

SEASONAL TRENDS AND CLINICAL FEATURES OF GASTROINTESTINAL INFECTIONS IN CHILDREN: A DESCRIPTIVE STUDY

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Abstract: Background: Gastrointestinal infections are a leading cause of pediatric morbidity worldwide, with seasonal patterns often influencing their incidence.

Aim: This study aimed to investigate the seasonal trends and clinical features of gastrointestinal infections in children presenting to a central pediatric teaching hospital over one year.

Methods: A descriptive observational study was conducted at the Central Teaching Hospital of Pediatrics over a 12-month period (January–December 2024). Children aged 1–12 years presenting with acute gastroenteritis were included. Data was collected on demographic characteristics, clinical features, season of presentation, and identified etiological agents. Stool samples were tested for viral (rotavirus, adenovirus) and bacteria (*Shigella*, *Salmonella*, *Escherichia coli*) pathogens. Descriptive statistics were used to analyze data.

Results: A total of 360 children were included, with a median age of 3 years (IQR: 1.5–5.0). Most cases occurred in winter (45%), with a peak in February. Viral infections were predominant, accounting for 60% of cases. Rotavirus was the most frequently identified pathogen (25%), followed by adenovirus (12.5%). Bacterial infections (*Shigella*, *Salmonella*) were more common in summer and autumn. The majority of children (70%) presented with watery diarrhea, while 14% had bloody diarrhea. Vomiting (72%) and fever (61%) were common clinical features. Moderate dehydration was seen in 25% of cases, and 5.5% experienced severe dehydration requiring hospitalization. No fatalities occurred.

Conclusion: Gastrointestinal infections in children show a clear seasonal pattern, with a winter peak dominated by viral agents, particularly rotavirus. Bacterial infections were more frequent in summer. These findings highlight the need for seasonal preparedness in pediatric care settings, including enhanced availability of rehydration solutions in winter and targeted hygiene education in summer. Implementation of rotavirus vaccination could significantly reduce the winter disease burden.

Keywords: Gastrointestinal infections, Pediatric, Seasonal trends, Rotavirus, Acute gastroenteritis, Descriptive study.

1. Introduction

Diarrheal diseases remain a major cause of childhood illness and death worldwide. Recent estimates from the World Health Organization indicate that diarrheal disease is the third leading cause of mortality in children 1–59 months old, claiming around 443,000 lives of children under 5 each year (plus about 50,000 deaths in children 5–9 years) (1). Globally, there are nearly 1.7 billion episodes of childhood diarrhea

annually (2). In addition to causing acute illness, repeated gastrointestinal infections can contribute to malnutrition and impaired growth (3).

Acute gastroenteritis in children is caused by a wide array of pathogens, with viruses being the most common etiology in young children (4). Worldwide, rotavirus has historically been the leading cause of severe acute gastroenteritis in infants and toddlers, responsible for a large proportion of hospitalizations and nearly 37% of diarrhea-related child deaths in the pre-vaccine era (5). Other important viral agents include norovirus, adenovirus (types 40/41), and astrovirus (6). Bacterial pathogens (such as diarrheagenic *Escherichia coli*, *Salmonella*, *Shigella*, and *Campylobacter*) and protozoal parasites (e.g. *Giardia*, *Cryptosporidium*) also contribute, particularly in certain settings (7). The clinical presentation can range from mild, self-limited diarrhea to severe dehydrating illness. Young children are especially vulnerable to dehydration from vomiting and profuse diarrhea, sometimes requiring hospitalization for intravenous rehydration (8). Fortunately, many of these infections are preventable or treatable with proper hydration, zinc supplementation, and, for some pathogens, vaccines (e.g. rotavirus vaccine) (9).

Seasonal patterns in pediatric gastrointestinal infections have been observed in many populations. In temperate climates of developed countries, viral gastroenteritis (especially rotavirus) typically peaks in the cooler winter months (10). By contrast, in many tropical developing regions, diarrheal illness is often more prevalent in the warmer rainy season, when bacterial pathogens from contaminated water and food play a larger role (11). Nevertheless, rotavirus remains a leading cause of pediatric diarrhea across diverse climates (12).

