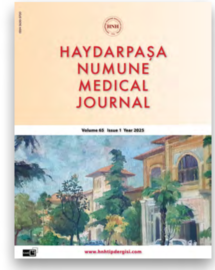
HAYDARPAŞA NUMUNE MEDICAL JOURNAL

DOI: 10.14744/hnhj.2025.73549
Haydarpasa Numune Med J 2025;65(4):363–368



hnhtipdergisi.com

ORIGINAL ARTICLE

Positivity Rate of Rotavirus and Adenovirus in Acute Gastroenteritis Patients: A Three-Year Analysis Based on Age, Season, and Gender

Mehmet Akif Durmuş, Nurhadiye Kuru

Department of Medical Microbiology, Başakşehir Çam and Sakura City Hospital, Istanbul, Türkiye

Abstract

Introduction: Acute gastroenteritis (AGE) is a significant cause of morbidity and mortality, particularly in children under five years of age. Among viral pathogens, rotavirus and adenovirus are the leading causes of both endemic and epidemic AGE worldwide. This study aims to investigate the positivity rate of rotavirus and adenovirus among gastroenteritis-suspected patients in Istanbul, focusing on demographic factors and seasonal distribution.

Methods: Between May 1, 2020, and May 1, 2023, stool samples from 16,064 patients who presented to Başakşehir Çam ve Sakura City Hospital in Istanbul were retrospectively evaluated. Rotavirus and adenovirus antigens were analyzed using two different immunochromatographic rapid tests employed during the study period: the CerTest® RotaAdeno Card Test (CerTest Biotec, Spain) and the Rotavirus Adenovirus Rapid Antigen Test (Türklab, Türkiye). Patients were categorized by age groups (0–12, 13–36, 37–60 months, 6–18 years, and >18 years), gender, and seasons. Statistical analyses were conducted using Chi-square and Z-tests, with $p<0.05$ considered statistically significant.

Results: A total of 2,270 (14.1%) patients tested positive for rotavirus, and 595 (3.7%) tested positive for adenovirus. The highest positivity rate for rotavirus occurred in the 13–36 months age group (20.3%), while adenovirus was most common in the 37–60 months age group (4.8%) ($p<0.001$). When the positivity rates between genders were examined, no significant difference was found (rotavirus: female and male 14.1%; adenovirus: female 3.9%, male 3.5%; $p>0.05$). Rotavirus infections peaked in spring and summer (14.7%-14.5%), whereas adenovirus infections peaked in autumn (4.5%) ($p<0.05$). The co-infection rate was 0.58% (n=93).

Discussion and Conclusion: Rotavirus has become a more dominant pathogen causing AGE than adenovirus. Both viruses showed high levels of positivity, especially in early childhood. The seasonal patterns indicate that rotavirus peaks in spring and summer, while adenovirus sees an increase in autumn. These insights are crucial for developing targeted preventive measures for managing AGE in specific age groups.

Keywords: Acute gastroenteritis; adenovirus; rotavirus.

Acute gastroenteritis (AGE) is defined by the International Pediatric Gastroenterology, Hepatology Associations Federation, and the Nutrition Working Group as a condition characterized by diarrhea. Diarrhea is identified as a change in stool consistency and/or an increase in the frequency of bowel movements, occurring three or more times within a 24-hour period, regardless of whether there is accompanying fever or vomiting [1]. Since norovirus was

Correspondence: Mehmet Akif Durmuş, M.D. Department of Medical Microbiology, Başakşehir Çam and Sakura City Hospital, Istanbul, Türkiye
Phone: +90 554 467 15 61 **E-mail:** drmehmetakifdurmus@gmail.com
Submitted Date: 24.06.2025 **Revised Date:** 04.09.2025 **Accepted Date:** 15.09.2025
Haydarpaşa Numune Medical Journal

