

Effect of Rice Solution on Dehydration among Children with Acute Diarrhea in the Pediatric Ward in Selected Hospital

C. Nagajothi^{1*}, S. Kalabarathi² and A. Helen Mary Perdita³

¹Child Health Nursing, Saveetha college of Nursing, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai, Tamil Nadu, India

²Obstetrics and Gynecological Nursing, Saveetha College of Nursing, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai, Tamil Nadu, India

³Child Health Nursing, Apollo College of Nursing, Madurai, Tamil Nadu, India

Author Designation: ¹Scholar, ²Professor, ³Principal

*Corresponding author: C. Nagajothi (e-mail: nagajothic11@yahoo.com).

©2026 the Author(s). This is an open access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>)

Abstract: **Background:** Acute diarrhea is one of the principal causes of morbidity in children and dehydration and electrolyte imbalance are important issues. Alternative oral rehydration solutions based on rice have been proposed to substitute usual ORS to enhance the absorption of fluids and electrolytes. The study aimed to assess the efficacy of rice solution in dehydration of children with acute diarrhea in a childhood hospital. **Methods:** A quantitative true experimental pre-test–posttest control group design was employed for the study. The research was conducted among 100 children aged 3–6 years, with 50 participants assigned to the experimental group and 50 to the control group using simple random sampling. Baseline assessment included evaluation of dehydration status using the IMNCI scale, along with measurement of serum sodium, potassium, and chloride levels. Participants in the experimental group received rice solution (150 ml, administered three times daily for three consecutive days) in addition to standard care, whereas the control group received standard care alone. Post-test assessment was conducted following the intervention period. Data were analyzed using descriptive and inferential statistics, including repeated measures ANOVA. **Results:** The analysis revealed a significant improvement in electrolyte levels from pre-test to post-test in both groups, with greater improvement observed in the experimental group. Statistically significant differences were noted between groups, across time points, and in the group–time interaction ($p < 0.001$). Dehydration status had a significant effect on sodium levels, whereas gender and nutritional status showed no significant influence. **Conclusion:** Rice solution was proven to be useful in the treatment of dehydration and electrolyte balance in acute diarrhea children. The results justify its application as a useful addition to conventional management in pediatrics.

Key Words: Pediatric, Rice-Based ORS, IMNCI, Clinical Trial

INTRODUCTION

Acute gastroenteritis is among the most common causes of morbidity and mortality in children of any age, and dehydration and electrolyte imbalance are the most common clinical problems [1,2,3]. The most common type of treatment is oral rehydration therapy (ORT) with oral rehydration solutions (ORS), which is used to replace intravascular volume, correct metabolic acidosis, and prevent malnutrition [3,4].

Oral rehydration solutions based on rice have also been suggested as an alternative to glucose-based ORS because they may have a greater absorption of sodium and water by mechanisms including colonic fermentation and greater short-chain fatty acid production [5,6]. Other studies have shown that rice-based ORS can decrease stool and

intravenous fluid needs; but results are inconclusive, especially with non-cholera pediatric diarrhea [7].

Guidelines from World Health Organization recommends oral rehydration solution (ORS) as the cornerstone of dehydration management, while acknowledging that the effectiveness of rice-based solutions may vary across different clinical settings and population groups [8]. The majority of the literature has been done in an outpatient or cholera-endemic environment, and there is little high-quality evidence done on hospitalized pediatric populations.

Although this has been studied before, there is a deficiency of clear evidence on the effectiveness of rice-based ORS in particular in children who are admitted to paediatric wards with acute diarrhea and dehydration. Rice-

based solutions are not well incorporated into the conventional WHO-ORS inpatient guidelines, and there is a lack of comparative information with glucose-based ORS with regard to stool output, electrolyte replacement, intravenous fluids, weight gain, and the length of stay in hospitals [9,10,11].

The originality of the given work is that the population studied is a hospital-based population of pediatrics, where the issue of dehydration management is more significant and demands rigorous clinical guidelines. This research will examine the effectiveness and safety of rice-based ORS in decreasing the stool burden, enhancing hydration and electrolyte imbalances, reducing the use of intravenous fluids, and reducing the length of stay, thus adding context-specific evidence to the current body of knowledge of improving the practice of pediatric inpatient care [12].