2. Methods

A hospital-based descriptive observational study over a 12-month period at the Central Teaching Hospital of Pediatrics (a tertiary care center). The study period spanned from January 2024 through March 2025, covering all seasons in one calendar year. Children between 1 year of age and 12 years of age (with a focus on the 1–5-year range and including some older children >5) who presented with gastrointestinal infection were eligible. Defined a gastrointestinal infection case as any child with acute onset of diarrhea (passage of ≥ 3 loose or watery stools in 24 hours) with or without vomiting, in whom an infectious cause was considered likely. Children often also had other symptoms such as fever or abdominal pain. Included both outpatients (seen in the emergency department or clinics and managed without admission) and inpatients (children who were hospitalized for severe gastroenteritis or complications). Excluded children with chronic diarrhea (>14 days), those with an alternate non-infectious diagnosis for GI symptoms, and neonates (<1 month old). Each eligible case was enrolled at the time of presentation; if a child had multiple episodes during the year, only the first episode was included to avoid over-representation. A total of 360 children met the inclusion criteria and were included in the analysis, exceeding the minimum sample size required.

A standardized data collection form was used for each case. At enrollment (presentation), we recorded the child's age (in years), sex, and residence. Clinical features documented included presence of fever ($\geq 38^{\circ}\text{C}$), number of diarrheal stools in the past 24 hours, presence of vomiting and its frequency, any blood or mucus observed in stool, signs of dehydration (categorized as none, some, or severe dehydration based on WHO guidelines), and whether hospitalization (admission) was required. Also noted the date of presentation to classify each case into a month and season. For the purposes of seasonal analysis, we defined winter as December–February, spring as March–May, summer as June–August, and autumn as September–November.

Wherever possible Laboratory Investigations, stool samples were collected from the children during their illness for pathogen identification.

Data Analysis summarized patient characteristics and clinical features using descriptive statistics. Categorical variables (e.g. presence of fever, dehydration severity) were summarized as frequencies and percentages. Age was reported as median with interquartile range (IQR). We tabulated the number of gastroenteritis cases per month and per season and computed the proportion of the total yearly cases that occurred in each season. These were visualized in a line graph to illustrate trends over time. The distribution of identified pathogens was summarized as percentages of tested cases. We also stratified some analyses by age group (1–2 years, 3–5 years, and >5 years) to examine if the etiology or severity varied with age. No formal hypothesis testing was performed, as this was primarily a descriptive epidemiological study; however, we used chi-square tests to explore any association between season and certain clinical features (proportion with dehydration in different seasons) and considered $p < 0.05$ as statistically significant for these exploratory comparisons. The study protocol was reviewed and approved by Ethics Committee Karkh Health Department / Central Teaching Hospital of Pediatrics.

3. Results

Table 1: Study Participants - Demographic and Clinical Characteristics

Characteristic	Categories	Frequency (N)	Percentage (%)
Total Participants	-	360	100
Age Distribution	1–2 years	120	33.3
	3–5 years	150	41.7
	>5 years (up to 12)	90	25.0
Median Age (IQR)	-	3.0 years	(1.5–5.0)
Gender	Male	200	55.6
	Female	160	44.4
Residence	Urban/Semi-urban	316	88.0
	Rural	44	12.0
Management	Outpatient	144	40.0
	Inpatient	216	60.0

This study included 360 pediatric patients with gastrointestinal infections, with a median age of 3.0 years (IQR 1.5–5.0). Most were aged 3–5 years (41.7%), followed by 1–2 years (33.3%), and over 5 years (25.0%). Boys were slightly more common (55.6%) than girls (44.4%). The majority (88.0%) were from urban/semi-urban areas, and 60.0% required hospitalization, mainly for intravenous rehydration.

Table 2: Clinical Features of Pediatric Gastrointestinal Infections (N=360)

Clinical Feature	Categories	Frequency (N)	Percentage (%)
Diarrhea Type	Watery Diarrhea	310	86.1
	Bloody Diarrhea (Dysentery)	50	13.9
Vomiting	Present	260	72.2
Fever ($\geq 38^\circ\text{C}$)	Present	220	61.1
Abdominal Pain	Present	108	30.0
Dehydration Severity	Mild or None	250	69.4
	Moderate	90	25.0
	Severe	20	5.6
Associated Complications	Seizure (due to electrolyte imbalance)	1	0.3
Rotavirus-Positive Cases	Vomiting Present	90 (of 90)	100.0
Dysentery (Shigella)	High Fever, Tenesmus	50 (of 50)	100.0
Convulsions or Encephalopathy	Not Observed	-	-

The most common symptom (86.1%), followed by bloody diarrhea (13.9%). Vomiting occurred in 72.2%, and fever in 61.1%. Abdominal pain was reported by 30.0% of children. Most had mild or no dehydration (69.4%), while 25.0% experienced moderate dehydration, and 5.6% had severe dehydration. Vomiting was universal in rotavirus-positive cases, and all *Shigella* infections (dysentery) presented with high fever and tenesmus. Only one case of seizure occurred, linked to severe dehydration.

