



ELECTROLYTE IMBALANCES IN PEDIATRIC DIARRHEA: COMPARATIVE ANALYSIS OF BREASTFEEDING AND OTHER FEEDING PRACTICES

Prakash S^{1*}, Prabakar S², Somasekar R³

^{1*} Assistant Professor, Department of Pediatrics, Madha Medical College and Research Institute, Chennai

² Associate Professor, Department of Pediatrics, Madha Medical College and Research Institute, Chennai

³ Professor, Department of Pediatrics, Madha Medical College and Research Institute, Chennai

***Corresponding Author: Prakash S**

* Assistant Professor, Department of Pediatrics, Madha Medical College and Research Institute, Chennai

Abstract

Background: Diarrheal disease is a leading cause of morbidity and mortality in children under five. Feeding practices may influence the incidence and severity of diarrheal complications, including electrolyte disturbances.

Objective: To compare the frequency and types of electrolyte imbalances in children under five with acute diarrhea according to feeding practice: exclusive breastfeeding versus other feeding (formula, cow's milk, mixed).

Methods: This cross-sectional observational study enrolled 100 children (1 month–5 years) presenting with acute diarrhea to the pediatric unit of a tertiary centre between December 2020 and December 2022. Clinical dehydration status, feeding history, and laboratory tests (serum Na⁺, K⁺, Cl⁻, blood glucose, renal function) were recorded. Participants were grouped into: [1] Breastfeeding (exclusive breastfeeding) and [2] Other feeding (formula, cow's milk, mixed). Data were analyzed using SPSS v21. Proportions were compared and $p < 0.05$ was considered statistically significant.

Results: Mean age was 24.04 ± 19.17 months (median 18.17 months; IQR 90–365); 58% male. Feeding distribution: 49% breastfed, 51% other feeding. Dehydration: none 38%, some 54%, severe 8%. Overall electrolyte disturbances: hyperkalemia 30%, hyponatremia 19%, hypokalemia 13%, hypernatremia 12%, elevated chloride 1%. Sodium distribution did not differ significantly between groups. Hypokalemia was significantly more frequent in the other feeding group (216%) than in the breastfeeding group (41%) ($p < 0.05$).

Conclusions: Exclusive breastfeeding was associated with a lower prevalence of hypokalemia in children presenting with acute diarrhea. No significant relationship was observed between feeding type and sodium or chloride abnormalities. These findings support continued promotion of exclusive breastfeeding as a protective measure against certain electrolyte disturbances.

Keywords: Pediatric diarrhea, breastfeeding, formula feeding, electrolyte imbalance, hyponatremia, hypokalemia

Introduction

Diarrheal diseases continue to be a major cause of preventable childhood mortality worldwide, particularly in low- and middle-income countries.¹ Early feeding practices — notably exclusive breastfeeding versus formula, cow's milk, or mixed feeding — influence the risk and severity of diarrheal episodes.^{2,7} Human milk provides not only balanced nutrition but also immunological components that reduce pathogen adherence and may mitigate enteric infections and their complications.^{4,6} Electrolyte disturbances (dyselectrolytemia) during acute diarrhea — especially sodium and potassium abnormalities — contribute to morbidity, including dehydration-related complications and neurological events such as seizures.³ This study compares the pattern and frequency of electrolyte imbalances in children under five with acute diarrhea according to feeding practice (exclusive breastfeeding vs other feeding), aiming to identify associations that could inform clinical care and public-health promotion of breastfeeding.

Methods

Study design & setting: Cross-sectional observational study at the pediatric unit of a tertiary care hospital

ss

Study period & approval: December 2020 – December 2022 , Institutional Ethical Committee approval obtained.

Participants: Consecutive children aged 1 month to 5 years presenting with acute diarrhea. Total enrolled participants = 100.

Inclusion criteria: Acute loose stools in children aged 1 month–5 years.

Exclusion criteria: Pneumonia or other systemic illness, history of diarrhea >14 days, neonates with diarrhea.

Data collection: After informed consent, detailed history (including feeding history — exclusive breastfeeding, formula, cow's milk, or mixed), physical exam with dehydration grading, and blood sampling for electrolytes, blood glucose, and renal function were performed.