Aim of the Study

The study aimed to evaluate the effect of Rice solution on dehydration and electrolytes among children admitted with acute diarrhea in the paediatric ward.

METHODS

A quantitative research approach using a true experimental pre-test–posttest control group design was adopted. The study was conducted in the pediatric ward of Government Rajaji Hospital among children admitted with acute diarrhea. Children aged 3–6 years who met the inclusion criteria were selected using probability sampling through a simple random lottery method.

Criteria of the Study

The inclusion criteria were the presence of acute diarrhea, hospitalization on the pediatric ward, and parental or guardian consent. Children who had chronic diarrhea, had severe systemic illness, or had special treatment of diarrhea were excluded.

Data Collection Procedure

Baseline data for both the control and experimental groups were collected after obtaining institutional permission and informed consent. Pre-test assessment included evaluation of dehydration status using the IMNCI Assessment of Dehydration Scale developed by the World Health Organization, which considers general condition, eyes, tears, mouth and tongue, thirst, and skin pinch. Baseline electrolyte levels (sodium, potassium, and chloride) were measured using blood samples.

The rice solution was prepared by taking 100 g of parboiled rice, washing it thoroughly, and soaking it in clean water for 30 minutes. The soaked rice was then boiled in 1000 ml of water with 5 g of salt for 40–50 minutes until a well-cooked, semi-liquid consistency was obtained. The mixture was cooled and filtered using a clean cloth or sieve to obtain a clear rice-based solution, ensuring hygienic preparation throughout. Children in the experimental group

received 150 ml of the prepared rice solution three times daily for three consecutive days, along with standard diarrhea management. The control group received standard hospital care only. No blinding was implemented in this study, as both caregivers and investigators were aware of group allocation due to the nature of the intervention.

Post-test assessment was conducted after the intervention period using the same IMNCI scale and laboratory investigations to measure electrolyte levels. The effectiveness of the intervention was determined by comparing pre-test and post-test findings between and within the groups.

Data Analysis

Data were analyzed using IBM SPSS Statistics. Demographic and clinical variables were described using descriptive statistics. Normality of the data was assessed with the Shapiro–Wilk test. Changes in electrolyte levels between groups and across time, including main and interaction effects, were evaluated using repeated measures ANOVA.

Ethical Considerations

Ethical approval was given by the Institutional Ethics Committee (Reference No: 12129/IEC/2024-26). Informed consent was given to parents or guardians in writing and they were only allowed to participate. The privacy, safety and confidentiality of the participants were maintained in the study.

RESULTS

Most of the children in both groups were 3 years old, 40 and 38 percent respectively in the control and experimental group respectively. The majority of the control group (64 percent) was comprised of male children and the experimental group was slightly higher in females (52 percent). The majority of children were of the Hindu religion, with 78% in the control and 70% in the experimental group. Most of the respondents in the two groups drank corporation water (88%). In the control group, fathers were mostly workers (62%), whereas in the experimental group they were mostly of the type of everybody being either a private or a government worker (42%). Likewise, the control group had mothers who were mostly workers (56%), whereas in the experimental group, the majority of mothers were either private or government employees (44%). Majority of the participants visited sanitary latrines with more of the experimental group (94%) using sanitary latrines as compared to the control group (68%) (Table 1).

The results indicate that dehydration status had a significant effect on sodium levels ($p < 0.001$), while gender and nutritional status did not show a significant independent effect. Significant differences were observed between control and experimental groups and between pre-test and post-test values across all variables. Interaction effects were significant mainly for dehydration status, indicating its

Table 1: Socio-Demographic Analysis of Control (Con) and Experimental (Exp) Groups

S.No	Variable	Category	Con (n = 50)	Exp (n = 50)
1	Age (years)	3	20 (40)	19 (38)
		4	15 (30)	13 (26)
		5	8 (16)	12 (24)
		6	7 (14)	6 (12)
2	Gender	Male	32 (64)	24 (48)
		Female	18 (36)	26 (52)
3	Religion	Hindu	39 (78)	35 (70)
		Christian	5 (10)	11 (22)
		Muslim	6 (12)	4 (8)
4	Occupation of Father	Worker	31 (62)	10 (20)
		Business	9 (18)	19 (38)
		Private/Government	10 (20)	21 (42)
5	Occupation of Mother	Home maker	16 (32)	19 (38)
		Worker	28 (56)	9 (18)
		Private/Government	6 (12)	22 (44)
6	Drinking Water Source	Corporation	44 (88)	44 (88)
		Mineral	4 (8)	4 (8)
		Bore well	2 (4)	2 (4)
7	Area of Defecation	Open field	16 (32)	3 (6)
		Sanitary latrine	34 (68)	47 (94)

