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PREDICTORS OF PROLONGED HOSPITAL STAY AMONG CHILDREN WITH ACUTE GASTROENTERITIS

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ABSTRACT

Background: Acute gastroenteritis is one of the most common causes of morbidity and hospital admission among children. Although most cases respond to appropriate rehydration and supportive treatment, some children require prolonged hospitalization, resulting in increased healthcare utilization and burden on families. Early identification of factors associated with prolonged hospital stay may facilitate timely intervention and more efficient allocation of pediatric healthcare resources. **Objectives:** To identify the clinical, demographic, nutritional, laboratory, and treatment-related predictors of prolonged hospital stay among children admitted with acute gastroenteritis. **Patients and methods:** A hospital-based analytical study was conducted at Baladruz Hospital, Diyala Governorate, Iraq, from August 2024 to June 2026. A total of 300 children diagnosed with acute gastroenteritis were included. Demographic, clinical, laboratory, and treatment-related data were collected from medical records. Prolonged hospital stay was defined as hospitalization for more than 4 days. Patients were divided into non-prolonged (≤4 days) and prolonged (>4 days) hospitalization groups. Associations were assessed using appropriate statistical tests, followed by univariate and multivariable logistic regression analyses to identify independent predictors of prolonged hospitalization. A P value <0.05 was considered statistically significant. **Results:** Among the 300 children, 164 (54.7%) were males and 136 (45.3%) were females, with a mean age of 3.2 ± 2.8 years. Dehydration was present in 186 (62.0%) children, including severe dehydration in 43 (14.3%). The mean hospital stay was 3.6 ± 2.4 days, and 72 (24.0%) children had prolonged hospitalization. Compared with children with non-prolonged hospitalization, those with prolonged hospitalization had significantly higher frequencies of illness lasting ≥3 days before admission, vomiting, frequent vomiting, fever, dehydration, and severe dehydration. They also had significantly higher WBC, BUN, and creatinine levels and lower serum sodium, chloride, and bicarbonate levels. In multivariable logistic regression, severe dehydration (adjusted OR=3.40, 95% CI: 1.70–6.80, P<0.001), illness duration ≥3 days before admission (adjusted OR=2.30, 95% CI: 1.30–4.10, P=0.004), frequent vomiting (adjusted OR=2.10, 95% CI: 1.20–3.80, P=0.009), hyponatremia (adjusted OR=2.60, 95% CI: 1.30–5.10, P=0.006), low serum bicarbonate (adjusted OR=2.20, 95% CI: 1.10–4.30, P=0.025), and intravenous fluid therapy (adjusted OR=1.80, 95% CI: 1.00–3.20, P=0.041) were independent predictors of prolonged hospital stay. **Conclusions:** Prolonged hospitalization among children with acute gastroenteritis was associated mainly with severe dehydration, delayed presentation, frequent vomiting, and electrolyte and metabolic abnormalities. Early recognition of high-risk children, prompt correction of dehydration and metabolic disturbances, and appropriate clinical monitoring may help reduce prolonged hospitalization and improve the utilization of pediatric healthcare resources.

KEYWORDS: Acute gastroenteritis; Children; Dehydration; Hospitalization; Hyponatremia; Predictors; Vomiting.

1-INTRODUCTION

Acute gastroenteritis (AGE) is one of the most common acute illnesses affecting children and remains an important cause of morbidity, emergency department visits, and hospital admission worldwide. It is characterized by the acute onset of diarrhea, usually accompanied by vomiting, abdominal discomfort, fever, or other systemic manifestations. Although most episodes are self-limiting, young children are particularly vulnerable to complications because of their relatively high fluid requirements, limited physiological reserves, and dependence on caregivers for adequate fluid and nutritional replacement.[1]

Diarrheal disease continues to represent a substantial global health burden. The World Health Organization (WHO) reported that approximately 1.7 billion episodes of childhood diarrheal disease occur annually worldwide, with diarrhea remaining one of the leading causes of death among children younger than 5 years. In 2024, WHO estimated that approximately 443,832 children younger than 5 years die annually from diarrheal disease. The burden is particularly important in low- and middle-income countries, where inadequate access to safe water, sanitation, hygiene, appropriate nutrition, and timely medical care may increase the risk of severe disease and complications.[2]

The clinical severity of AGE varies considerably among children and is influenced by the causative pathogen, age, nutritional status, duration and severity of diarrhea and vomiting, and the degree of fluid and electrolyte loss. Dehydration is the most important acute complication and represents a major determinant of morbidity and the need for medical intervention. Losses of water and electrolytes, including sodium, potassium, chloride, and bicarbonate, may result in hypovolemia, metabolic acidosis, electrolyte abnormalities, and, in severe cases, circulatory compromise and acute kidney injury. Infants and young children are particularly susceptible to dehydration because of their higher body-water turnover and limited ability to independently compensate for fluid losses.[3]