discovered in 1972 as the cause of what was previously known as acute infectious nonbacterial gastroenteritis, our scientific understanding of viral gastroenteritis has evolved significantly. It is now widely accepted that a small number of viruses are the primary causes of acute gastroenteritis worldwide, affecting both high-income and low-income regions [2]. Viral gastroenteritis is an etiological category that can clinically manifest in a wide range of diseases, depending on the specific pathogen and various host-related factors [1]. Rotavirus (family Reoviridae), norovirus (family Caliciviridae), and adenovirus (family Adenoviridae) are the primary viral causes of both endemic and epidemic gastroenteritis in children worldwide. In addition to these, human astrovirus (family Astroviridae), sapovirus (family Caliciviridae), and aichivirus (family Picornaviridae) are also viruses that can be associated with gastroenteritis [3,4]. AGE remains a significant cause of childhood morbidity and mortality worldwide, particularly affecting children under five years old in low-income regions [5]. According to the Global Health Data Exchange, in 2016, diarrhea was the eighth leading cause of death globally, and it became the fifth leading cause of death among children under five years old [6]. According to data from the Centers for Disease Control and Prevention (CDC), viral gastroenteritis infections lead to the deaths of over 200,000 children worldwide each year [7,8].

This study aims to determine the frequency of rotavirus and adenovirus antigens in stool samples of gastroenteritis-suspected patients sent to our laboratory using an immunochromatographic rapid test kit and to examine the distribution of these pathogens based on gender, age, and season.

Materials and Methods

This study analyzed stool samples sent to the Medical Microbiology Laboratory of Başakşehir Çam ve Sakura City Hospital in Istanbul between May 1, 2020, and May 1, 2023. These samples were collected from various outpatient clinics and departments, where there was a clinical suspicion of acute gastroenteritis, and a request for testing for rotavirus and adenovirus was made. A qualitative immunochromatographic rapid test method, utilizing specific monoclonal antibodies, was employed to detect rotavirus and adenovirus antigens in the stool samples. For this purpose, two different commercial kits were used during the study period: the CerTest® RotaAdeno Card Test (CerTest Biotec, Spain) and the Rotavirus Adenovirus Rapid Antigen Test (Türklab, Türkiye). The application of the test and the evaluation of results were carried out according to the protocols recommended by the manufacturer. Participants in the study were categorized into five age groups: 0–12 months, 13–36 months, 37–60 months, 6–18 years, and over 18 years.

Ethical Approval

The study was approved by the Başakşehir Çam ve Sakura City Hospital Ethical Committee on November 20, 2023, with approval number 568. The study was conducted in accordance with the principles of the Declaration of Helsinki.

Statistical Analysis

Chi-square (χ^2) tests were used to test the differences in proportions between groups based on gender, age, and seasons for positivity rates. For each virus, seasonal periods (December–February, March–May, June–August, September–November), age groups (0–12, 13–36, 37–60 months, 6–18 years, and >18 years), and gender (female/male) categories were analyzed separately. Positivity rates were determined based on the positive isolate rates calculated from the total number of tested samples. The statistical significance level was set at $p=0.05$, and a two-tailed test approach was adopted. All statistical analyses were conducted using IBM SPSS Statistics (Version 26.6, IBM Corp., NY, USA).

Results

The microbiology laboratory analyzed 16,064 patient samples. Of these, 2,270 tested positive for rotavirus, while 595 tested positive for adenovirus. Additionally, both viruses (rotavirus and adenovirus) were found to be positive together in 93 patients. For the rotavirus test results, out of the 2,270 positive samples, 965 (42.5%) were from female patients, and 1,305 (57.5%) were from male patients. When examining positivity rates by age groups, the highest rate was observed in the 13–36 months group at 20.3%, followed by the 37–60 months group at 16.9%, and the 0–12 months group at 15.6%. The positivity rate decreased to 8.9% in the 6–18 years group and dropped to 3.6% in the >18 years group. Gender distribution revealed that the positivity rates for female and male patients were similar, with both genders having a rate of 14.1%. Detailed data on these rates are presented in Table 1. For the adenovirus test results, 269 (45.2%) of the 595 positive samples were from female patients, while 326 (54.8%) were from male patients. The highest positivity rate for adenovirus was found in the 37–60 months group at 4.8%, followed by the 0–12 months group at 4.2%, and the 13–36 months group at 3.9%. The positivity rate decreased to 2.8% in the 6–18 years group and to 1.5% in the >18 years group. Similar positivity rates were also observed

