

ORIGINAL ARTICLE

Rotavirus Positivity in Children and Adolescents: Evaluation of Ten-Year Results

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SUMMARY

Background: Although they are declining, diarrheal diseases remain a significant cause of mortality. Rotavirus is reported to be the most important cause of severe diarrhea in children under the age of five in the pre-rotavirus vaccine era. This study aimed to determine the rotavirus positivity in diarrheal children in our region and examine the age distribution and seasonality of rotavirus to contribute to epidemiological studies.

Methods: A total of 18,847 stool samples were collected from pediatric patients (0 - 18 years) who presented with diarrhea at the Department of Medical Microbiology, Istanbul University, Istanbul Faculty of Medicine, between March 2011 and December 2021. These samples were examined for rotavirus antigen positivity using a commercial immunochromatographic kit.

Results: Rotavirus antigen was detected in 2,353 (12.5%) of the samples. The positivity rates for 2011 - 2021 were 14.9%, 16.1%, 13%, 9.9%, 12.3%, 10.3%, 9.1%, 7.9%, 22.1%, 10.6%, and 12.6%, respectively. Rotavirus seasonality analysis revealed that the season starts in November and ends in May, with the highest rates in March (20.5%) and February (19.9%). The highest positivity rate (41.8%) was found in the 1 - 2 years age group.

Conclusions: Rotavirus remains a leading cause of gastroenteritis in children in Turkey. Monitoring rotavirus epidemiology is crucial, especially for countries without rotavirus vaccines in their national immunization programs. (Clin. Lab. 2025;71:xx-xx. DOI: 10.7754/Clin.Lab.2024.240803)

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KEYWORDS

acute gastroenteritis, diarrhea, rotavirus, rotavirus season, prevalence

INTRODUCTION

Despite a decline in incidence, diarrheal diseases still represent a group with high mortality rates. According to the global health estimates report by the World Health Organization (WHO), diarrheal diseases caused more than 1.2 million deaths in 2021 [1]. Viruses are among the leading causes of acute gastroenteritis, particularly in children. Rotavirus, first demonstrated by Bishop et al. in Australia in 1973 [2], is an unenveloped double-stranded RNA virus transmitted via the fecal-oral route [3]. Rotavirus exhibits marked seasonal characteristics in some countries, and it is predicted that almost all children will experience a rotavirus gas-

troenteritis episode by the age of five [4,5]. In 2013, there were an estimated 215,000 child deaths worldwide due to rotavirus infection [6]. This study aimed to determine the prevalence of rotavirus positivity in diarrheal children in our region, contribute to epidemiological studies, and examine the distribution according to age groups and seasons to monitor the rotavirus season.

MATERIALS AND METHODS

Between March 2011 and December 2021, a total of 18,847 stool samples were analyzed in the Department of Medical Microbiology, Istanbul University, Istanbul Faculty of Medicine. These samples were collected from patients who presented with diarrhea and were admitted to clinical settings.

These samples were examined for rotavirus antigen positivity by using a commercial kit (Rota/Adeno Rapid, Standard Diagnostics, Korea) based on the principle of the immunochromatographic method, following the manufacturer's recommendations.

Consistent with similar studies, the onset of the rotavirus season was defined as the first month with a positive sample rate greater than 10%, while the end of the rotavirus season was defined as the last month with a positive sample rate greater than 10%. The findings were evaluated according to these criteria [7,8].

Data analysis

Statistical analysis was performed using SPSS version 21.0. Descriptive statistics were utilized to summarize the data. ANOVA and chi-squared tests were conducted to compare the yearly and monthly positivity rates. To compare positivity rates within age groups, ANOVA followed by a post-hoc Tukey's honest significant difference (HSD) test was employed. A p-value of < 0.05 was considered statistically significant.

RESULTS

Out of the 18,847 samples examined, rotavirus antigen was detected in 2,353 samples (12.5%). The positivity rates for the years 2011 - 2021 are shown in Figure 1. There was no significant difference in the mean positivity rates across different years (p-value = 0.2455). However, the chi-squared test revealed significant differences in the distribution of positive cases across years (p-value < 0.001), suggesting variations in the number of cases over the years.