Grouping: Breastfeeding group (exclusive breastfeeding) and Other feeding group (formula, cow's milk, or mixed feeding).

Statistical analysis: Performed with SPSS v21.0. Continuous data expressed as mean $\pm$ SD or median (IQR). Categorical data expressed as frequencies and percentages. Chi-square test or Fisher's exact test used for categorical comparisons; $p < 0.05$ considered statistically significant.

Results

Demographics: Mean age 24.04 ± 19.17 months; median 18.17 months (IQR 9.0–36.5); age range 11–60 months. (Table 1). 58 males (58%), 42 females (42%). 47% were <1 year (Table 2).

Feeding practices: Breastfeeding 49%, formula 16%, cow's milk 14%, mixed 21% (breastfeeding group $n = 49$; other feeding group $n = 51$).

Dehydration: None 38%, some 54%, severe 8%.

Overall electrolyte disturbances ($n = 100$): Hyperkalemia 30%, hyponatremia 19%, hypokalemia 13%, hypernatremia 12%, elevated chloride (>108 mmol/L) 1%. (Table 3).

Comparison by feeding group:

- Sodium: No significant difference between groups ($p > 0.05$). (Figure 1)
- Potassium: Hypokalemia significantly higher in other feeding group (216%) compared with breastfeeding group (41%) ($p < 0.05$). (Figure 2)
- Chloride: No significant difference between groups ($p > 0.05$). (Figure 3)

Discussion

This study examined whether feeding practice is associated with different patterns of electrolyte disturbances in children under five with acute diarrhea. The principal finding was a significantly higher prevalence of hypokalemia among children who received formula, cow's milk, or mixed

feeding compared with exclusively breastfed children. Sodium and chloride abnormalities did not differ significantly between groups.

Possible explanations include immunological protection and better nutritional balance in breastfed children. Formula or cow's milk feeding may predispose to more severe fluid loss or malnutrition, worsening potassium depletion. Findings align with prior studies reporting breastfeeding as protective against hypokalemia, though discrepancies exist in sodium abnormalities across studies.

Limitations: Small sample size, cross-sectional design, and lack of control for hygiene, water source, and formula preparation methods. These factors may have influenced results.

Clinical implications: Results reinforce exclusive breastfeeding promotion as part of diarrheal disease prevention and highlight the need for early electrolyte monitoring in non-breastfed children with diarrhea.

Conclusion

Exclusive breastfeeding was associated with a significantly lower frequency of hypokalemia among children under five presenting with acute diarrhea. No statistically significant association between feeding type and sodium or chloride abnormalities was observed. Promotion of exclusive breastfeeding, early recognition of electrolyte disturbances, and prompt correction remain important strategies in reducing diarrheal morbidity.

Declarations

Funding: Nil

Conflict of interest: None declared

Ethical approval: Approved by the Institutional Ethical Committee

References :

1. Ardythe L. Morrow, Guillermo M. Ruiz-Palacios, Xi Jiang, David S. Newburg; Human Milk Glycans That Inhibit Pathogen Binding Protect Breast-feeding Infants against Infectious Diarrhea, *The Journal of Nutrition*, Volume 135, Issue 5, 1 May 2005, Pages 1304–1307
2. Lakshminarayanan S, Jayalakshmy R. Diarrheal diseases among children in India: Current scenario and future perspectives. *J Nat Sci Biol Med*. 2015 Jan-Jun;6(1):24-8. doi: 10.4103/0976-9668.149073. PMID: 25810630; PMCID: PMC4367049.
3. Ahmed SF, Farheen A, Muzaffar A, Mattoo GM. Prevalence of Diarrhoeal Disease, its Seasonal and Age Variation in under- fives in Kashmir, India. *Int J Health Sci (Qassim)*. 2008 Jul;2(2):126-33. PMID: 21475494; PMCID: PMC3068726.
4. Lamberti LM, Fischer Walker CL, Noiman A, Victora C, Black RE. Breastfeeding and the risk for diarrhea morbidity and mortality. *BMC Public Health*. 2011 Apr 13;11 Suppl 3(Suppl 3):S15. doi: 10.1186/1471-2458-11-S3-S15. PMID: 21501432; PMCID: PMC3231888.
5. Dhami MV, Ogbo FA, Diallo TMO, Agho KE, On Behalf Of The Global Maternal And Child Health Research Collaboration GloMACH. Regional Analysis of Associations between Infant and Young Child Feeding Practices and Diarrhoea in Indian Children. *Int J Environ Res Public Health*. 2020 Jul 1;17(13):4740. doi: 10.3390/ijerph17134740. PMID: 32630337; PMCID: PMC7370018.
6. Shrestha A, Six J, Dahal D, Marks S, Meierhofer R. Association of nutrition, water, sanitation and hygiene practices with children's nutritional status, intestinal parasitic infections and diarrhoea in rural Nepal: a cross-sectional study. *BMC Public Health*. 2020 Aug 15;20(1):1241. doi: 10.1186/s12889-020-09302-3. PMID: 32799826; PMCID: PMC7429949.
7. Ogbo FA, Agho K, Ogeleka P, Woolfenden S, Page A, Eastwood J; Global Child Health Research Interest Group. Infant feeding practices and diarrhoea in sub-Saharan African