Table 3: Seasonal Distribution of Pediatric Gastrointestinal Infections (N=360)

Season	Number of Cases (N)	Percentage (%)	Age Group (1-2 years)	Percentage (%)	Age Group (>5 years)	Percentage (%)
Winter (Dec-Feb)	162	45.0	60 (of 120)	50.0	32 (of 90)	35.6
Spring (Mar-May)	54	15.0	18 (of 120)	15.0	16 (of 90)	17.8
Summer (Jun-Aug)	72	20.0	24 (of 120)	20.0	20 (of 90)	22.2
Autumn (Sep-Nov)	72	20.0	18 (of 120)	15.0	22 (of 90)	24.4
Total	360	100.0	120	100.0	90	100.0

Pediatric gastrointestinal infections showed a clear seasonal pattern, with nearly half (45.0%) of cases occurring in winter, especially among younger children (50.0% of 1–2 years). Spring had the fewest cases (15.0%), while summer and autumn each accounted for 20.0%. Older children (>5 years) were slightly more affected in autumn (24.4%), while younger children were most affected in winter.

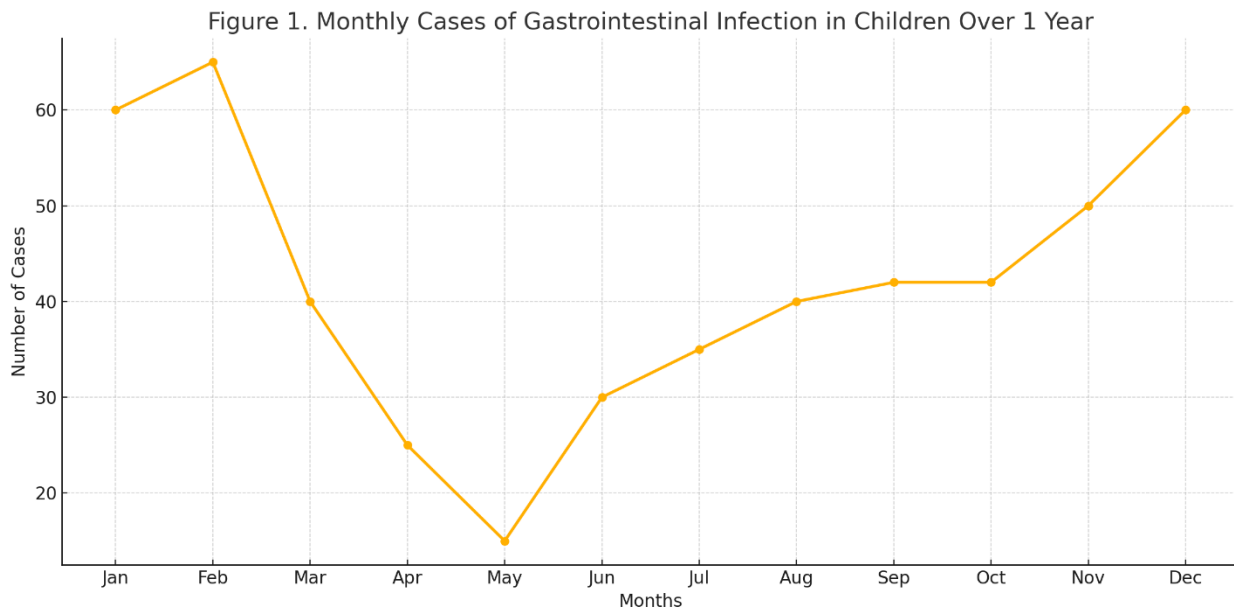


Figure 1. Monthly cases of gastrointestinal infection in children over the 1-year study period.

Table 4: Identified Pathogens in Pediatric Gastroenteritis (N=360)

Pathogen Type	Specific Pathogen	Number of Cases (N)	Percentage of Total Cases (%)	Percentage of Tested Cases (%)
Viral Pathogens	Rotavirus	90	25.0	30.0
	Adenovirus	45	12.5	15.0
	Suspected Norovirus (clinical)	30	8.3	10.0
	Other Viruses (Astrovirus)	10	2.8	3.3
Bacterial Pathogens	Shigella spp.	20	5.6	6.7
	Salmonella spp. (Non-typhoidal)	15	4.2	5.0
	Enteropathogenic E. coli (EPEC)	10	2.8	3.3
Protozoal Pathogens	Giardia lamblia	8	2.2	2.7
No Pathogen Identified	-	112	31.1	37.3
Total Tested Cases	-	300	83.3	100.0

Suspected Norovirus refers to clinically presumed viral cases with negative rota/adenovirus tests; exact number uncertain (not lab-confirmed). Percentages are of total cases (N=360). Many cases had co-infections; counts here reflect the primary pathogen considered for each case. Peak season indicates when that pathogen was most frequently observed in this study. Rotavirus and adenovirus together constituted the majority of winter cases, whereas bacterial pathogens like Shigella and Salmonella were relatively more common during the hot summer months.