Accurate assessment of dehydration is therefore central to the management of children with AGE. Clinical assessment incorporates general appearance, thirst, mucous membrane status, skin turgor, capillary refill, urine output, respiratory pattern, and other signs of impaired perfusion. Established clinical assessment systems can assist in grading dehydration and identifying children who require more intensive rehydration. Evidence indicates that increasing severity of dehydration is associated with greater requirements for intravenous fluid therapy and hospitalization.[1-4]

Management of pediatric AGE is primarily supportive and focuses on preventing or correcting dehydration while maintaining appropriate nutrition. Oral rehydration solution remains the cornerstone of treatment for children with mild-to-moderate dehydration, whereas intravenous fluid therapy is indicated for severe dehydration, shock, or failure of oral or enteral rehydration. Early appropriate rehydration and continued feeding can reduce complications and may shorten the duration of hospitalization. The WHO's recent guideline on the management of pneumonia and diarrhea in children up to 10 years emphasizes evidence-based assessment and treatment of diarrheal illness, particularly the recognition and management of dehydration and other complications.[5-6]

Despite standardized approaches to treatment, the duration of hospitalization varies substantially among children with AGE. A prolonged hospital stay increases healthcare utilization, nursing workload, treatment costs, and the risk of hospital-acquired complications, while also imposing psychological and socioeconomic burdens on children and their families. Consequently, early identification of children who are likely to require prolonged hospitalization may facilitate appropriate triage, closer monitoring, timely correction of dehydration and electrolyte abnormalities, and more efficient allocation of limited pediatric healthcare resources.[7-8]

Several clinical and laboratory characteristics have been associated with prolonged hospitalization in children with AGE. In a study of hospitalized children younger than 5 years in a tertiary hospital in Northern Ghana, prolonged hospital stay was associated with longer duration of fever, greater dehydration, and longer duration of symptoms before presentation. Following multivariable analysis, duration of fever, dehydration, and symptom duration remained significant predictors of prolonged length of stay. These findings are particularly relevant to resource-limited settings because delayed presentation and dehydration may be influenced by healthcare accessibility, caregiver practices, and socioeconomic circumstances.[9]

Electrolyte and metabolic abnormalities may also contribute to prolonged hospitalization. A recent observational study involving 361 children aged 2–60 months admitted with AGE found significant associations between multiple electrolyte abnormalities and length of hospital stay. Hyponatremia, hypochloremia, and antibiotic use were individually associated with prolonged hospitalization, highlighting the potential importance of biochemical abnormalities in determining clinical recovery and discharge readiness.[10] Furthermore, acute kidney injury has been documented in hospitalized children with AGE and was associated with substantially longer hospitalization. Duration of symptoms before admission, significant dehydration, and lower serum bicarbonate were identified as independent predictors of acute kidney injury, emphasizing the relationship between delayed presentation, dehydration, metabolic disturbance, and clinical outcome.[11]

Other clinical factors, including frequent vomiting, high stool frequency, fever, nutritional status, age, and the need for intravenous fluid therapy, may influence disease severity and healthcare utilization. Previous studies have demonstrated that dehydration severity and vomiting frequency are important determinants of the need for intravenous rehydration and hospitalization. In a large secondary analysis of pediatric AGE trials, increasing clinical dehydration severity was strongly associated with hospitalization, while greater vomiting frequency was associated with increased use of intravenous fluids. These findings suggest that a combination of clinical, nutritional, and laboratory characteristics may provide a more useful prediction of prolonged hospitalization than any single parameter.[12-13]

Although the management of AGE is well established, predictors of prolonged hospital stay may vary according to patient characteristics, healthcare practices, disease severity, and local environmental and socioeconomic conditions. Evidence from other countries cannot necessarily be directly extrapolated to Iraqi pediatric populations because differences may exist in healthcare-seeking behavior, timing of presentation, nutritional status, infectious disease patterns, availability of laboratory investigations, antimicrobial prescribing practices, and access to oral rehydration therapy. Therefore, identifying locally relevant predictors of prolonged hospitalization may provide clinically useful information for pediatricians and healthcare institutions. In Iraq, where acute gastroenteritis remains a common reason for pediatric healthcare utilization, determining the factors associated with prolonged hospitalization may help clinicians recognize high-risk children at an early stage. Such information could support more effective initial assessment, individualized fluid and electrolyte management, closer monitoring of vulnerable patients, and improved utilization of pediatric hospital resources. Accordingly, the present study aims to identify the clinical, demographic, nutritional, and laboratory predictors of prolonged hospital stay among children hospitalized with acute gastroenteritis.

2-PATIENTS AND METHODS

This hospital-based analytical study was conducted at Baladruz Hospital, Diyala Governorate, Iraq, during the period from August 2024 to June 2026. A total of 300 pediatric patients diagnosed with acute gastroenteritis and admitted to the hospital during the study period were included in the study.

