Herbal Oral Rehydration Solutions: A Natural Approach to Fluid and Electrolyte Management

Saveriya Parveen Ab Raheman[1], Ansarii Mohammed Sharique Ansari[2], Mohammed Shabbir[3], Mohammed Saud Khan Ejaz Khan[4], DR. Deepak Shomuansi[5]
[1,2,3,4,5]*Department of Pharmacognosy, KBHSS Trust's Institute of Pharmacy, Malegaon (423105) Dist. Nashik, Maharashtra*

***Abstract*—To formulate a standardized Herbal Oral Rehydration Solution (H-ORS) using selected medicinal plant extracts. To evaluate physicochemical, phytochemical, and microbiological parameters of the formulation. To compare H-ORS with WHO ORS for pH, osmolarity, clarity, and stability. To assess additional therapeutic benefits including antidiarrheal, antimicrobial, antioxidant, and anti-inflammatory properties. Aqueous extracts of Zingiber officinale (ginger), Punica granatum (pomegranate peel), Psidium guajava (guava leaves), and Mentha piperita (peppermint) were prepared. Coconut water, rice starch solution, sodium chloride, and potassium chloride were incorporated to prepare a 500 ml standardized H-ORS. Evaluation included pH, osmolarity, phytochemical tests, microbial load, and short-term stability. H-ORS exhibited pH 6.8 and closely matching WHO ORS standards. Phytochemical tests confirmed presence of tannins, flavonoids, polyphenols, providing antidiarrheal and antioxidant effects. The formulation remained microbiologically safe up to 15 days at room temperature and 30 days at refrigeration.**

***Index Terms*—Oral Rehydration Solution (H-ORS) Phytochemicals (Tannins, Flavonoids, Polyphenols), Coconut Water-Based ORS, electrolyte**

I. INTRODUCTION

Dehydration is a clinically significant condition resulting from excessive loss of water and electrolytes due to diarrhea, vomiting, fever, or environmental heat exposure. Oral Rehydration Therapy (ORT) has been one of the most successful medical interventions worldwide, reducing millions of deaths [1]

Conventional Oral Rehydration Solution (ORS), recommended by the World Health Organization (WHO), works through the sodium–glucose co-transport mechanism [1].

Although effective, conventional ORS offers only rehydration without additional therapeutic advantages such as antimicrobial or antidiarrheal effects. Herbal Oral Rehydration Solutions (H-ORS) aim to improve traditional ORS by integrating medicinal plant extracts known for their pharmacological activities [2].

Medicinal plants like ginger, guava leaves, peppermint, and pomegranate have been traditionally used in Ayurvedic and ethno medicinal practices to treat diarrhea and gastrointestinal disturbances. Therefore, developing a standardized, scientifically evaluated herbal ORS may provide a multi-beneficial alternative, especially in low-resource settings [3].

II. MATERIALS AND METHODS

Several medicinal plants have been traditionally used for managing dehydration and gastrointestinal disturbances. These plants not only provide hydration but also contribute therapeutic benefits.

Cocas nucifera (Coconut water)

Figure no.1. Coconut water

Coconut water is a natural isotonic fluid rich in potassium, sodium, and glucose. It is widely used as a natural rehydration solution due to its excellent electrolyte balance and high bioavailability [4].

Mentha Piperita (Peppermint leaves)

Figure no.2. Peppermint leaf water

Peppermint possesses antispasmodic and carminative properties, which help relieve gastrointestinal discomfort and reduce intestinal motility [4].

Punica granatum (Pomegranate rind)

Pomegranate contains polyphenols and tannins that exhibit strong antioxidant and antidiarrheals effects, gut mucosal protection [5].

Zingiber officinale (Ginger rhizome)

Ginger is known as for its antiemetic and antiinflammatory properties. It helps in reducing nausea, vomiting [6].

Psidium guajava (Guava leaves)

Guava leaves are rich in tannins and flavonoids, which help reduce intestinal secretions and control diarrhea [7].

Table no.1. Material & Quantity

Sr.No.	Ingredients	Batch No.					Cateogory
		Quantity Per Ors Liq. (Ml)					
		F1	F2	F3	F4	F5	
1	Coconut Water	200ml	200ml	200ml	200ml	200ml	Electrolyte
2	Ginger Rhizome Extract	5ml	5ml	5ml	5ml	5ml	Antiemetic
3	Peppermint Leaf Extract	5ml	5ml	5ml	5ml	5ml	Antispasmodic
4	Guava Leaf Extract	5ml	5ml	5ml	5ml	5ml	Tannin
5	ɒmegranate Rind Decoction	10ml	10ml	10ml	10ml	10ml	Polyphenol
6	Sodium Chloride	1g	1.25g	1.50g	1.75g	2.0g	Supplement
7	Potassium Chloride	0.1g	0.2g	0.3g	0.4g	0.5g	Supplement
8	Distilled Water	500ml (Q.S)	500ml (Q.S)	500ml (Q.S)	500ml (Q.S)	500ml (Q.S)	Diluent

III. METHODOLOGY

- Preparation of Herbal Extracts

A. Ginger Extract

20 g fresh ginger crushed Boiled in 100 ml water for 10 minutes Filtered to obtain clear extract.

