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ORIGINAL ARTICLE

Association between diarrhea-related complications and severity of dehydration in children aged 2–59 months at a tertiary care hospital.

Afsheen Batool Raza[1], Nadia Nawaz[2], Sadia Qasim[3], Tahira Aslam[4]

ABSTRACT… Objective: To examine the relationship between the severity of dehydration and the complications associated with diarrhea in children aged 2–59 months. To evaluate the range of complications observed in pediatric patients with diarrhea admitted to a tertiary care hospital, focusing on different dehydration levels. **Study Design:** Cross-sectional study. **Setting:** Department of Pediatric Medicine, Children's Hospital and University of Child Health Sciences (UCHS), Lahore. **Period:** June 2023 to December 2023. **Methods:** Inclusion criteria consisted of previously healthy children aged between 2 -59 months of either gender, exhibiting symptoms of acute watery diarrhea, including loose motions and vomiting. Patients diagnosed with chronic diarrhea, immunodeficiency, neuromuscular impairment, or congenital heart disease were excluded. Non-probability purposive sampling technique was used and a total of 120 pediatric patients meeting the inclusion criteria were enrolled in the study. Following parental consent, data was collected using a pre-designed form, and all eligible patients received treatment. The data was analyzed using SPSS version 22. **Results:** The majority (58.3%) were aged between 2 to 6 months. Complications associated with diarrhea included hypokalemia (35%), acute kidney injury (10%), and metabolic acidosis (55%). Severe dehydration was observed in 39.2% of patients. **Conclusion:** Metabolic acidosis was the most common complication, present in 55% of cases. A significant correlation was found between the severity of dehydration and the occurrence of metabolic acidosis.

Key words: Diarrhea, Dehydration, Hypokalemia, Metabolic Acidosis.

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INTRODUCTION

Diarrhea is a leading cause of morbidity and mortality worldwide, particularly among children under five years of age. Globally, approximately four million child deaths are attributed to diarrheal illnesses annually.[1] It is the primary cause of death in this age group, with the highest burden observed in sub-Saharan Africa, South Asia, and Southeast Asia.[2,3] The higher prevalence in these regions is often linked to inadequate sanitation facilities, limited awareness of personal hygiene, and shortages of well-trained healthcare personnel.

Epidemiological patterns of diarrhea differ across regions.[4] Viral diarrhea is more common in developed countries, whereas bacterial diarrhea predominates in developing nations.[5] Effective management of diarrhea requires a comprehensive clinical assessment, including detailed history-taking, physical examination, and evaluation of hydration and nutritional status. This process facilitates early identification of complications, which may include dehydration, electrolyte imbalances, or malnutrition.

Fluid and electrolyte replacement are cornerstone interventions in the management of diarrheal diseases.[6] Despite most cases being viral in origin and self-limiting, continuous monitoring remains essential to prevent complications. Antibiotics, however, play a limited role and are indicated only in specific cases.[7-9] Continuous monitoring and surveillance of pediatric diarrhea and its underlying causes are essential for identifying strategies aimed at prevention and control of diarrhea.[10,11]

Children with severe acute malnutrition (SAM) face an exponentially higher risk of death from diarrheal illnesses, with the mortality risk up to 12 times greater compared to well-nourished children.[12-15] Chronic malnutrition, or stunting, is another significant predictor of mortality during and after moderate-to-severe diarrhea episodes.[16]

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Socioeconomic factors also influence disease outcomes, with children from lower-income households often presenting with more severe illness due to delays in seeking medical care.[17] Diarrhea and its associated complications, including dehydration and malnutrition, continue to be significant contributors to hospitalizations and mortality among children.[18]

Despite its significant impact on pediatric health, data on the correlation between complications of diarrhea, hydration status, and age groups remain scarce in our setting. This study aims to address this gap by assessing the association between diarrheal complications, levels of dehydration, and age groups in pediatric patients admitted to a tertiary care hospital. The objective of the study was to examine the relationship between the severity of dehydration and the complications associated with diarrhea in children aged 2–59 months, and to evaluate the range of complications observed in pediatric patients with diarrhea admitted to a tertiary care hospital, with a particular focus on different levels of dehydration.