4. Discussion

This one-year descriptive study provides insight into the epidemiology of pediatric gastrointestinal infections at a tertiary hospital, highlighting both seasonal trends and clinical characteristics of cases. Our findings confirm a strong seasonal pattern: the incidence of gastroenteritis in children was highest in winter months (notably peaking in January–February) and lowest in late spring to early summer. This pattern aligns with classical epidemiological data from temperate regions, where rotavirus and other viral diarrheas surge in cooler seasons (13). Viral agents were indeed the predominant cause of illness in our study, accounting for ~60% of cases, and were chiefly responsible for the winter peak. In particular, rotavirus was the single most frequent pathogen identified, which is consistent with its historical role as a leading cause of pediatric acute gastroenteritis worldwide (14).

The winter dominance of viral gastroenteritis observed in hospital is supported by numerous studies. A comprehensive review of 21 studies from the Middle East and North Africa noted that most reported rotavirus infections peaking in winter or autumn. Our data specifically showed 45% of annual cases

occurred in winter, which is in line with findings from Turkey and other temperate locales where a majority of rotavirus cases cluster in cooler months (15). In very hot climates or where rotavirus is less seasonal, waterborne bacterial diarrhea might dominate the rainy months. In our context, the summer is extremely dry and hot, which might naturally limit rotavirus transmission but can facilitate bacterial proliferation in improperly stored foods. Indeed, we observed that while overall cases were low in summer, a higher fraction of those were bacterial (e.g. *Shigella* outbreaks in July–September). This mirrors the general paradigm that developed, temperate regions see winter virus-mediated diarrhea, whereas developing, tropical regions often see a rainy-season bacterial diarrhea pattern (16). Our locale perhaps experiences a bit of both patterns: a strong winter viral wave and a smaller summer bacterial wave.

Clinically, the children in our study presented with typical features of acute gastroenteritis. Watery diarrhea with vomiting and moderate fever was the most common presentation, especially in presumed viral cases. The high rate of vomiting (72% overall) is notable and had implications for treatment (many children required IV fluids due to vomit-induced dehydration). Rotavirus in particular is known for causing frequent vomiting; this was evident in our data as well, and it contributed to rotavirus patients more often needing hospitalization for dehydration. Adenovirus gastroenteritis, while also causing diarrhea, tended to be slightly milder (fewer vomiting episodes), consistent with some reports that adenoviral diarrhea has a more prolonged but less severe course. We did not have the capability to test for norovirus, but clinically many of the cases with short-lived vomiting and diarrhea (especially among older children and those occurring in sporadic clusters) were suggestive of norovirus. Norovirus is highly contagious and often causes outbreaks in communities; it may have contributed to the autumn rise we saw, as has been documented in some temperate countries where norovirus peaks in colder months or around school terms (17).

Findings on gender and age distribution warrant brief discussion. We observed a modest male predominance (55% male). Interestingly, many other studies have documented a higher incidence of viral gastroenteritis in male children. The reasons are not fully understood, but biological and sociocultural factors (e.g. care-seeking behavior) may play a role. The most affected age group in our study was 1–2 years, followed by 3–5 years, which is expected as toddlers have the highest susceptibility to severe diarrhea (maternal antibodies have waned and their own immunity is still developing, plus rotavirus illness tends to strike in the first 2–3 years of life). Infants <1 were not the focus of our study, but global data show the burden is also very high in that group (15). By school-age years (>5), children in our cohort had fewer cases, possibly due to acquired immunity from earlier exposures. This age distribution underscores the importance of interventions in the first years of life – notably rotavirus vaccination, which has proven to dramatically reduce rotavirus hospitalizations where implemented. Our country's lack of rotavirus vaccine in the routine schedule likely contributed to the substantial rotavirus burden we documented. As part of the discussion, these results have been shared with public health officials to advocate for introducing the rotavirus vaccine, which could shift or reduce the winter peak in coming years (as seen in countries like the US, where rotavirus seasons became shorter and biennial post-vaccine) (18).