The study population comprised children admitted with a clinical diagnosis of acute gastroenteritis, defined as an acute gastrointestinal illness characterized mainly by increased stool frequency and/or decreased stool consistency, with or without associated symptoms such as vomiting, fever, abdominal pain, or dehydration. Patients were identified from hospital admission records and medical files. Children were included if they had a documented diagnosis of acute gastroenteritis, were admitted during the study period, and had sufficient medical records containing the relevant demographic, clinical, laboratory, treatment, and hospitalization data.

Children were excluded if they had chronic gastrointestinal disorders, known malabsorption syndromes, major chronic systemic diseases likely to independently prolong hospitalization, or another primary medical condition responsible for the admission. Patients with incomplete medical records, particularly those without documented admission or discharge dates, were also excluded from the analysis.

Data were collected using a structured data collection form. Demographic characteristics included age, sex, residence, body weight, and nutritional status. Clinical data included the duration of illness before admission, frequency and duration of diarrhea, frequency and duration of vomiting, presence and duration of fever, abdominal pain, dehydration, general clinical condition, urine output, and other associated symptoms or complications. The severity of dehydration was assessed according to the clinical findings documented at admission and categorized as no dehydration, mild-to-moderate dehydration, or severe dehydration.

Laboratory investigations performed as part of routine clinical management were recorded from the patients' medical files. These included complete blood count, serum sodium, potassium, chloride, bicarbonate, blood urea nitrogen, serum creatinine, and blood glucose levels. Additional investigations, such as stool examination or stool culture, were recorded when clinically indicated. Treatment-related information included the use of oral rehydration solution, intravenous fluids, antibiotics, antiemetics, zinc supplementation, electrolyte correction, and other supportive treatments.

The primary outcome of the study was prolonged hospital stay. Length of hospital stay was calculated in days from the date of admission to the date of discharge. For the purposes of this study, a hospital stay of more than 4 days was considered prolonged, whereas a stay of 4 days or less was considered non-prolonged. Accordingly, the patients were divided into two groups according to the duration of hospitalization. The study subsequently evaluated the association between prolonged hospitalization and demographic, clinical, nutritional, laboratory, and treatment-related variables.

The collected data were entered, organized, and analyzed using IBM SPSS Statistics. Continuous variables were presented as mean ± standard deviation or median with interquartile range, depending on the distribution of the data, whereas categorical variables were presented as frequencies and percentages. The Chi-square test or Fisher's exact test was used to assess associations between categorical variables. For continuous variables, the independent-samples t test was used for normally distributed data, while the Mann–Whitney U test was

used for non-normally distributed data. Variables demonstrating significant associations with prolonged hospital stay in the univariate analysis were subsequently entered into a multivariable binary logistic regression model to identify independent predictors of prolonged hospitalization. The results of logistic regression were expressed as odds ratios with 95% confidence intervals. Receiver operating characteristic analysis was also considered for significant continuous variables to assess their ability to predict prolonged hospital stay and determine appropriate cutoff values. A P value <0.05 was considered statistically significant.

3-RESULTS

Table 3.1 shows the demographic characteristics of the studied children. Among the 300 children, 104 (34.7%) were aged 1–<3 years, 78 (26.0%) were aged 3–<5 years, 70 (23.3%) were aged ≥5 years, and 48 (16.0%) were younger than 1 year. Males represented 164 (54.7%) of the studied children, while females represented 136 (45.3%). Regarding residence, 201 (67.0%) children were from urban areas and 99 (33.0%) were from rural areas. Normal nutritional status was observed in 221 (73.7%) children, while 56 (18.7%) were underweight and 23 (7.6%) were overweight.

Table 3.1. Demographic characteristics of the studied children with acute gastroenteritis (n=300).

Characteristic	Number	Percent
Age groups		
<1 year	48	16.0
1–<3 years	104	34.7
3–<5 years	78	26.0
≥5 years	70	23.3
Genders		
Male	164	54.7
Female	136	45.3
Residence		
Urban	201	67.0
Rural	99	33.0
Nutritional status		
Normal	221	73.7
Underweight	56	18.7
Overweight	23	7.6

Table 3.2 shows the clinical characteristics of the studied children. Diarrhea was present in 300 (100.0%) children, while vomiting was reported in 214 (71.3%) and fever in 176 (58.7%). Abdominal pain was documented in 91 (30.3%) children. Dehydration was present in 186 (62.0%) children, including mild-to-moderate dehydration in 143 (47.7%) and severe dehydration in 43 (14.3%). Frequent vomiting was reported in 82 (27.3%), while frequent diarrhea was reported in 97 (32.3%).

Table 3.2. Clinical characteristics of the studied children.

Clinical characteristic	Number	Percent
Diarrhea	300	100.0
Vomiting	214	71.3
Fever	176	58.7
Abdominal pain	91	30.3
Dehydration	186	62.0
Mild–moderate dehydration	143	47.7
Severe dehydration	43	14.3
Frequent vomiting*	82	27.3
Frequent diarrhea*	97	32.3

Table 3.3 shows the duration of illness and hospitalization among the studied children. The mean duration of illness before admission was 2.8 ± 1.7 days, while the mean duration of diarrhea was 3.1 ± 1.8 days. The mean duration of vomiting and fever was 1.7 ± 1.1 days and 2.1 ± 1.4 days, respectively. The mean length of hospital stay was 3.6 ± 2.4 days. A total of 228 (76.0%) children had a hospital stay of ≤4 days, whereas 72 (24.0%) had a prolonged hospital stay of >4 days.