B. Pomegranate Peel Decoction

10 g dried rind boiled in 100 ml water Rich in tannins and antioxidants Filtered extract collected.

C. Guava Leaf Extract

10 g guava leaves washed and dried Boiled in 100 ml water for 15 minutes Filtered.

D. Peppermint Extract

10gm of peppermint dried leaves boil in 100ml water for 10 minutes. Filtered to obtain clear extract.

- Formulation of Herbal Oral Rehydration Solution

The formulation of the Herbal Oral Rehydration Solution (H-ORS) was carried out by incorporating herbal extracts along with essential electrolytes to achieve an effective rehydration composition. The procedure followed the fundamental principles of WHO-recommended ORS while integrating plant-based therapeutic components known for their antidiarrheal, antimicrobial, and antioxidant properties.

The formulation was prepared to obtain a 500 ml final solution, and all ingredients were measured accurately to ensure consistency and reproducibility. The following standardized procedure was adopted [8].

3.1 Composition of the Herbal ORS Formulation

The ingredients included a combination of coconut water, distilled water, herbal extracts (ginger rhizome, peppermint leaf, guava leaf, and pomegranate rind) and essential electrolytes (sodium and potassium).

Each component was selected based on its documented phytochemical profile and pharmacological importance in restoring fluid and electrolyte balance [9].

3.2 Method of Preparation

The herbal ORS formulation was prepared using the following standardized steps:

1. Preparation of Herbal Extracts:

Each herbal ingredient (ginger rhizome, peppermint leaf, guava leaves, and pomegranate rind) was subjected to aqueous extraction. The plant material was washed, chopped or powdered, boiled in distilled water for the required duration, and filtered to obtain clear extracts rich in active phytoconstituents [10].

2. Mixing of Electrolyte Base:

A mixture of coconut water and distilled water was taken as the primary base. Sodium chloride and potassium chloride were dissolved completely in this mixture to provide the essential electrolyte profile [11].

3. Incorporation of Herbal Extracts:

The prepared herbal extracts and were added sequentially to the electrolyte base with continuous stirring to ensure uniform distribution [12].

4. Filtration and Standardization:

The final mixture was filtered through sterile muslin cloth or Whatman filter paper to achieve clarity. The pH of the formulation was adjusted within the physiological range of 6.5–7.5, and osmolarity was measured to align with ORS standards [13].

5. Storage:

The prepared formulation was transferred into sterile amber glass bottles and stored under controlled conditions. Samples were maintained at both room temperature and refrigerated settings to assess short-term stability [14].

IV. EVALUATION AND QUALITY CONTROL

Quality control is crucial to ensure the safety and efficacy of herbal ORS formulations.

4.1 pH Determination

pH of the formulation was measured using a calibrated digital pH meter. The electrode was dipped into 10 ml of the sample at room temperature. Acceptable range: 6.5–7.5 (physiological range)

Purpose: To ensure the solution does not irritate the gastrointestinal mucosa and matches WHO ORS standards [15].

Figure no.3.pH test

4.2. Benedicts test

Benedict's test is a qualitative test used to detect the presence of reducing sugars such as glucose, fructose, maltose, and lactose in a sample. Reducing sugars reduce blue Cu^{2+} ions to brick-red cuprous oxide (Cu_2O) when heated in an alkaline medium.

The color change indicates the amount of reducing sugar present [16].

Figure No.4. Benedicts Test

4.3. Microbial Limit Test:

Microbial Limit Test is performed to determine the total number of viable microorganisms and to ensure the absence of pathogenic bacteria in the herbal ORS formulation.

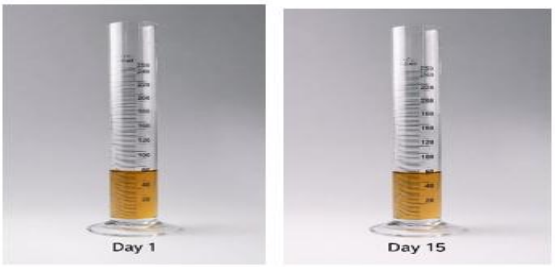

Figure no. 5 Microbial limit test

V. RESULT

The formulated Herbal Oral Rehydration Solution (H-ORS) exhibited acceptable physicochemical and microbiological characteristics. The pH of the solution remained within the physiological range (6.6–7.1), and the formulation showed good clarity, stable color, and no precipitation during the evaluation period. Phytochemical testing confirmed the presence of tannins, flavonoids, polyphenols, and natural electrolytes, supporting its antidiarrheal and antioxidant potential. Microbial Limit test was within Acceptable Limit. No Pathogenic organism detected. Formulation is Microbiologically Safe for Consumption. the formulation remained stable up to 15 days at room temperature and up to 30 days under refrigeration The Batch F3 show better clarity and acceptable pH 6.8, So it is used in formulation