METHODS

This Cross-sectional study was conducted at Department of Pediatric Medicine, Children's Hospital and University of Child Health Sciences (UCHS), Lahore from June 2023 to December 2023 after taking approval from ethical committee (No. 56738/UCHS-CH) Dated: 28/02/23. All patients diagnosed with acute watery diarrhea were included in the study. Inclusion criteria consisted of previously healthy children aged between 2-59 months of either gender, exhibiting symptoms of acute watery diarrhea, including loose motions and vomiting. Patients diagnosed with chronic diarrhea, immunodeficiency, neuromuscular impairment, or congenital heart disease were excluded. After obtaining parental consent, a pre-designed form was completed, documenting detailed history, clinical signs, and outcomes. Treatment was given to all eligible patients, and their progress was monitored during their ward stay. Data analysis was performed using SPSS version 22. Frequencies and percentages were calculated through descriptive statistics, and the Chi-square test was applied to compute P-values. Statistical significance was defined as a P-value of less than 0.05.

RESULTS

Out of the total 120 patients, 70 cases (58.3%) aged between 2-6 months, 30 cases (25%) aged between 6-12 months, and 20 cases (16.7%) were over 12 months of age, 69 cases (57.5%), were male and 51 cases (42.5%) were female. The mean duration of stay was 3.3 days with a standard deviation of 2.06, and the mean height, weight, and MUAC were 65.7 +16.65, 5.20+2.85, and 10.9+5.46 respectively. The mean hemoglobin (Hb) level was 8.87+1.71, and the mean total leukocyte count (TLC) was 10.7 +5.3.

Regarding electrolytes, serum sodium levels were below 135 in 37 cases (30.8%) and above 135 in 83 cases (69.2%), while serum potassium levels were below 3.5 in 46 cases (38.3%) and between 3.5-5.5 in 74 cases (61.7%). Serum calcium levels were below 7.0 in 6 cases (5.0%) and above 7.0 in 114 cases (95.0%). As for hydration status, 30 cases (25%) were mildly dehydrated, 23 cases (19.2%) were moderately dehydrated, 47 cases (39.2%) were severely dehydrated, and 20 cases (16.7%) had no dehydration. Regarding outcomes, 118 cases (98.3%) were discharged. Signs and symptoms are illustrated in Figure-1, while complications of diarrhea are depicted in Figure-2. Electrolyte imbalance was found to have an insignificant relationship with dehydration status (P > 0.05) (Figure-3).

FIGURE-1

Signs and symptoms (n=120)

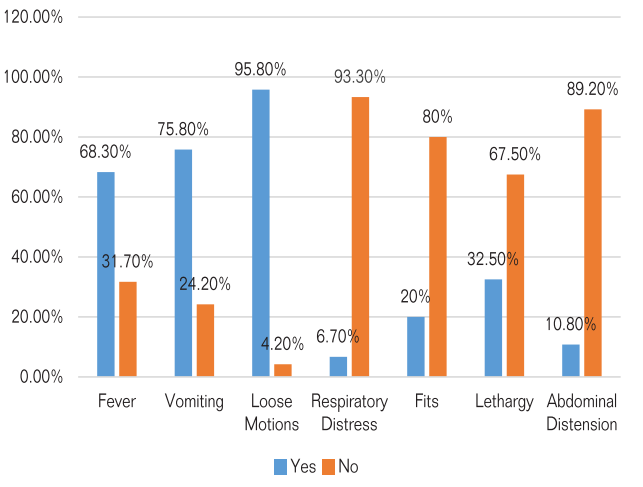
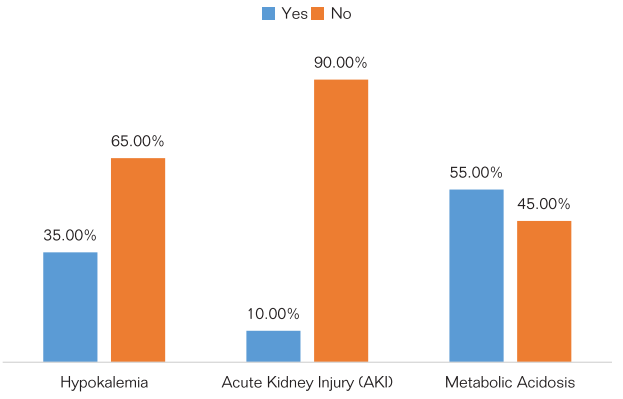