Table 3.3. Duration of illness and hospitalization.

Variable	Mean ± SD / Number (percent)
Duration of illness before admission (days)	2.8 ± 1.7
Duration of diarrhea (days)	3.1 ± 1.8
Duration of vomiting (days)	1.7 ± 1.1
Duration of fever (days)	2.1 ± 1.4
Length of hospital stay (days)	3.6 ± 2.4
Hospital stay ≤4 days	228 (76.0%)
Hospital stay >4 days	72 (24.0%)

Table 3.4 shows the laboratory characteristics of the studied children. The mean hemoglobin level was 10.9 ± 1.5 g/dL, with abnormal findings in 92 (30.7%) children. The mean WBC count was 11.8 ± 4.6 $\times 10^9$/L, with

abnormal findings in 84 (28.0%). The mean serum sodium, potassium, and chloride levels were 136.8 ± 5.2, 4.1 ± 0.6, and 101.7 ± 6.1 mmol/L, respectively. Low serum bicarbonate was observed in 71 (23.7%) children. Elevated blood urea nitrogen and serum creatinine were found in 62 (20.7%) and 28 (9.3%) children, respectively. The mean random blood glucose level was 91.4 ± 18.7 mg/dL, with abnormal glucose levels documented in 24 (8.0%) children.

Table 3.4: Laboratory characteristics of the studied children.

Laboratory parameter	Mean ± SD	Abnormal findings, Number (percent)
Hemoglobin (g/dL)	10.9 ± 1.5	92 (30.7)
WBC ($\times 10^9$/L)	11.8 ± 4.6	84 (28.0)
Serum sodium (mmol/L)	136.8 ± 5.2	43 (14.3)
Serum potassium (mmol/L)	4.1 ± 0.6	38 (12.7)
Serum chloride (mmol/L)	101.7 ± 6.1	46 (15.3)
Serum bicarbonate (mmol/L)	19.8 ± 4.1	71 (23.7)
Blood urea nitrogen	28.6 ± 14.2	62 (20.7)
Serum creatinine	0.48 ± 0.19	28 (9.3)
Blood glucose (mg/dL)	91.4 ± 18.7	24 (8.0)

Table 3.5 shows the treatment characteristics of the studied children. Oral rehydration therapy was administered to 247 (82.3%) children, while 172 (57.3%) received intravenous fluid therapy. Zinc supplementation was given to 218 (72.7%) children. Antiemetic therapy was administered to 121 (40.3%), antibiotic therapy to 96 (32.0%), and electrolyte correction was required in 49 (16.3%) children.

Table 3.5: Treatment characteristics of the studied children.

Treatment	Number	Percent
Oral rehydration therapy	247	82.3
Intravenous fluid therapy	172	57.3
Zinc supplementation	218	72.7
Antiemetic therapy	121	40.3
Antibiotic therapy	96	32.0
Electrolyte correction	49	16.3

Table 3.6 shows the comparison of demographic characteristics according to the length of hospital stay. The mean age was 3.4 ± 2.9 years among children with a stay of ≤4 days and 2.7 ± 2.3 years among those with a stay of >4 days (P=0.061). Males represented 126 (55.3%) and 38 (52.8%) of the two groups, respectively (P=0.711). Urban residence was reported in 159 (69.7%) and 42 (58.3%), respectively (P=0.079). Underweight was significantly more frequent among children with prolonged hospitalization, occurring in 22 (30.6%) compared with 34 (14.9%) in the non-prolonged group (P=0.004).

Table 3.6. Comparison of demographic characteristics according to length of hospital stay.

Variable	Stay ≤4 days (n=228)	Stay >4 days (n=72)	P value
Mean age (years)	3.4 ± 2.9	2.7 ± 2.3	0.061
Male	126 (55.3)	38 (52.8)	0.711
Female	102 (44.7)	34 (47.2)	
Urban residence	159 (69.7)	42 (58.3)	0.079
Underweight	34 (14.9)	22 (30.6)	**0.004**

Table 3.7 shows the comparison of clinical characteristics according to hospital stay. Illness lasting ≥3 days before admission was significantly more frequent among children with prolonged hospitalization, 39 (54.2%) versus 72 (31.6%) (P=0.001). Vomiting was reported in 59 (81.9%) versus 155 (68.0%) (P=0.021), while frequent vomiting occurred in 31 (43.1%) versus 51 (22.4%) (P=0.001). Fever was present in 50 (69.4%) versus 126 (55.3%) (P=0.037). Dehydration was significantly more common among children with prolonged hospitalization, 58 (80.6%) versus 128 (56.1%) (P<0.001), particularly severe dehydration, 26 (36.1%) versus 17 (7.5%) (P<0.001). Frequent diarrhea was also significantly more common in the prolonged-stay group, 34 (47.2%) versus 63 (27.6%) (P=0.002).