Table 1. Distribution of rotavirus positivity by age and gender

	Positive (n)		Total (n)		Positivity rate (%)		The overall positivity rate (%)
The age range	**Female**	**Male**	**Female**	**Male**	**Female**	**Male**	
The 0–12 months age group	459	624	2942	3982	15.6	15.7	15.6
The 13–36 months age group	238	323	1171	1598	20.3	20.2	20.3
The 37–60 months age group	116	166	713	952	16.3	17.4	16.9
The 6–18 years age group	127	168	1296	2037	9.8	8.2	8.9
The >18 years age group	25	24	705	668	3.5	3.6	3.6
Total	965	1305	6827	9237	14.1	14.1	14.1

Table 2. Distribution of adenovirus positivity by age and gender

	Positive (n)		Total (n)		Positivity rate (%)		The overall positivity rate (%)
The age range	**Female**	**Male**	**Femal**	**Male**	**Female**	**Male**	
The 0-12 months age group	122	171	2942	3982	4.1%	4.3	4.2
The 13-36 months age group	58	50	1171	1598	5.0%	3.1	3.9
The 37-60 months age group	37	43	713	952	5.2%	4.5	4.8
The 6-18 years age group	41	52	1296	2037	3.2%	2.6	2.8
The >18 years age group	11	10	705	668	1.6%	1.5	1.5
Total	269	326	6827	9237	3.9%	3.5	3.7

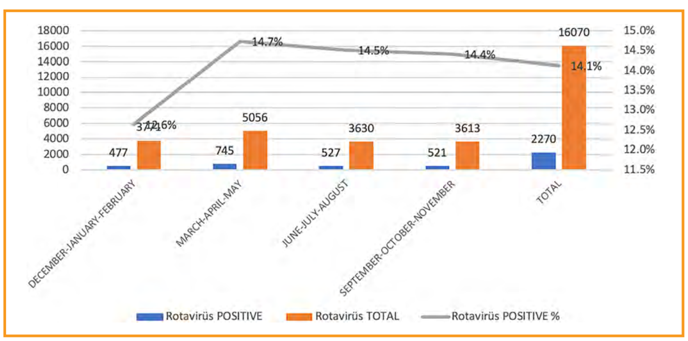


Figure 1. Distribution of rotavirus positivity by seasons.

between female and male patients. Data on these rates are presented in Table 2. Overall, the positivity rate for adenovirus was significantly lower than that for rotavirus.

Figure 1 illustrates the seasonal distribution of rotavirus positivity, while Figure 2 depicts the seasonal distribution of adenovirus positivity.

Discussion

Viral gastroenteritis remains a significant public health concern and is one of the leading causes of diarrhea-related deaths, especially in children under the age of five [6,9]. Rotavirus and adenovirus are known to be the most common viral pathogens responsible for acute gastroenteritis worldwide [3,4].

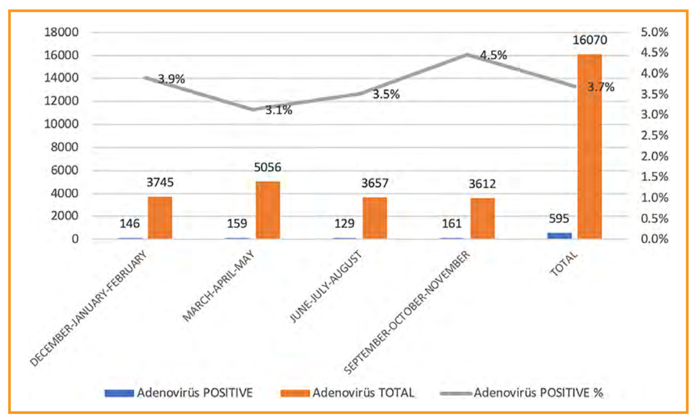


Figure 2. Distribution of adenovirus positivity by seasons.