FIGURE-2

Complications of diarrhea (n=120)



Electrolytes Imbalance has insignificant relationship with hydration status (P >0.05) (P <0.05 is considered significant)

There was insignificant relationship of complications like AKI, metabolic acidosis with age while hypokalemia was slightly or nearly to significant with age group. (P <0.05) is considered significant. Dehydration status demonstrated a significant correlation with metabolic acidosis but an insignificant correlation with AKI and hypokalemia (Table-II).

FIGURE-3

Correlation of electrolyte imbalance with hydration status (n=120)

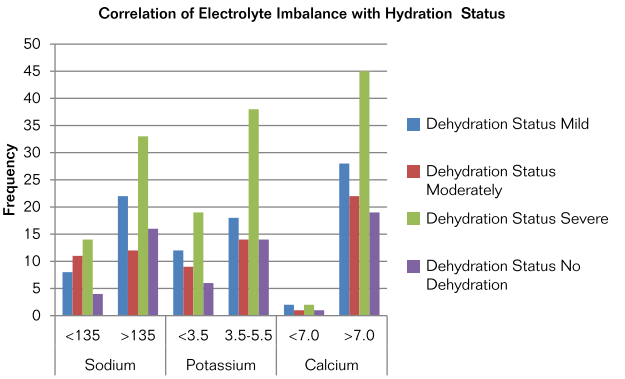


TABLE-I

Correlation Of complications with age groups

Complications		Age in Months			P-Value
		2-6 Months	6-12 Months	>12 Months	
Hypokalemia	Yes	20(28.2%)	12(38.7%)	11(55.0%)	0.07
	No	51(71.8%)	19(61.3%)	9(45%)	
AKI	Yes	9(12.7%)	3(9.7%)	0	0.243
	No	62(87.3%)	28(9.3%)	20(100%)	
Metabolic Acidosis	Yes	40(56.3%)	18(58.1%)	9(45%)	0.614
	No	31(43.7%)	13(41.9%)	11(55.0%)	

TABLE-II

Correlation of complications with hydration status

Complications		Dehydration Status				
		Mild	Moderate	Severe	No Dehydration	P-Value
Hypokalemia	Yes	5(16.7%)	9(37.5%)	21(43.8%)	8(40%)	0.09
	No	25(83.3%)	15(62.5%)	27(56.3%)	12(60%)	
AKI (Acute kidney inury)	Yes	1(3.3%)	3(12.5%)	6(12.5%)	2(10%)	0.571
	No	29(96.7%)	21(87.5%)	42(87.5%)	18(90%)	
Metabolic Acidiosis	Yes	11(36.7%)	12(50%)	37(77.1%)	7(35%)	0.001
	No	19(63.3%)	12(50%)	11(22.9%)	13(65%)	

Dehydration status has significant correlation with metabolic acidosis (P <0.05) and insignificant correlation with AKI and hypokalemia.

