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Exposure of Acute Gastroenteritis in Relation to Season: A Cross-Sectional Study Based on Demographic Representation of Paediatric Patients with Their Outcomes

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ABSTRACT

Among children, acute gastroenteritis (viral) is a major concern for public health. In Pakistan, childhood mortality remains fourth largest, with gastrointestinal infections remaining a major cause. **Objectives:** To compare acute gastroenteritis and seasonal variations based on their demographic representation. **Methods:** After informed consent and ethical approval, this cross-sectional (prospective) research was carried out in the Paediatric Ward of Al-Tibri Medical College and Hospital, Karachi, from June 2023 to May 2024. Patients diagnosed with acute gastroenteritis were included, while those with any other diagnosis (such as intestinal obstruction, urinary tract infection, etc.) were excluded. SPSS version 23.0 was used for the analysis of data. To test significance, the chi-square test was applied at a p-value≤0.05. **Results:** Among 377 paediatric cases, 55% were male and 45% female, with 34% infants and 38% between 1-4 years. 72.7% of patients were admitted in the summer and 27.3% in winter, with most being admitted in May 2024 (14%) and least in the month of November 2023 (3%). The majority were discharged alive and healthy (99%). A significant association was observed in patients admitted in each month (p-value<0.001). **Conclusions:** This study showed that acute gastroenteritis in paediatric patients was more common among males and children aged 1–4 years, with a significantly higher number of admissions during the summer months, particularly in May 2024. Despite the seasonal surge, almost all patients recovered well, with 99% discharged alive and healthy.

INTRODUCTION

Acute gastroenteritis (AGE) in Pediatric patients shows clear seasonal patterns influenced by the causative viral agents. Some infections, such as rotavirus, typically peak in winter and early spring, while others (like adenovirus) are more prevalent in summer and early autumn, with some studies noting dual peaks in cooler months like January and September [1, 2]. Other viruses also peak in winter, with certain genotypes causing more severe symptoms and outbreaks during this season [3]. Some associated with gastroenteritis tend to have higher prevalence during the rainy season in tropical regions [4]. The COVID-19 pandemic and related protective measures have altered the epidemiology of these viruses, reduced some infections, but highlighted the need for ongoing surveillance [5]. Overall, seasonality varies by virus type and geographic region, but winter months generally see increased viral gastroenteritis cases in children, emphasizing the importance of targeted prevention and

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vaccination strategies [6]. The majority of children below 5 years of age commonly have diarrhoea with or without vomiting. It is an acute gastroenteritis (AGE) defining trait. Anorexia, vomiting, diarrhoea, fever, pallor, and stomach cramps are all symptoms of AGE that frequently result in dehydration [1]. It is the second most common infection observed among children <5 years. In countries that are developed, the occurrence of diarrheal illness caused by Acute Gastroenteritis (AGE) has been estimated to range between 0.5 to 1.9 episodes/child/year in infants and children up to 3 years [7]. The main public health concern affects children under the age of five, as well as occasionally children over the age of five [8]. According to reports, viruses are the most frequent cause of AGE [9]. The prevalence of AGE in developed countries is significantly lower than in less developed countries, largely due to improved hygiene, appropriate sanitation systems, and heightened public health education and awareness. Despite this, AGE cases are still reported in both developed and underdeveloped countries [10]. Research has shown that AGE is a major cause of childhood mortality in Pakistan.

Even though there are lots of studies in Pakistan that show the mortality caused by AGE, there is not enough data from different hospitals in different parts of the country [11]. As AGE is still a prevalent issue in developing countries, it is beneficial to investigate the seasonal patterns of presentation of the disease for taking necessary procedures in seasons with a higher AGE burden in order to address the issue and reduce the incidence rate. This study aimed to evaluate the exposure of paediatric patients to AGE based on their demographic representation, their outcomes, the month/season of admission, duration of hospitalization, and the manner in which they were discharged.