In our study, the rotavirus positivity rate was 14.1%, consistent with rates of 4.7% to 14% reported in similar studies from Türkiye [10–15]. Adenovirus positivity was recorded at 3.7%, consistent with the range of 1.2% to 9.1% found in previous studies [10–15]. Additionally, co-infection of rotavirus and adenovirus was observed in a low proportion in 93 (0.58%) patients. Co-infections in viral gastroenteritis are quite common. The most frequently reported co-infection is the combination of norovirus and rotavirus, while the combination of rotavirus and adenovirus is seen less often [16,17].

A study conducted in Spain examined stool samples from children aged five years and younger who visited outpatient clinics with symptoms of gastroenteritis of unknown cause. When the cause could not be identified through routine examinations—such as tests for enteropathogenic bacteria (including Salmonella spp., Shigella spp., Yersinia spp., Aeromonas spp., and Campylobacter spp.) and immunochromatographic tests for rotavirus or adenovirus—the researchers utilized the Polymerase Chain Reaction (PCR) method. This analysis revealed that viral co-infections were present in 21% of the cases examined [18]. In an 11-year study conducted in Italy by De Grazia et al. [17], co-infection was reported at a rate of 8.3%. A separate study in Türkiye revealed that the rate of virus-virus co-infections in cases of acute gastroenteritis was 10.4%. The most frequently detected combinations were rotavirus-norovirus at 4.5% and adenovirus-norovirus at 4.1%. Additionally, the coexistence of rotavirus and adenovirus was observed in 1.2% of cases [16]. In another study by Aytaç et al. [13], the coexistence of adenovirus and rotavirus was found in 17 patients, accounting for 0.3%.

Our study found the highest rotavirus positivity rate in the 13–36 months age group, which was 20.3%. This was followed by the 37–60 months age group at 16.9%, and the 0–12 months age group at 15.6%. For adenovirus positivity, the highest rate was observed in the 37–60 months age group, at 4.8%. There were statistically significant differences in the positivity rates of rotavirus and adenovirus across the age groups ($p<0.001$). In their study, Vural et al. [11], found that the age group with the highest rotavirus positivity was children aged 2 to 5, with a rate of 24.5%. In contrast, adenovirus positivity increased with age, peaking at 35.8% in the group older than 18. Sert et al. [15] reported that the highest rotavirus positivity was observed in the 0–2-year age group (1.9%), and this rate decreased with age. A similar decline was observed for adenovirus positivity, with the highest positivity again found in the 0–2 years age group (4.8%). In the study conducted by Gündüz et al. [14], there was no significant difference in rotavirus positivity rates between the age groups of 0–2 years (49.9%) and those older than 2 years (50.1%). However, for adenovirus positivity, the researchers reported a rate of 42% in the 0–2 years group, compared to 58% in the group older than 2 years, and this difference was found to be statistically significant. Duran et al. [19] reported that rotavirus infections were most prevalent in the 3 to 5-year age group, with an incidence of 11.6%, followed closely by the 1 to 2-year age group at 11.2%. In contrast, adenovirus infections were primarily observed in the 6 to 9-year age group (8.4%) and the 1 to 2-year age group (6.3%). However, no significant differences were found between the various age groups for either pathogen. Aktaş et al. [16] reported that rotavirus infections were significantly higher in children aged 0–24 months. Aytaç et al. [13], conducted a study in Elazığ and found that the positivity rate for rotavirus was notably high in the 0–12 months age group (12.9%) and the 13–24 months age group (11.1%). In contrast, this rate decreased to 5.1% among individuals aged 5 years and older. Similarly, the positivity rate for adenovirus was higher in younger age groups, recorded at 3.7% for those aged 0–12 months and 2.6% for those aged 13–24 months, while it was found to be 1.7% in older age groups. Our study's distribution of test positivity rates according to age groups aligns with existing literature, suggesting that rotavirus and adenovirus infections are more prevalent, particularly during early childhood.