Table 3.7. Comparison of clinical characteristics according to length of hospital stay.

Clinical characteristic	Stay ≤4 days (n=228)	Stay >4 days (n=72)	P value
Illness ≥3 days before admission	72 (31.6)	39 (54.2)	**0.001**
Vomiting	155 (68.0)	59 (81.9)	**0.021**
Frequent vomiting	51 (22.4)	31 (43.1)	**0.001**
Fever	126 (55.3)	50 (69.4)	**0.037**
Dehydration	128 (56.1)	58 (80.6)	**<0.001**
Mild–moderate dehydration	111 (48.7)	32 (44.4)	0.540
Severe dehydration	17 (7.5)	26 (36.1)	**<0.001**
Frequent diarrhea	63 (27.6)	34 (47.2)	**0.002**

Table 3.8 shows the comparison of laboratory findings according to hospital stay. Children with prolonged hospitalization had significantly higher mean WBC count (13.1 ± 5.3 vs. 11.4 ± 4.2 $\times 10^9$/L, P=0.008), BUN (34.5 ± 17.1 vs. 26.7 ± 12.8, P<0.001), and creatinine (0.57 ± 0.24 vs. 0.45 ± 0.16, P<0.001), while mean sodium (134.6 ± 6.0 vs. 137.5 ± 4.7 mmol/L, P<0.001), chloride (99.8 ± 6.9 vs. 102.3 ± 5.7 mmol/L, P=0.003), and bicarbonate (17.3 ± 4.5 vs, 20.6 ± 3.7 mmol/L, P<0.001) were significantly lower. Hemoglobin and potassium levels did not differ significantly between the groups (P=0.071 and P=0.213, respectively).

Table 3.8. Comparison of laboratory findings according to length of hospital stay.

Laboratory parameter	Stay ≤4 days	Stay >4 days	P value
Hemoglobin (g/dL)	11.0 ± 1.4	10.6 ± 1.7	0.071
WBC ($\times 10^9$/L)	11.4 ± 4.2	13.1 ± 5.3	**0.008**
Sodium (mmol/L)	137.5 ± 4.7	134.6 ± 6.0	**<0.001**
Potassium (mmol/L)	4.1 ± 0.5	4.0 ± 0.7	0.213
Chloride (mmol/L)	102.3 ± 5.7	99.8 ± 6.9	**0.003**
Bicarbonate (mmol/L)	20.6 ± 3.7	17.3 ± 4.5	**<0.001**
BUN	26.7 ± 12.8	34.5 ± 17.1	**<0.001**
Creatinine	0.45 ± 0.16	0.57 ± 0.24	**<0.001**

Table 3.9 shows the distribution of electrolyte and biochemical abnormalities according to hospital stay. Hyponatremia was significantly more frequent among children with prolonged hospitalization, 20 (27.8%) versus 24 (10.5%) (P<0.001), as were hypochloremia, 19 (26.4%) versus 27 (11.8%) (P=0.003), low bicarbonate, 29 (40.3%) versus 42 (18.4%) (P<0.001), elevated BUN, 26 (36.1%) versus 36 (15.8%) (P<0.001), and elevated creatinine, 13 (18.1%) versus 15 (6.6%) (P=0.004). Hypokalemia did not differ significantly between the groups (P=0.053).

Table 3.9. Electrolyte and biochemical abnormalities according to length of hospital stay.

Abnormality	Stay ≤4 days (n=228)	Stay >4 days (n=72)	P value
Hyponatremia	24 (10.5)	20 (27.8)	**<0.001**
Hypokalemia	24 (10.5)	14 (19.4)	0.053
Hypochloremia	27 (11.8)	19 (26.4)	**0.003**
Low bicarbonate	42 (18.4)	29 (40.3)	**<0.001**
Elevated BUN	36 (15.8)	26 (36.1)	**<0.001**
Elevated creatinine	15 (6.6)	13 (18.1)	**0.004**

Table 3.10 shows the treatment characteristics according to hospital stay. Intravenous fluid therapy was significantly more frequent among children with prolonged hospitalization, 59 (81.9%) versus 113 (49.6%) (P<0.001). Antiemetic therapy and antibiotic use were also significantly higher in the prolonged-stay group, 38 (52.8%) versus 83 (36.4%) (P=0.014) and 31 (43.1%) versus 65 (28.5%) (P=0.021), respectively. Electrolyte correction was required in 22 (30.6%) versus 27 (11.8%) children (P<0.001). Oral rehydration therapy also differed significantly (P=0.008), whereas zinc supplementation did not (P=0.322).

Table 3.10. Treatment characteristics according to length of hospital stay.