METHODS

A cross-sectional observational study was conducted at the Department of Paediatrics of Al-Tibri Medical College and Hospital, involving 377 paediatric cases who were admitted between June 2023 and May 2024. The study received approval from the Ethical Review Committee of Al-Tibri Medical College and Hospital and Isra University, Karachi, with ref no: IERC/ATMC/02-2021/20, and obtained informed consent from guardians or parents. The study utilized a non-probability, convenience sampling technique to collect data. This study included patients who had been admitted to the Paediatric Ward with an AGE diagnosis. The study included paediatric patients aged between one month and twelve years. Excluded from the study were any other paediatric patients with other illnesses (such as urinary tract infection, appendicitis, intussusception, intestinal obstruction, drug induced gastritis, inflammatory bowel disease etc.) those who had been observed in the Emergency/Intensive Care Unit (ECU) for < 24 hours, those admitted to Paediatric ICU, and those with surgical paediatric conditions (such as appendicitis, intestinal obstruction, intussusception etc.). The study utilized version 23.0 of the Statistical Package for Social Sciences (SPSS) to gather and analyse data. The study employed descriptive statistics to gather and examine information, including variables such as age, gender, duration of hospital stays, hospitalization month, admission season, admission outcome, discharge method, and diagnosis. This study then provided calculations for frequency and percentages. To assess the data's significance, we performed chi-square test or Fisher's exact test where appropriate, and one-way ANOVA keeping p-value<0.05, showing significant difference in presentation of age based on gender and season.

RESULTS

377 paediatric subjects were admitted during one year, beginning in June 2023 and concluding in May 2024, for acute gastrointestinal disease. Out of the 377 patients, 55 % were male, while 45 % were female. The frequency of male was higher than that of female patients (p=0.45) (Figure 1).

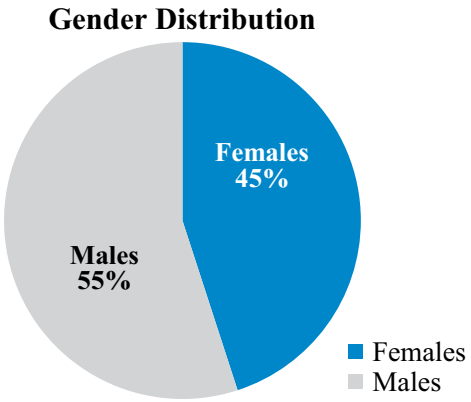

Figure 1: Distribution of Pediatric Patients with Acute Gastroenteritis Based on Gender (p=0.45)

The total number of cases was 377, 128 (34%) being infants; 144 (38.2%) being between 1 and 4 years of age; 66, with 17.5% being between 5 and 8 years of age; and 10.3% being between 9 and 12 years of age. There was a non-significant difference in age by season (0.43) (Table 1).

Table 1: Categorization of Pediatric Cases of Acute Gastroenteritis According to Age Groups (n=377)

Age Groups	Frequency (%)	p-value
Infant	128 (34%)	0.43
1-4 Years	144 (38.2%)	
5-8 Years	66 (17.5%)	
9-12 Years	39 (10.3%)	

*Chi-square test applied

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According to month wise admission, 29 (7.7%)of patients were admitted in June 2023,34(9%) in July 2023, 39(10.3%) in August 2023, 31 (8.2%) in September 2023, 27 (7.2%) in October 2023, 13 (3.4%) in November 2023, 26 (6.9%) in December 2023, 34 (9.0%) in January 2024, 30 (8.0%) in February 2024, 37 (9.8%) in March 2024, 24 (6.4%) in April 2024, 53 (14.1%) in May 2024, There was a significant relationship between admissions and season (p-value<0.001)(Table 2).

Table 2: Frequency Distribution of Patients Admitted to Pediatric Ward Between June 2023 to May 2024

Month of Admission	Frequency (%)
June 2023	29 (7.7%)
July 2023	34 (9.0%)
August 2023	39 (10.3%)
September 2023	31 (8.2%)
October 2023	27 (7.2%)
November 2023	13 (3.4%)
December 2023	26 (6.9%)
January 2024	34 (9.0%)
February 2024	30 (8.0%)
March 2024	37 (9.8%)
April 2024	24 (6.4%)
May 2024	53 (14.1%)

In total, 274 children were admitted in summer (72.7%), and 103 in winter (27.3%)(Figure 2).

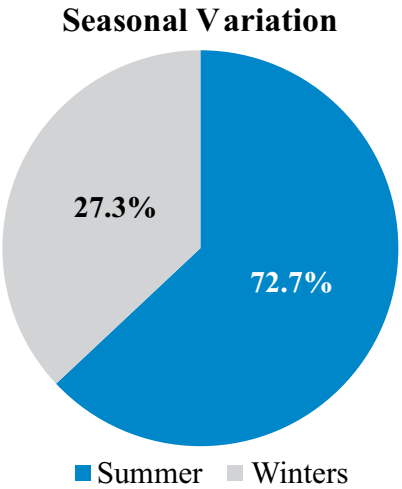

Figure 2: Seasonal Distribution of Admitted Patients(n=377)

Out of 377 patients, 373 were discharged alive (98.9%), and only 04 died (1.1%), with a difference of just 0.26 between the two seasons (Figure 3).