countries with high diarrhoea mortality. PLoS One. 2017 Feb 13;12(2):e0171792. doi: 10.1371/journal.pone.0171792. PMID: 28192518; PMCID: PMC5305225.

Table 1: Age distribution among study participants

Age Category	Frequency	Percent
≤ 1 year	47	47.0 %
> 1 to 2 years	18	18.0 %
> 2 to 5 years	35	35.0 %
Mean Age in months + SD	24.04 ± 19.17	
Median Age in months (IQR)	18.17 (IQR = 9.0 – 36.5)	
Minimum age in months	1.1	
Maximum age in months	60	
Total	100	100.0 %

Note: SD – Standard deviation, IQR – Inter Quartile range.

Table 2: Gender distribution among study participants

Gender	Frequency	Percent
Male	58	58 %
Female	42	42 %
Total	100	100.0 %

Table 3: Electrolyte imbalance observed among study participants

Electrolyte imbalance	Number	Percentage
Sodium levels		
Hyponatremia (<135)	19	19%
Normal	69	69 %
Hypernatremia (> 145)	12	12 %
Potassium levels		
Hypokalemia (< 3.5)	13	13 %
Normal (3.5 to 4.5)	57	57 %
Hyperkalemia (> 4.5)	30	30 %
Chloride level		
< 89	0	0%
89 to 108	99	99%
> 108	1	1%
Total	100	100%

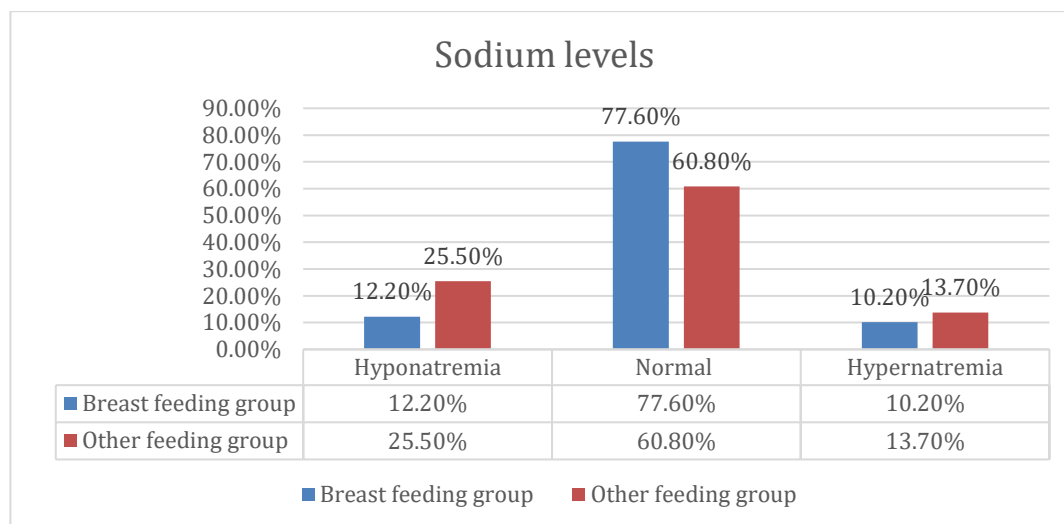


Figure 1: : Bar diagram shows comparison between sodium levels with type of feeding