Treatment	Stay ≤4 days (n=228)	Stay >4 days (n=72)	P value
Oral rehydration therapy	195 (85.5)	52 (72.2)	**0.008**
Intravenous fluid therapy	113 (49.6)	59 (81.9)	**<0.001**
Zinc supplementation	169 (74.1)	49 (68.1)	0.322
Antiemetic therapy	83 (36.4)	38 (52.8)	**0.014**
Antibiotic therapy	65 (28.5)	31 (43.1)	**0.021**
Electrolyte correction	27 (11.8)	22 (30.6)	**<0.001**

Table 3.11 shows the univariate logistic regression analysis of potential predictors of prolonged hospital stay. Significant predictors included underweight (OR=2.50, P=0.006), illness ≥3 days before admission (OR=2.55, P=0.001), frequent vomiting (OR=2.63, P=0.001), dehydration (OR=3.25, P<0.001), severe dehydration (OR=7.02, P<0.001), frequent diarrhea (OR=2.35, P=0.003), hyponatremia (OR=3.28, P=0.001), low bicarbonate (OR=2.99, P<0.001), elevated BUN (OR=3.02, P<0.001), elevated creatinine (OR=3.15, P=0.005), and intravenous fluid therapy (OR=4.61, P<0.001). Fever was also significantly associated with prolonged hospitalization (OR=1.84, P=0.036).

Table 3.11. Univariate analysis of potential predictors of prolonged hospital stay.

Predictor	OR	95% CI	P value
Underweight	2.50	1.30–4.80	0.006
Illness ≥3 days before admission	2.55	1.45–4.48	0.001
Frequent vomiting	2.63	1.47–4.70	0.001
Fever	1.84	1.04–3.25	0.036
Dehydration	3.25	1.67–6.32	<0.001
Severe dehydration	7.02	3.43–14.36	<0.001
Frequent diarrhea	2.35	1.33–4.15	0.003
Hyponatremia	3.28	1.65–6.52	0.001
Low bicarbonate	2.99	1.66–5.39	<0.001
Elevated BUN	3.02	1.61–5.66	<0.001
Elevated creatinine	3.15	1.42–6.98	0.005
Intravenous fluid therapy	4.61	2.30–9.23	<0.001

Table 3.12 shows the multivariable logistic regression analysis of independent predictors of prolonged hospital stay. Severe dehydration remained the strongest predictor (adjusted OR=3.40, 95% CI: 1.70–6.80, P<0.001), followed by hyponatremia (adjusted OR=2.60, P=0.006), illness ≥3 days before admission (adjusted OR=2.30, P=0.004), frequent vomiting (adjusted OR=2.10, P=0.009), low serum bicarbonate (adjusted OR=2.20, P=0.025), and intravenous fluid therapy (adjusted OR=1.80, P=0.041). Underweight was not independently significant (adjusted OR=1.70, P=0.098).

Table 3.12. Multivariable logistic regression analysis of independent predictors of prolonged hospital stay.

Independent predictor	Adjusted OR	95% CI	P value
Severe dehydration	**3.40**	**1.70–6.80**	**<0.001**
Illness ≥3 days before admission	**2.30**	**1.30–4.10**	**0.004**
Frequent vomiting	**2.10**	**1.20–3.80**	**0.009**
Hyponatremia	**2.60**	**1.30–5.10**	**0.006**
Low serum bicarbonate	**2.20**	**1.10–4.30**	**0.025**
Intravenous fluid therapy	**1.80**	**1.00–3.20**	**0.041**
Underweight	1.70	0.90–3.20	0.098

4- DISCUSSION

The present study evaluated 300 children admitted with acute gastroenteritis at Baladruz Hospital and focused on factors associated with prolonged hospitalization, defined as a hospital stay of more than 4 days. In the present estimated results, 72 (24.0%) children had prolonged hospitalization, with a mean hospital stay of 3.6 ± 2.4 days. This finding indicates that approximately one-quarter of hospitalized children required an extended inpatient course. The proportion is lower than that reported by Alhassan **Abdul-Mumin *et al***., who found prolonged hospitalization in 35.3% of children admitted with acute gastroenteritis in Northern Ghana using the same >4-day definition. Their study identified dehydration and longer duration of symptoms before presentation as important predictors of prolonged length of stay.[9] Differences in hospitalization rates may reflect variations in patient severity, admission practices, healthcare accessibility, nutritional status, and local treatment protocols.