DISCUSSION

Throughout the world, diarrheal diseases are identified as the primary cause of death among children under the age of five.[19] Intestinal permeability plays a central role in the pathophysiology of environmental enteric dysfunction, a condition believed to be a frequent contributor to inadequate growth. This disease process has been documented in children diagnosed with kwashiorkor.[20] Among the 120 patients, the majority fell within the 2 to 6month age range, with a mean age of 9.31 ± 12 months. More than half of the participants were under 12 months old, indicating a prevalence of younger age groups in our study. Conversely, in another study, the mean age was 15.46 ± 9.3 months, suggesting that the majority of our patients were younger in comparison. Similarly, research conducted in Ethiopia revealed that children aged 6 to 23 months were over twice as likely to develop diarrhea compared to those aged 2 years or older.[21]

A similar finding was also noted in a study conducted in Bangladesh.[22] This is attributed to the fact that during infancy, children are exposed to various contaminated agents while crawling and walking, which increases the risk of infectious diseases.[23] Concerning gender distribution, the majority of participants were male in this study, aligning with findings from another study where 115 individuals (57.5%) were male.[24] Research conducted in both Bangladesh and Western Maharashtra, India, demonstrated that male children had greater odds of experiencing diarrhea compared to female.[23]

Among environmental factors, the disposal of child stool and the materials used for the floor and roof of the household unit were significantly linked to diarrhea in children under the age of five consistent with prior studies[23], this could be attributed to the transmission of pathogens facilitated by unclean floor surfaces and thatch roofing materials in the dwelling, potentially elevating the susceptibility to diarrheal diseases.[25] In terms of hydration status in our study, 30 cases (25%) were classified as mildly dehydrated, 23 cases (19.2%) as moderately dehydrated, 47 cases (39.2%) as severely dehydrated, and 20 cases (16.7%) showed no signs of dehydration. Conversely, in another study, 93 cases (46.5%) were categorized as mildly dehydrated, 68 cases (34%) as moderately dehydrated, 11 cases (5.5%) as severely dehydrated, and 28 cases (14%) showed no signs of dehydration. Therefore, in our dataset, the majority of cases exhibited severe dehydration. Numerous studies indicate that infants experiencing frequent diarrhea, elevated fever, or increased frequency of vomiting or diarrhea episodes are at a higher risk of dehydration.[26,27] However, there are also publications that challenge these findings.[23,28] In our study, acute kidney injury (AKI) was observed in 10% of cases, with raised serum urea levels detected in 25 cases (20.8%).

Another study revealed a correlation between urea concentration and the severity of dehydration, suggesting that serum urea levels could serve as a valuable predictor of dehydration according to some researchers.[28,29] In our study, elevated serum creatinine levels were detected in 11 cases (9.2%) among those with severe dehydration. Shaoul et al. found that creatinine concentration may not reliably indicate dehydration, while another study suggested that creatinine levels could predict severe dehydration.[28] Hypokalemia often manifests with symptoms such as muscle weakness, hypotonia, apathy, paralytic ileus, and cardiac arrhythmias. In our study, hypokalemia was observed in 46 cases (38.3%), hyponatremia in 37 cases (30.8%), and hypocalcemia in 6 cases (5%). These findings are consistent with earlier research.[30] In our study, metabolic acidosis emerged as the most prevalent complication, aligning with a study conducted by Tahmina et al.[31] Furthermore, we observed a significant correlation between dehydration and metabolic acidosis. This correlation was also noted in studies conducted by Mackenzie et al. and Vega and Avner.[31] Metabolic acidosis in severe dehydration in children primarily occurs due to loss of bicarbonate, tissue hypo perfusion leading to anaerobic metabolism and lactic acidosis and renal Impairment resulting in decreases hydrogen ion excretion and bicarbonate regeneration.[32,33]

CONCLUSION

A significant correlation was found between dehydration status and the development of metabolic acidosis. However, dehydration did not show a significant relationship with acute kidney

injury (AKI) or hypokalemia. No significant impact of age on AKI or metabolic acidosis is found. Additionally, electrolyte imbalance was found to have no significant relationship with dehydration status. These findings highlight the critical role of dehydration in the development of metabolic acidosis, emphasizing the importance of timely management in pediatric diarrhea cases.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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REFERENCES