Table 2: Influence of Gender, Nutritional Status, and Dehydration Status on Sodium Level

Factors	Gender (F, p)	Nutrition (F, p)	Dehydration (F, p)
Variables	0.0531, 0.818	0.468, 0.627	39.291, <0.001
Groups	8.391, <0.001	6.425, 0.012	18.434, <0.001
Tests	299.250, <0.001	105.373, <0.001	369.962, <0.001

Table 3: Comparison of Sodium, Potassium, Chloride among the Groups

S.No	Groups	Test	Sodium	Potassium	Chloride
1	Control	Pre-test	134.1±0.2	3.358±0.018	92.520±0.301
		Post-test	137.9±0.2	3.792±0.016	93.600±0.345
2	Experimental	Pre-test	133.7±0.4	3.368±0.031	91.260±0.484
		Post-test	140.0±0.2	4.212±0.033	100.420±0.277
3	Within Control	Pre-Post	9.597, <0.001	12.089, <0.001	2.255, 0.026
4	Within Experimental	Pre-Post	15.893, <0.001	23.509, <0.001	19.122, <0.001
5	Between Groups	Pre-test	0.946, 0.345	0.275, 0.783	2.469, 0.014
		Post-test	5.227, <0.001	11.567, <0.001	13.363, <0.001

strong influence on sodium levels. Overall, dehydration status was the key factor affecting sodium levels (Table 2).

The mean values reveal that both groups have an increase in the level of sodium, potassium and chloride between the pre-test and post-test, but the improvement is more in the experimental group. There were significant group differences, test differences and interaction differences among all electrolytes ($p < 0.001$). The result of within-group analysis indicated significant improvement in both groups with greater effects in the experimental group. There was no large difference in groups at pre-test in sodium and potassium and a slight difference in chloride. Post-test concentration demonstrated significant differences of all three electrolytes which resulted in improved outcomes in the case of experimental group (Table 3).

DISCUSSION

The study findings demonstrated that electrolyte levels, including sodium, potassium, and chloride, improved significantly following the intervention, with greater post-test improvement observed in the experimental group compared to the control group [13,14]. This finding is consistent with previous studies indicating that balanced

or low-sodium interventions can effectively regulate serum electrolytes and reduce complications such as hyperchloremia, thereby enhancing overall electrolyte status [15,16]. Furthermore, significant differences between groups at both pre-test and post-test, along with significant interaction effects ($p < 0.001$), indicate a strong and distinct impact of the intervention on electrolyte balance [17,18].

Although minor variations in effect size were observed across studies due to differences in intervention composition, dosage, and participant characteristics, the overall findings consistently support the effectiveness of the intervention in improving electrolyte homeostasis [19,20].

Limitations

A small sample was used to carry out the study and this could influence the generalizability of the findings. The duration of follow-up was short, restricting the assessment of long-term effects of the intervention on electrolyte balance. Variations in individual characteristics such as dietary intake, hydration status, and severity of illness were not fully controlled. Additionally, the study was carried out in a single clinical setting, which may limit external validity.

CONCLUSIONS

The study concludes that the intervention was effective in improving electrolyte levels, including sodium, potassium, and chloride, among children. Significant improvements were observed from pre-test to post-test, with greater changes in the experimental group compared to the control group. The findings support the effectiveness of the intervention in enhancing electrolyte balance and reducing dehydration-related complications, indicating its potential value in clinical practice.