No significant difference was found in positivity rates related to gender for both rotavirus and adenovirus ($p>0.05$). The rotavirus positivity rate was 14.1% for both females and males, while the adenovirus positivity rate was 3.9% in females and 3.5% in males. These findings indicate that the distribution by gender is balanced, suggesting that gender is not a risk factor for infection. These results are consistent with findings from other studies [13,14,19].

When the seasonal distribution was examined, rotavirus positivity was found to be at the highest level in the spring (March–May) and summer (June–August) months, with 14.7% and 14.5%, respectively. In contrast, adenovirus positivity peaked in the autumn (September–November) at 4.5%. The seasonal difference was statistically significant for rotavirus ($p=0.013$) and adenovirus ($p=0.030$). Studies on the seasonal distribution of rotavirus and adenovirus infections present different findings in the literature. In their study, Genç et al. [10] reported that the rotavirus positivity rate was statistically significantly higher, especially in the autumn compared to other seasons; however, adenovirus positivity increased significantly in the summer. The study of Vural et al. [11] stated that both viral agents were detected positive most frequently in the spring and winter months. The seasonal distribution of rotavirus showed a statistically significant difference, but the seasonal difference was not significant for adenovirus. The study of Aytaç et al. [13] showed that the rotavirus positivity rate in the winter season was higher compared to other seasons, and this difference was significant. However, according to the seasons, no significant difference was determined in adenovirus infections. According to Sert et al. [15], rotavirus infections were observed with the highest frequency in December and generally in the winter season, while adenovirus infections occurred most frequently in March and spring. The seasonality of both types of infection was also determined at a high statistical significance level in this study. These findings show that rotavirus infections are generally more common in the winter months, while adenovirus infections are more variable regarding seasonal distribution. However, some studies reported them more frequently in the spring and summer. These different results suggest that geographical region and environmental factors (climate, humidity, etc.) may play a decisive role in the seasonal patterns of viral agents.

Conclusion

The results of our study indicate that the positivity rates of adenovirus are significantly lower than those of rotavirus. This finding confirms that rotavirus plays a more dominant role in the etiology of AGE compared to adenovirus. In conclusion, our study underscores the significance of both rotavirus and adenovirus in the causes of AGE, highlighting their positivity rate during childhood. Rotavirus is more common in the spring and summer, while adenovirus is typically observed in the autumn. Seasonal patterns may vary based on regional climate conditions, hygiene standards, vaccination rates, and the variants of the circulating viruses. Looking ahead, multicenter studies are necessary to assess vaccination status, explore serotype distributions, evaluate the clinical impacts of co-infections, and investigate regional differences in greater detail.

Ethics Committee Approval: The study was approved by Başakşehir Çam ve Sakura City Hospital Ethics Committee (No: 568, Date: 20.11.2023).

Use of AI for Writing Assistance: Grammarly was used for English grammar editing.

Peer-review: Externally peer-reviewed.

Authorship Contributions: Concept – M.A.D.; Design – M.A.D.; Supervision – M.A.D.; Materials –N.K.; Data collection and/or processing – N.K.; Analysis and/or interpretation – M.A.D.; Literature search – M.A.D.; Writing – M.A.D.; Critical review – M.A.D., N.K.

Conflict of Interest: The authors declare that there is no conflict of interest.