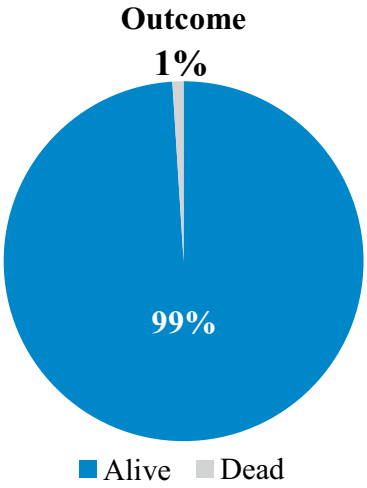

Figure 3: Outcome of Admitted Patients(n=377)

DISCUSSION

In this study, 377 paediatric cases (between 1 month to 12 years) were enrolled in the hospital, of which 208 were male (55.2%), 169 were female (44.8%), and 144 were between 1-4 years of age (38.2%). Infants accounted for 34% of the patients. The majority of the patients' hospital stays were 24- 72 hours, while 104 were 4-7 days (27.6%). The majority of the patients were admitted in the summer, May 2024, among them, 99% were discharged by the attending paediatrician. Viral acute gastroenteritis in children shows distinct seasonal patterns depending on the causative virus: rotavirus peaks mainly in winter and spring, adenovirus shows dual peaks in autumn and winter, and norovirus is most prevalent in winter [3]. Male predominance in viral infections is common but often not statistically significant, consistent with the observed gender distribution in this cohort [6]. These seasonal and demographic patterns highlight the importance of targeted prevention, vaccination, and resource planning for paediatric acute gastroenteritis [12]. Despite the prevalence of AGE cases being reported throughout the year, the AGE incidences by season have never been evaluated. In current research, most patients were admitted during the summer months, with May being the month with the highest number of admissions for gastroenteritis. Studies have indicated that AGE prevalence is higher in areas with low air temperature, particularly during the rainy/post-monsoon season [13]. Research from South Asian regions and other countries has also reported that AGE presentation is consistent throughout the year, with less seasonal variation [14]. Conversely, various studies have reported that AGE prevalence peaks occurred in winters and less frequently in summers [15]. This seasonal pattern aligns with research indicating that viral gastroenteritis cases in children often peak in cooler months, particularly winter and early spring

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[16]. Infections also show seasonal peaks, often with dual peaks in autumn and winter, while some tend to peak during rainy seasons in tropical regions [17]. The significant relationship between admissions and season ($p<0.001$) reflects these viral epidemiological trends, emphasizing the importance of season-aware healthcare planning and preventive measures such as vaccination and hygiene promotion [18]. In current study, higher admissions were encountered during the summer season. This indicates a strong seasonal pattern in paediatric acute gastroenteritis cases, with a significantly higher burden in warmer months [19]. The significant seasonal variation in admissions reflects the diverse epidemiology of causative viruses, which vary by region and climate [20]. Continuous surveillance is essential to monitor these patterns, especially as viral prevalence can shift due to factors like vaccination and public health measures. Understanding these seasonal dynamics supports targeted prevention and healthcare resource allocation for paediatric gastroenteritis.

This study was single-center and cross-sectional, limiting generalizability. Viral etiologies were not confirmed with laboratory testing, and data on environmental or socioeconomic factors were not collected, which may have influenced seasonal patterns. Future research should involve multicenter, longitudinal studies with laboratory-confirmed viral identification to better understand seasonal trends and guide targeted prevention and resource planning for pediatric acute gastroenteritis.

CONCLUSIONS

This study demonstrates a clear seasonal pattern in the exposure and hospitalization of paediatric patients with acute gastroenteritis, with a significantly higher burden of cases presenting during the summer months compared to winter. Most affected children were between 1 and 4 years of age, with a slight predominance of males. Despite the seasonal surge, clinical outcomes were overwhelmingly favourable, with nearly all patients discharged alive and healthy. These findings highlight the strong influence of seasonal and demographic factors on acute gastroenteritis incidence and underscore the need for heightened preventive strategies and resource preparedness during peak summer months.

Authors' Contribution

Conceptualization: ES
Methodology: SBK, WA, SKF
Formal analysis: AI, SKF
Writing and Drafting: NS, SBK
Review and Editing: NS, ES, AI, SBK, WA, SKF

All authors approved the final manuscript and take responsibility for the integrity of the work

Conflicts of Interest

All the authors declare no conflict of interest.

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