1. Alshammari M, Aljohani MA, Hashash JM, Alsaedi HA, Alobaidi WY, Alhuzali NK. **Shwachman-diamond syndrome in a child presenting with chronic diarrhea: A rare case in family medicine practice.** Cureus. 2021; 13(11):e19391.
2. Aliabadi N, Antoni S, Mwenda JM, Weldegebriel G, Biey JN, Cheikh D, et al. **Global impact of rotavirus vaccine introduction on rotavirus hospitalisations among children under 5 years of age, 2008–16: findings from the Global Rotavirus Surveillance Network.** The Lancet Global Health. 2019 Jul 1; 7(7):e893-903.
3. Cohen AL, Platts-Mills JA , Nakamura T, Operario DJ, Antoni S, MwendaJM, et al. **Aetiology and incidence of diarrhoea requiring hospitalisation in children under 5 years of age in 28 low-income and middle-income countries: Findings from the Global Pediatric Diarrhea Surveillance network.** BMJ Global Health. 2022; 7:3-12.
4. Chang H, Guo J, Wei Z, Huang Z, Wang C, Qiu Y, et al. **Aetiology of acute diarrhoea in children in Shanghai, 2015–2018.** PLoS ONE. 2021; 16(4):e0249888.
5. Wang X, Wang J, Sun H, Xia S, Duan R, Liang J, et al. **Etiology of childhood infectious diarrhea in a developed region of china: Compared to childhood diarrhea in a developing region and adult diarrhea in a developed region.** PLoS One. 2015; 10:e0142136.
6. Liu L, Oza S, Hogan D, Chu Y, Perin J, Zhu J, et al. **Global, regional, and national causes of under-5 mortality in 2000–15: An updated systematic analysis with implications for the Sustainable Development Goals.** Lancet. 2016; 388:3027-35.
7. Song P, Theodoratou E, Li X, Liu L, Chu Y, Black RE, et al. **Causes of death in children younger than five years in China in 2015: An updated analysis.** J Glob Health. 2016; 6:020802.
8. Wang Y, Miao L, Qian Y, Liang J, Wu Y, Zhu J, et al. **Analysis of under 5 years old children mortality and the leading death cause in China from 1996 to 2000.** Chin J Prev Med. 2005; 39:260-64.
9. Gashaw AT, Nedi T, BachaT. **Assessment of the management of diarrhoea among children under five in Addis Ababa, Ethiopia.** Pediatric Health, Medicine and Therapeutics. 2020; 11: 135-43.
10. Shankar S, Rosenbaum J. **Chronic diarrhoea in children: A practical algorithm-based approach.** J Paediatr Child Health. 2020, 56:1029-38.
11. Shandro BM, Nagarajah R, Poullis A. **Challenges in the management of pancreatic exocrine insufficiency.** World J GastrointestPharmacolTher. 2018; 9:39-46.
12. Caulfield LE, De Onis M, Blossner M, Black RE. **Undernutrition as an underlying cause of child deaths associated with diarrhea, pneumonia, malaria, and measles.** Am J ClinNutr. 2004; 80:193-98.
13. O'Reilly CE, Jaron P, Ochieng B, Nyaguara A, Tate JE, Parsons MB, et al. **Risk factors for death among children less than 5 years old hospitalized with diarrhea in rural western Kenya, 2005–2007: A cohort study.** PLoS Medicine. 2012 Jul 3; 9(7):e1001256.
14. Uysal G, Sokmen A, Vidinlisan S. **Clinical risk factors for fatal diarrhea in hospitalized children.** Indian J Pediatr. 2000; 67:329-33.
15. TickellK, Pavlinac PB, John-Stewart GC, Denno DM, Richardson BA, Naulikha JM, et al. **Impact of childhood nutritional status on pathogen prevalence and severity of acute diarrhea.** Am. J. Trop. Med. Hyg. 2017; 97(5):1337-44.
16. Kotloff KL, Nataro JP, Blackwelder WC, Nasrin D, Farag TH, Panchalingam S, et al. **Burden and aetiology of diarrhoeal disease in infants and young children in developing countries (the Global Enteric Multicenter Study, GEMS): A prospective, case-control study.** The lancet. 2013 Jul 20; 382(9888):209-22.
17. Rose AM. **Late presentation to hospital services necessitates greater community-based care for malnourished children.** J Trop Pediatr. 2015; 61:61-64.
18. Tsige AG, Nedi T, Bacha T. **Assessment of the management of diarrhea among children under five in Addis Ababa, Ethiopia.** Pediatric Health, Medicine and Therapeutics. 2020; 11 135-43.
19. Ugboko HU, Nwinyi OC, Oranusi SU, Oyewale JO. **Childhood diarrhoeal diseases in developing countries.** Heliyon. 2020 Apr 1; 6(4):e03690.
20. Jones KD, Thitiri J, Ngari M, Berkley JA. **Childhood malnutrition: Toward an understanding of infections, inflammation, and antimicrobials.** Food Nutr Bull. 2014; 35:S64-S70.
21. Workie GY, Akalu TY, Baraki AG. **Environmental factors affecting childhood diarrheal disease among under-five children in Jamma district, south Wello zone, Northeast Ethiopia.** BMC Infect Dis. 2019; 19(1):804.
22. Sarker AR, Sultana M, Mahumud RA, Sheikh N, Van Der Meer R, Morton A. **Prevalence and health care–seeking behavior for childhood diarrheal disease in Bangladesh.** Glob Pediatr Health. 2016; 3:1-12.