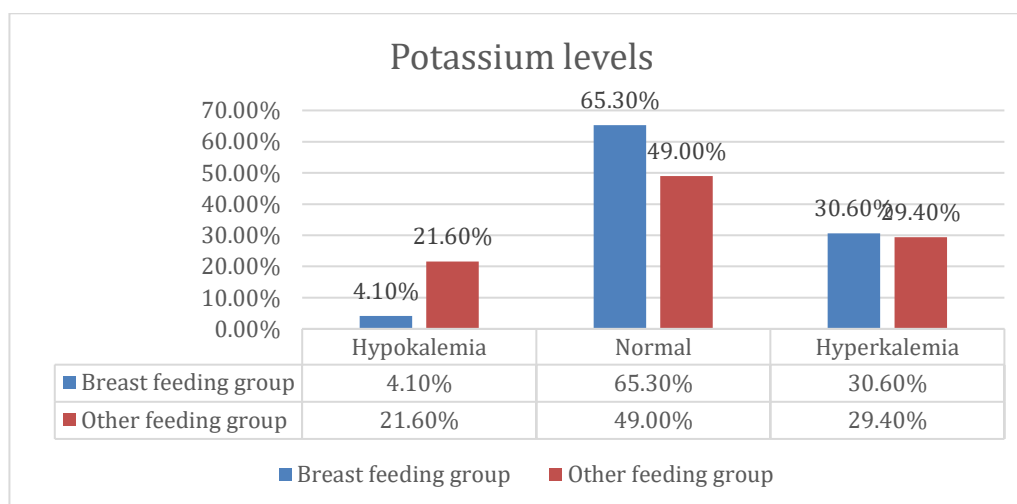


Figure 2: Bar diagram shows comparison between potassium levels with type of feeding

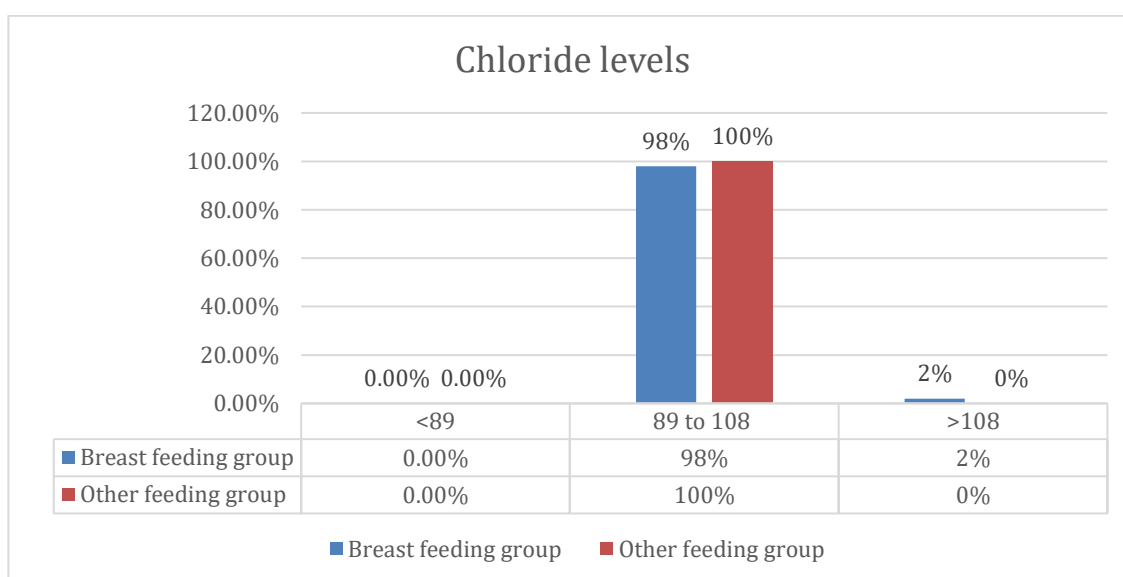


Figure 3: Bar diagram shows comparison between chloride levels with type of feeding