Financial Disclosure: This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

References

1. Guarino A, Lo Vecchio A, Dias JA, Berkley JA, Boey C, Bruzzese D, et al. Universal recommendations for the management of acute diarrhea in nonmalnourished children. J Pediatr Gastroenterol Nutr 2018;67:586–93. [CrossRef]
2. Flynn TG, Olortegui MP, Kosek MN. Viral gastroenteritis. Lancet 2024;403:862–76. [CrossRef]
3. Manouana GP, Nguema-Moure PA, Mbong Ngwese M, Bock CT, Kremsner PG, et al. Genetic diversity of enteric viruses in children under five years old in Gabon. Viruses 2021;13:545. [CrossRef]
4. Rossouw E, Brauer M, Meyer P, du Plessis NM, Avenant T, Mans J. Virus etiology, diversity and clinical characteristics in South African children hospitalised with gastroenteritis. Viruses 2021;13:215. [CrossRef]
5. Perin J, Mulick A, Yeung D, Villavicencio F, Lopez G, Strong KL, et al. Global, regional, and national causes of under-5 mortality in 2000-19: an updated systematic analysis with implications for the sustainable development goals. Lancet Child Adolesc Health 2022;6:106–15. [CrossRef]
6. GBD 2016 Diarrhoeal Disease Collaborators. Estimates of the global, regional, and national morbidity, mortality, and aetiologies of diarrhoea in 195 countries: a systematic analysis for the Global Burden of Disease Study 2016. Lancet Infect Dis 2018;18:1211–28.
7. Stuempfig ND, Tobin EH, Seroy J. Viral gastroenteritis. 2025. In: StatPearls. Treasure Island (FL): StatPearls Publishing; 2025.
8. King CK, Glass R, Bresee JS, Duggan C; Centers for Disease Control and Prevention. Managing acute gastroenteritis among children: oral rehydration, maintenance, and nutritional therapy. MMWR Recomm Rep 2003;52:1–16.
9. GBD 2016 Causes of Death Collaborators. Global, regional, and national age-sex specific mortality for 264 causes of death, 1980-2016: a systematic analysis for the Global Burden of Disease Study 2016. Lancet 2017;390:1151–210. Erratum in: Lancet 2017;390:e38.
10. Genç BY, Özüdoğru O, Acer Ö. The frequency of rotavirus and adenovirus in case of gastroenterit observed in Siirt region. Gevher Nesibe J Med Health Sci 2022;7:23–8. [Article in Turkish]
11. Vural DG, Torun EG, Bıyık İ, Çaycı YT, Bilgin K, Birinci A. Investigation of frequency of rotavirus and adenovirus in patients with acute gastroenteritis. Kırıkkale Üniv Tıp Fak Derg 2022;24:289–94. [Article in Turkish] [CrossRef]
12. Turna G, Sezgin FM, İlanbey B, Babaoğlu ÜT, Ünlü E. Retrospective evaluation of laboratory tests of patients with rotavirus and adenovirus positivity in Kırşehir province. Ahi Evran Med J 2020;4:103–8. [Article in Turkish] [CrossRef]
13. Aytaç Ö, Şenol FF, Oner P, Erkmen N, Aslan R, Doğukan M et al. Rotavirus and adenovirus frequency in acute gastroenteric diseases. Türk Hij Den Biyol Derg 2020;77:179–84. [Article in Turkish] [CrossRef]
14. Gündüz A. Prevalence of rotavirus-adenovirus positivity: 5-year retrospective evaluation. J Med Topics Updates 2022;1:50–3. [Article in Turkish]
15. Sert S, Erayman B. Frequency and seasonal distribution of adenovirus and rotavirus in children diagnosed with acute gastroenteritis: A single centre experience. J Contemp Med 2023;13:353–9. [CrossRef]
16. Aktaş O, Aydin H, Timurkan MO. A molecular study on

the prevalence and coinfections of Rotavirus, Norovirus, Astrovirus and Adenovirus in children with gastroenteritis. Minerva Pediatr 2019;71:431–7. [CrossRef]

17. De Grazia S, Bonura F, Bonura C, Mangiaracina L, Filizzolo C, Martella V, et al. Assessing the burden of viral co-infections in acute gastroenteritis in children: An eleven-year-long investigation. J Clin Virol 2020;129:104513. [CrossRef]
18. Vu DL, Sabrià A, Aregall N, Michl K, Rodriguez Garrido V, Goterris L, et al. Novel human astroviruses: prevalence and association with common enteric viruses in undiagnosed gastroenteritis cases in Spain. Viruses 2019;11:585. [CrossRef]
19. Duran H, Yücel FY. Frequency of rotavirus and adenovirus in children with diarrhea. J Contemp Med 2023;13:724–8. [CrossRef]