23. Paul P. **Socio-demographic and environmental factors associated with diarrhoeal disease among children under five in India.** BMC Public Health. 2020; 20:1886.
24. Hoxha TF, Azemi M, Avdiu M, Jaha VI, Grajqevci V, PetrelaE. **The usefulness of clinical and laboratory parameters for predicting severity of dehydration in children with acute gastroenteritis.** Med Arh. 2014 Oct; 68(5):304-07.
25. Melese B, Paulos W, Astawesegn FH, Gelgelu TB. **Prevalence of diarrheal diseases and associated factors among under-five children in Dale District, Sidama zone, southern Ethiopia: A cross-sectional study.** BMC Public Health. 2019; 19(1):1235.
26. King CK, Glass R, Bresce JS, Duggan C. **Managing acute gastroenteritis among children.** MMWR Recomm Rep. 2003; 52(RR16):1-16.
27. Elliott EJ, Dalby-Payne JR. **Acute infectious diarrhoea and dehydration in children.** Med J Aust. 2004; 181:565-70.
28. Hayajneh WA, Jdaitawi H, Al Shurman A, Hayajneh YA. **Comparison of clinical associations and laboratory abnormalities in children with moderate and severe dehydration.** J PediatrGastroenterolNutr. 2010 Mar; 50(3):290-94.
29. Tavakolizadeh R, Sadeghi M, Namiranian N, Fahimi D, Barkhordari M. **Blood chemical analysis in children with acute gastroenteritis, when is it useful?** J Ped. Nephrology. 2013 Oct; 1(2):65-69.
30. Raza M, Kumar S , Ejaz M , Azim D , Azizullah S, HussainA. **Electrolyte imbalance in children with severe acute malnutrition at a Tertiary Care Hospital in Pakistan: A cross-sectional study.** Cureus. 2020; 12(9):e10541.
31. Alam T, Ahmed T, Sarmin M, Shahrin L, Afroze F, Sharifuzzaman, et al. **Risk factors for death in bangladeshi children under 5 years of age hospitalized for diarrhea and severe respiratory distress in an urban critical care ward.** Global Pediatric Health Volume. 2017; 4:1-5.
32. World Health Organization. **The treatment of diarrhoea: A manual for physicians and other senior health workers.** 4th rev. ed. Geneva: WHO; 2005.
33. Binder HJ. **Mechanisms of diarrheal disease associated with malnutrition.** J Pediatr Gastroenterol Nutr. 2014; 58(5):523-26.

AUTHORSHIP AND CONTRIBUTION DECLARATION	
1	**Afsheen Batool Raza:** Concept of study, drafting.
2	**Nadia Nawaz:** Data interpretation.
3	**Sadia Qasim:** Data collection.
4	**Tahira Aslam:** Data analysis.