VI. DISCUSSION

The prepared H-ORS successfully achieved WHO-standard rehydration parameters. The herbal ingredients provided additional therapeutic properties absent in conventional ORS. Tannins from guava leaves and pomegranate peels reduced intestinal fluid secretion. Ginger and peppermint improved gastrointestinal comfort, reducing vomiting and spasms. Coconut water enhanced taste and compliance. The only limitation noted was reduced stability at room temperature over long duration, which is typical for herbal aqueous formulations.

Overall, the study suggests that H-ORS can serve as a cost-effective, accessible, and multi-beneficial approach to dehydration management in low-resource settings. However, variability in herbal constituents and the lack of large-scale clinical validation remain significant challenges. Further research focusing on standardization, long-term stability, and clinical trials is required to fully establish H-ORS as a reliable complementary or alternative therapy to conventional ORS.

VII. CONCLUSION

Herbal Oral Rehydration Solutions represent a promising advancement in the management of dehydration by combining rehydration with additional therapeutic benefits such as antimicrobial, antioxidant, and antidiarrheal effects. Medicinal plants like ginger rhizome, and guava leaf extract, peppermint leaf extract provide a natural and accessible alternative to conventional ORS formulations.

However, challenges related to standardization, quality control, and clinical validation must be addressed before wide spread adoption. Future research should focus on well-designed clinical trials and formulation optimization to establish herbal ORS as a reliable complementary or alternative therapy in fluid and electrolyte management.

VIII. FUTURE PROSPECTS

Herbal ORS holds significant potential as an alternative or complementary therapy in dehydration management. Future research should focus on:

- Development of ready-to-use dosage forms
- Large-scale clinical trials to establish efficacy and safety.
- Integration into public health programs

REFERENCES

[1] World Health Organization, *Oral Rehydration Salts: Production of the New ORS*. Geneva, Switzerland: WHO, 2006.

[2] H. J. Binder, I. Brown, B. S. Ramakrishna, and G. P. Young, “Oral rehydration therapy in the second decade of the twenty-first century,” Curr. Gastroenterol. Rep., vol. 16, no. 3, p. 376, 2014.

[3] M. K. Munos, C. L. F. Walker, and R. E. Black, “The effect of oral rehydration solution on mortality,” Int. J. Epidemiol., vol. 39, pp. 75–87, 2010.

[4] C. Duggan, O. Fontaine, and N. F. Pierce, “Scientific rationale for a change in ORS composition,” JAMA, pp. 2628–2631, 2004.

[5] N. H. Alam and H. Ashraf, “Treatment of infectious diarrhea in children,” Paediatr. Drugs, pp. 151–165, 2003.

[6] J. N. Ruxin, “Magic bullet: The history of oral rehydration therapy,” Med. Hist., pp. 363–397, 1994.

[7] D. Mahalanabis, “Development of oral rehydration therapy,” Indian J. Med. Res., pp. 349–353, 2011.

[8] Y. K. Gupta and S. Briyal, “Role of traditional

medicinal plants in diarrhea," Phytother. Res., pp. 761–769, 2010.

[9] World Health Organization, *Guidelines for the Control of Diarrhoeal Diseases*. Geneva, Switzerland: WHO, 2005.

[10] M. K. Bhan and N. Bhandari, "Oral rehydration therapy: Recent advances," Indian Pediatr., pp. 1079–1088, 1998.

[11] S. Ghosh and P. G. Sengupta, "Natural remedies in diarrhea management," J. Health Popul. Nutr., pp. 151–156, 2007.

[12] C. K. Lutter and J. A. Rivera, "Nutritional status and diarrhea," J. Nutr., pp. 279–282, 2003.

[13] S. Prasad and A. K. Tyagi, "Ginger and its constituents: Role in health," Crit. Rev. Food Sci. Nutr., pp. 499–509, 2015.

[14] M. M. Cowan, "Plant products as antimicrobial agents," Clin. Microbiol. Rev., pp. 564–582, 1999.

[15] P. Biswas et al., "Tulsi and its medicinal properties," J. Nat. Prod., pp. 102–110, 2012.

[16] Organisation for Economic Co-operation and Development (OECD), *Safety of Herbal Medicines*. Paris, France: OECD.