Results are broadly consistent with prior literature on pediatric gastroenteritis in hospital settings. The proportion of cases attributed to rotavirus (25%) is within the range reported by the Global Enteric Multicenter Study (GEMS) and other regional studies before widespread vaccination, where rotavirus was found in roughly 20–40% of moderate-to-severe diarrhea cases (16). The dominance of viral causes (60%) over bacterial (10%) in our study mirrors findings from Samawah, Iraq in 2018–19, which reported ~57% viral and 8% bacterial diarrhea rates (19).

5. Conclusion

In conclusion, this study demonstrates that seasonal trends play a significant role in pediatric gastrointestinal infections in our setting. Over a one-year period at a central pediatric hospital, we observed a pronounced winter peak in gastroenteritis cases, driven largely by viral pathogens such as rotavirus and

adenovirus. In contrast, relatively fewer cases occurred in summer, and a higher proportion of those were bacterial in nature. The clinical features were consistent with acute infectious diarrhea, with most children presenting with watery diarrhea, vomiting, and mild to moderate dehydration, while a minority (mostly with bacterial infections) had dysentery.

References

1. Keusch GT, Walker CF, Das JK, Horton S, Habte D. Diarrheal diseases. 2016.
2. Das JK, Salam RA, Bhutta ZA. Global burden of childhood diarrhea and interventions. *Current opinion in infectious diseases*. 2014;27(5):451-8.
3. Rodríguez L, Cervantes E, Ortiz R. Malnutrition and gastrointestinal and respiratory infections in children: a public health problem. *International journal of environmental research and public health*. 2011;8(4):1174-205.
4. Bányai K, Estes MK, Martella V, Parashar UD. Viral gastroenteritis. *The Lancet*. 2018;392(10142):175-86.
5. Troeger C, Khalil IA, Rao PC, Cao S, Blacker BF, Ahmed T, et al. Rotavirus vaccination and the global burden of rotavirus diarrhea among children younger than 5 years. *JAMA pediatrics*. 2018;172(10):958-65.
6. Lopman BA, Vinjé J, Glass RI. Noroviruses, Sapoviruses, and Astroviruses. *Viral Infections of Humans: Epidemiology and Control: Springer*; 2014. p. 479-99.
7. Sell J, Dolan B. Common gastrointestinal infections. *Primary Care: Clinics in Office Practice*. 2018;45(3):519-32.
8. Siciliano V, Nista EC, Rosà T, Brigida M, Franceschi F. Clinical management of infectious diarrhea. *Reviews on Recent Clinical Trials*. 2020;15(4):298-308.
9. Lazarus RP. Evaluation of Immune responses to Rotavirus Vaccination in Indian Infants Supplemented with Zinc and Probiotics: The Tamilnadu Dr. MGR Medical University, Chennai; 2015.
10. Fares A. Global patterns of seasonal variation in gastrointestinal diseases. *Journal of Postgraduate Medicine*. 2013;59(3):203-7.
11. Nichols G, Lake I, Heaviside C. Climate change and water-related infectious diseases. *Atmosphere*. 2018;9(10):385.
12. Julian TR. Environmental transmission of diarrheal pathogens in low and middle income countries. *Environmental Science: Processes & Impacts*. 2016;18(8):944-55.
13. Chao DL, Roose A, Roh M, Kotloff KL, Proctor JL. The seasonality of diarrheal pathogens: A retrospective study of seven sites over three years. *PLoS neglected tropical diseases*. 2019;13(8):e0007211.
14. Dias E, Ritwik P, Tayeb H. Pediatric infectious diseases. OMICS groups e-book, USA. 2015.
15. Shaheen MNF. Rotavirus gastroenteritis among hospitalized children under 5 years of age in the eastern mediterranean region: a review. *Eastern Mediterranean Health Journal*. 2019;25(6):422-30.
16. Shah M, Kathiiko C, Wada A, Odoyo E, Bundi M, Miringu G, et al. Prevalence, seasonal variation, and antibiotic resistance pattern of enteric bacterial pathogens among hospitalized diarrheic children in suburban regions of central Kenya. *Tropical medicine and health*. 2016;44:1-8.

17. Schrijver TV, Brand PL, Bekhof J. Seasonal variation of diseases in children: a 6-year prospective cohort study in a general hospital. *European journal of pediatrics*. 2016;175:457-64.
18. Nichols GL, Iacono GL. Examining the influence of weather on rotavirus infection. *The Lancet Planetary Health*. 2019;3(6):e236-e7.
19. Thwiny HT, Alsalih NJ, Saeed ZF, Al-Yasari AMR, Al-Saadawe MAA, Alsaadawi MAE. Prevalence and seasonal pattern of enteric viruses among hospitalized children with acute gastroenteritis in Samawah, Iraq. *Journal of Medicine and Life*. 2022;15(1):52.