The age distribution in the present study showed that children aged 1–<3 years constituted the largest group, 104 (34.7%), followed by those aged 3–<5 years. This predominance of younger children is consistent with the epidemiology of pediatric gastroenteritis, as infants and young children are particularly vulnerable to rapid fluid and electrolyte losses. The 2024 WHO guideline emphasizes that diarrheal disease remains a major cause of morbidity and mortality in children and provides updated recommendations for management in children up to 10 years of age.[14] A recent 2025 study from Kenya similarly demonstrated that age and nutritional status were relevant to prolonged hospitalization among children younger than 5 years with acute gastroenteritis.[15]

A slight male predominance was observed in the present study, with 164 (54.7%) males compared with 136 (45.3%) females. This finding is broadly comparable with several pediatric gastroenteritis cohorts, although sex has not consistently been demonstrated as an independent determinant of disease severity or length of hospitalization. Importantly, sex was not significantly different between the prolonged and non-prolonged hospitalization groups in the present study (P=0.711), suggesting that the observed male predominance did not substantially influence hospital length of stay.[13,16,17]

The relationship between electrolyte abnormalities and hospital stay is strongly supported by recent evidence. A 2026 study of 361 children with acute gastroenteritis found a significant association between multiple electrolyte abnormalities and length of hospital stay. Hyponatremia was associated with prolonged hospitalization (OR=1.90), while hypochloremia was also significantly associated with longer stay (OR=3.18).[10] Similarly, a recent study of children hospitalized with AGE in Botswana reported longer hospital stays among children with hypokalemia and hyponatremia compared with those without electrolyte abnormalities.[3] These findings are highly consistent with the present results and strengthen the evidence that electrolyte disturbances are clinically useful markers of disease severity.

Hyponatremia was present in 20 (27.8%) children with prolonged hospitalization compared with 24 (10.5%) in the non-prolonged group (P<0.001). It remained an independent predictor after multivariable adjustment, with an adjusted OR of 2.60 (95% CI: 1.30–5.10, P=0.006). The association may reflect substantial gastrointestinal sodium loss, inappropriate replacement of free water, or more severe disease. The recent 2026 Pakistani study similarly demonstrated a significant relationship between hyponatremia and prolonged hospitalization in children with AGE.[10]

Low serum bicarbonate was another important finding. It was present in 29 (40.3%) children with prolonged hospitalization compared with 42 (18.4%) in the non-prolonged group (P<0.001) and remained independently associated with prolonged hospitalization (adjusted OR=2.20, 95% CI: 1.10–4.30, P=0.025). Reduced bicarbonate is commonly associated with metabolic acidosis resulting from bicarbonate loss in diarrhea and tissue hypoperfusion in significant dehydration. Recent evidence also supports the clinical relevance of bicarbonate: a 2025 study found bicarbonate ≤16 mmol/L to be independently associated with hospital admission among children with dehydration.[20] The 2026 AGE study likewise reported very frequent bicarbonate reduction and demonstrated an association between electrolyte abnormalities and length of hospitalization.[10]

Renal biochemical markers also differed significantly between the two groups. Mean BUN was 34.5 ± 17.1 among children with prolonged hospitalization compared with 26.7 ± 12.8 among those with shorter hospitalization (P<0.001), while mean creatinine was 0.57 ± 0.24 versus 0.45 ± 0.16, respectively (P<0.001). Elevated BUN and creatinine were also significantly more frequent in the prolonged-stay group. These findings are consistent with previous evidence showing that dehydration associated with acute gastroenteritis can lead to reduced renal perfusion and acute kidney injury. **Marzuillo *et al***. reported that 24.6% of hospitalized children with acute gastroenteritis developed acute kidney injury, with dehydration >5% being a strong independent predictor; importantly, mean hospital stay increased from 3.6 ± 1.2 days in children without acute kidney injury to 5.0 ± 1.8 days and 10.5 ± 5.8 days in those with mild and severe acute kidney injury, respectively (P<0.001).[11]

Nutritional status was another factor associated with hospitalization duration. Underweight children represented 22 (30.6%) of the prolonged-stay group compared with 34 (14.9%) of the non-prolonged group (P=0.004). Although underweight was significant in univariate analysis (OR=2.50), it did not remain statistically significant after multivariable adjustment (adjusted OR=1.70, P=0.098). This attenuation suggests that part of the relationship between nutritional status and prolonged hospitalization may be explained by clinical severity and dehydration. Nevertheless, recent evidence supports the importance of nutritional status. A 2025 Kenyan study found severe stunting and severe wasting to be associated with increased odds of prolonged hospitalization among children with AGE.[15] Therefore, nutritional assessment remains important in the initial evaluation of hospitalized children with gastroenteritis.

Regarding treatment, intravenous fluid therapy was significantly more common among children with prolonged hospitalization, occurring in 59 (81.9%) compared with 113 (49.6%) among children with shorter hospitalization (P<0.001). It remained independently associated with prolonged hospitalization in the multivariable model (adjusted OR=1.80, 95% CI: 1.00–3.20, P=0.041). This association should be interpreted cautiously because intravenous fluid therapy is likely to be a marker of greater disease severity rather than a direct cause of prolonged hospitalization. Children with more severe dehydration, vomiting, electrolyte disturbances, or inability to tolerate oral fluids are more likely to require intravenous therapy and are also more likely to remain hospitalized longer. Current WHO recommendations emphasize low-osmolality oral rehydration solution for children with acute watery diarrhea and dehydration, reserving intravenous therapy for appropriate clinical indications.[18]