REFERENCES

- [1] Gastañaduy, A.S. and Bégué, R. "Acute gastroenteritis." *Clinical Pediatrics*, vol. 38, no. 1, 1999, pp. 1–12.
- [2] Farthing, M.J.G. "Oral rehydration: an evolving solution." *Journal of Pediatric Gastroenterology and Nutrition*, vol. 34, no. S1, 2002.
- [3] Mohamed, S. *et al.* "Racecadotril for the treatment of acute gastroenteritis in children received outpatient care in Qatar." *Pharmacy Practice*, vol. 21, no. 3, 2023, pp. 1–4.
- [4] Adrian, D. *et al.* "Nutritional management in child diarrhea: an evaluation of awareness in general population from Dobrogea region." *Ars Medica Tomitana*, vol. 25, no. 3, 2019, pp. 138–141.
- [5] Nalin, D.R. *et al.* "Clinical concerns about reduced-osmolality oral rehydration solution." *JAMA*, vol. 291, no. 21, 2004, pp. 2632.
- [6] Maulén-Radován, I. *et al.* "Safety and efficacy of a premixed, rice-based oral rehydration solution." *Journal of Pediatric Gastroenterology and Nutrition*, vol. 38, no. 2, 2004, pp. 159–163.
- [7] Goepf, J.G. *et al.* "Comparison of two regimens of feeding and oral electrolyte solutions in infants with diarrhea." *Journal of Pediatric Gastroenterology and Nutrition*, vol. 24, no. 4, 1997, pp. 374–379.
- [8] Guarino, A. *et al.* "European society for pediatric gastroenterology, hepatology, and nutrition/european society for pediatric infectious diseases evidence-based guidelines for the management of acute gastroenteritis in children in Europe." *Journal of Pediatric Gastroenterology and Nutrition*, vol. 59, no. 1, 2014, pp. 132–152.
- [9] Guarino, A., Albano, F. and Guandalini, S. "Oral rehydration: toward a real solution." *Journal of Pediatric Gastroenterology and Nutrition*, vol. 33, no. S2, 2001.
- [10] Monira, S. *et al.* "Time course of bacterial diversity in stool samples of malnourished children with cholera receiving treatment." *Journal of Pediatric Gastroenterology and Nutrition*, vol. 48, no. 5, 2009, pp. 571–578.
- [11] Al-Ramahi, R. *et al.* "Evaluation of mothers' practice in the treatment of children diarrhea and measurement of the osmolality and pH of some oral rehydration solutions and carbonated beverages." *An-Najah University Journal for Research - A (Natural Sciences)*, vol. 30, no. 2, 2016, pp. 269–282.
- [12] Simakachorn, N. *et al.* "Clinical evaluation of the addition of lyophilized, heat-killed *Lactobacillus acidophilus* LB to oral rehydration therapy in the treatment of acute diarrhea in children." *Journal of Pediatric Gastroenterology and Nutrition*, vol. 30, no. 1, 2000, pp. 68–72.
- [13] Chang, Y. *et al.* "Plasma-lyte solution versus saline in kidney transplantation: a systematic review and meta-analysis of randomized controlled trials." *PLoS One*, vol. 20, no. 4, 2025, pp. e0320082.
- [14] Boyd-Shiwerski, C. *et al.* "The impact of a commercial electrolyte beverage on the hydration status of active men and women." *Nutrients*, vol. 17, no. 3, 2025, pp. 585.
- [15] Ridhowati, S. *et al.* "Evaluation of the safe consumption of aqueous extract of flour from *Stichopus variegates*." *Biomedical Research and Therapy*, vol. 6, no. 11, 2019, pp. 3452–3459.
- [16] Zhang, Z. *et al.* "Novel low-sodium salt formulations combined with Chinese modified DASH diet for reducing blood pressure in patients with hypertension and type 2 diabetes: a clinical trial." *Frontiers in Nutrition*, vol. 10, 2023.
- [17] Al-Khaldi, K. *et al.* "Safety and efficacy of oral edible bird's nest supplementation: anti-inflammatory and immunomodulatory benefits for Arabian race stallions during exercise." *Veterinary World*, 2025, pp. 178–188.
- [18] Mu, L. *et al.* "Effects of the 52% low-sodium salt applied to CM-DASH diet in hypertensive patients with type 2 diabetes: a randomized controlled trial." 2024.
- [19] Papatotiriou, M. *et al.* "Normal saline versus balanced crystalloids in patients with prerenal acute kidney injury and pre-existing chronic kidney disease." *Romanian Journal of Internal Medicine*, vol. 61, no. 2, 2023, pp. 98–105.
- [20] Hoehne, S. *et al.* "Comparison of the effects of 7.2% hypertonic saline and 20% mannitol on electrolyte and acid-base variables in dogs with suspected intracranial hypertension." *Journal of Veterinary Internal Medicine*, vol. 35, no. 1, 2021, pp. 341–351.