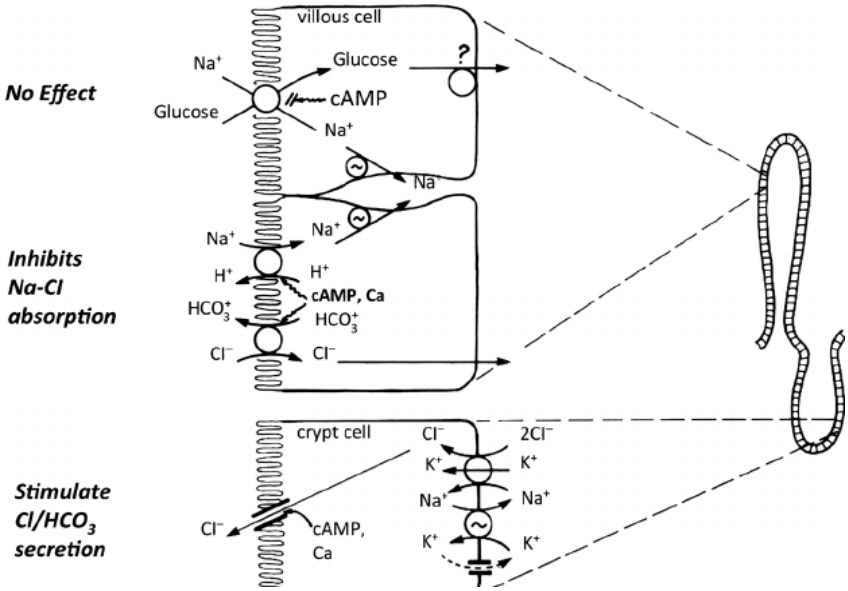

Figure 2: Physiological basis of ORS rests on the demonstration that absorptive and secretory processes in the mammalian small intestine are separate and independent. The cholera - toxin - mediated cyclic AMP - induced active Cl secretion does not affect glucose - induced Na absorption; and most importantly, glucose stimulates Na absorption via a cyclic AMP - independent transport process. Glucose increases sodium absorption and it also reverses cyclic AMP's down regulation of Na – H exchanger 3 [16]

Preparation of ORS

Figure 3: Safe preparation of oral rehydration salt solution [17]

Composition and OS Molarity

Table 1: Composition of New ORS [18]

New ORS	gram/ Litre	%	New ORS	mmol/ Litre
Sodium Chloride	2.6	12.683	Sodium	75
Glucose (Anhydrous)	13.5	65.854	Chloride	65
Potassium Chloride	1.5	7.317	Glucose (Anhydrous)	75
Trisodium Citrate, Dihydrate	2.9	14.146	Potassium	20
			Citrate	10
Total	20.5	100.00	Total OS Molarity	245

This ORS composition has clinical evaluations and stability tests. The pharmacokinetics and therapeutic profile of the ORS substances are as follows:

- Glucose absorbs sodium on a 1: 1 molar basis in the small intestine. [19]
- Sodium and potassium are replaced the loss of essential ions during diarrhea.
- Citrate corrects the acidosis as a result of diarrhea and dehydration.

ORS may contain suitable pharmaceutical aids (e. g., suitable flow agent in minimal quantities to improve the flow characteristics) and/or the flavoring agents. [20] [21]

2. Dosage

Prevention of dehydration (WHO - Treatment plan A)

- Child under 24 months50 to 100 ml after each loose stool
- Child from 2 to 10 years100 to 200 ml after loosestool.
- Child above 10 years and adult 200 to 400 ml after each loose stool.

Treatment of moderate dehydration (WHO - Treatment plan B)

For Child and adult: -
Over the first four hours:

Table 2: WHO Administration PlanB [23]

Age	Under 4 months	4 to 11 months	12 to 23 months	2 to 4 years	5 to 14 years	15 years and over
Weight	Under 5 kg	5 to 7.9 kg	8 to 10.9 kg	11 to 15.9 kg	16 to 29.9 kg	30 kg and over
ORS in ml	200 – 400	400 – 600	600 – 800	800 - 1200	1200 – 2200	2200 - 4000

After four hours: -

- If there are no signs of dehydration: follow *Treatment plan A.*
- If there are signs of moderate dehydration: repeat *Treatment plan B.*
- If there are signs of severe dehydration: start IV therapy (*Treatment plan C*). [24]

Treatment of severe dehydration (WHO - Treatment plan C)

- In mixture with IV therapy and only to a conscious patient:
- Child and adult: 5 ml/kg per hour
- After 3 hours reassess and choose the appropriate plan *A, B* or*C*. [25]

A New Policy to reach more Children: -

In **July** 2019, the world Health Organization added Co - packaged ORS and Zinc to the Essential Medicinefor children coordinate with diarrhea treatment best practices and create the enable environment for greater access and afford both zinc and ORS. [26]

Contra - indications, Adverse effects, Precautions: -

- If the eyelids become swollen during the treatment stop ORS given in plain water than resume ORS according to treatment plan 1A when the puffiness is completely gone.
- If case of vomiting, stop ORS for 10 min and then start at a slower rate, do not stop rehydration.
- Pregnancy: no allergy
- Breast - feeding: no reaction. [27] [28]

3. Conclusion

Oral rehydration therapy has been grown over the past 40 years and has been established as the standard of therapy for the treatment of the dehydration and metabolic acidosis associated with acute diarrhea. The use of ORS has been attributable as primary reason for the substantial reduction in morbidityand mortality of acute infectious diarrhea. Despite these successes, ORS is not employed by mothers to the extent that would anticipate, and multiple efforts have been made possible for the the dosage of ORS and oral rehydration therapy. [29] [30]

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