Oral rehydration therapy was used in 247 (82.3%) children overall and was significantly more frequent among those with non-prolonged hospitalization. This

finding is compatible with the established role of oral rehydration in reducing the need for intravenous therapy and facilitating earlier discharge when oral intake is tolerated. WHO's updated guidance recommends low-osmolality oral rehydration solution for children with acute watery diarrhea and dehydration.[18] The 2024 German pediatric AGE guideline similarly emphasizes evidence-based management and avoidance of unnecessary hospitalization.[1]

Antibiotics were administered to 96 (32.0%) children overall and were more frequently used among children with prolonged hospitalization. In univariate analysis, antibiotic use was associated with prolonged hospitalization in the treatment comparison, although it was not included as an independent predictor in the final multivariable model. This finding may reflect confounding by severity or suspected bacterial infection rather than a causal effect of antibiotics on length of stay. Importantly, the current WHO guideline recommends against routine antibiotics for acute watery diarrhea in children, regardless of etiology, while recommending antibiotics when diarrhea is accompanied by blood in the stool.[18] A recent systematic review and meta-analysis also evaluated antibiotic therapy in pediatric acute diarrhea and highlighted the uncertainty of benefit in many cases alongside concerns about adverse effects and antimicrobial resistance.[19]

The multivariable analysis is one of the most important findings of the present study. Severe dehydration, illness lasting ≥3 days before admission, frequent vomiting, hyponatremia, low serum bicarbonate, and intravenous fluid therapy remained independently associated with prolonged hospitalization. Severe dehydration demonstrated the strongest association (adjusted OR=3.40), followed by hyponatremia (adjusted OR=2.60) and delayed presentation (adjusted OR=2.30). These findings indicate that prolonged hospitalization in pediatric AGE is principally related to severity of fluid loss, delayed presentation, inability to maintain adequate oral hydration, and associated electrolyte/metabolic disturbances. The findings are particularly relevant to a hospital such as Baladruz Hospital because early recognition of these factors could assist clinicians in identifying children at increased risk of prolonged hospitalization. The 2024 WHO guideline emphasizes evidence-based assessment and management of childhood diarrhea, while recent studies demonstrate the usefulness of dehydration severity, nutritional status, electrolyte abnormalities, and symptom duration in identifying children at higher risk of adverse resource utilization.[14] In a resource-limited setting, early identification of high-risk patients may facilitate appropriate monitoring, timely correction of dehydration and electrolyte abnormalities, and more rational use of hospital beds and intravenous therapy.

The present study has several limitations. First, it was conducted at a single hospital, Baladruz Hospital, which may limit the generalizability of the findings to children with acute gastroenteritis treated in other hospitals or regions of Iraq. Second, the sample size of 300 children may have limited the ability to detect weaker associations, particularly for less frequent clinical and laboratory abnormalities. Third, assessment of dehydration was based mainly on clinical findings, which may be subject to interobserver variability. Fourth, the study did not systematically identify the specific infectious etiological agents responsible for gastroenteritis; therefore, differences in hospitalization duration according to viral, bacterial, or parasitic causes could not be evaluated. Fifth, some laboratory investigations were performed according to clinical indications rather than a standardized research protocol, which may have introduced selection or ascertainment bias. In addition, treatment-related variables such as intravenous fluid therapy, antibiotic use, and electrolyte correction may represent markers of disease severity rather than independent causal factors for prolonged hospitalization. Finally, the use of more than 4 days as the definition of prolonged hospital stay, although previously used in pediatric gastroenteritis research, may differ from definitions used in other studies and could influence the estimated prevalence and strength of associations.

5- CONCLUSION AND RECOMMENDATION

The present study demonstrated that prolonged hospital stay among children with acute gastroenteritis was primarily associated with greater disease severity, delayed presentation, and metabolic disturbances. Severe dehydration, illness lasting ≥3 days before admission, frequent vomiting, hyponatremia, low serum bicarbonate, and intravenous fluid therapy were identified as independent predictors of prolonged hospitalization. Children with prolonged hospital stays also showed significantly higher WBC, BUN, and creatinine levels and lower serum sodium, chloride, and bicarbonate levels compared with those with shorter hospitalization. Based on these findings, early assessment of dehydration severity and prompt initiation of appropriate rehydration therapy are recommended for all children presenting with acute gastroenteritis, with particular attention to those with delayed presentation, frequent vomiting, or severe dehydration. Serum electrolytes, bicarbonate, BUN, and creatinine should be assessed in children with moderate-to-severe dehydration or suspected metabolic disturbance, and high-risk children should receive closer clinical monitoring. Nutritional status should also be routinely assessed, particularly in underweight children. Furthermore, unnecessary antibiotic use should be avoided and treatment should follow established pediatric gastroenteritis guidelines. Finally, multicenter prospective studies involving larger pediatric populations across different regions of Iraq are recommended to validate these predictors and develop a locally applicable model for early identification of children at risk of prolonged hospitalization.

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