When the distribution of rotavirus positivity was examined by months, significant differences in the mean positivity rates across different months were found (p-value = 0.000012). The rotavirus season was found to start in November and end in May. January, February, and March exhibited the highest mean positivity rates, suggesting a seasonal peak in rotavirus infections during these months (Figure 2). March and December

showed the highest variability in positivity rates across different years, as indicated by their higher standard deviations of 7.11 and 7.36, respectively.

Rotavirus antigen positivity was highest in children under five years old (Figure 3, 4). There was a significant difference in rotavirus positivity rates among the age groups (p-value = 1.36×10^{-5}). Post-hoc analysis with Tukey's HSD test showed that the 1 - 2 years age group had a significantly higher positivity rate compared to the 0 - 1 year (p < 0.001) and 3 - 5 years (p < 0.001) age groups. Additionally, the 11 - 18 years age group had a significantly lower positivity rate compared to the 0 - 1 year (p = 0.008) and 3 - 5 years (p = 0.041) age groups. These findings indicate that children aged 1 - 2 years have the highest rotavirus positivity rates (41.8%), while those aged 11 - 18 years have the lowest.

DISCUSSION

The frequency of rotavirus infections, an important public health issue, varies by country and region. Patel et al. [4], in their study of epidemiological research conducted between 1995 and 2010, reported a rotavirus positivity rate of approximately 26% in about 428,000 stool samples, with positivity distribution by regions reported as approximately 24% in Africa, 35% in Asia, and 18% in Europe.

Despite the decrease in rotavirus frequency with the introduction of rotavirus vaccines, high rates of rotavirus positivity are still observed in countries in the Middle East and North Africa (MENA) region, including Turkey, where rotavirus vaccines are generally not included in the national vaccination schedule. Zaraket et al. [9] calculated a median positivity of 27.39% based on 169 studies reported from MENA region countries. Studies investigating rotavirus positivity have also been conducted in Turkey [7,10-20]. Some of these studies are summarized in Table 1. Tuzuner et al. [20] reported a rotavirus positivity of 14.8% in 5,156 stool samples collected between 2013 and 2015, while Iraz et al. [15] reported a positivity of 12.20% in 6,749 stool samples collected between 2011 and 2012. In a study evaluating stool samples from fully vaccinated children, Kayiran et al. [16] found a notably low positivity rate (3.6%). In a study conducted at our hospital covering the years 2003 - 2005, the frequency of rotavirus was 20.6%, and in the study covering the years 2006 - 2010, it was 15.5% [7,18]. In this study we retrospectively analyzed 10 years of data (2011 - 2021), identifying a rotavirus positivity rate of 12.5%. There was no statistically significant difference in rotavirus positivity across the years.

Geographical features such as year-round prevalence in tropical regions and more frequent occurrence in autumn and winter in temperate climate zones have been reported for rotavirus infections, which may show seasonal variations based on countries' income levels [4,

Table 1. Summary of some studies conducted in Turkey.

Sample size (n)	Positivity (%)	Age range with highest positivity	Method	Peak period	Years	Reference
1,168	18.10%	0 - 24 months	Immunochromatography	Spring - Winter	2010 - 2013	[11]
3,445	27.80%	0 - 24 months	Immunochromatography	Winter - Spring	2009 - 2011	[12]
398	17.30%	13 months - 4 years	Immunochromatography	Winter - Spring	2013 - 2015	[13]
435	9.70%	N/A	Immunochromatography	Winter - Spring	2011 - 2012	[15]
6,749	12.20%	12 - 24 months	Immunochromatography	Winter - Spring	2011 - 2012	[16]
474	3.60%	N/A	Immunochromatography	Spring	2016	[17]
251	21.10%	12 - 23 months	ELISA	Autumn	2009 - 2010	[18]
363	32.20%	13 - 24 months	ELISA	Winter	2008	[20]
5,156	14.8%	N/A	Immunochromatography	Winter - Spring	2013 - 2015	[21]

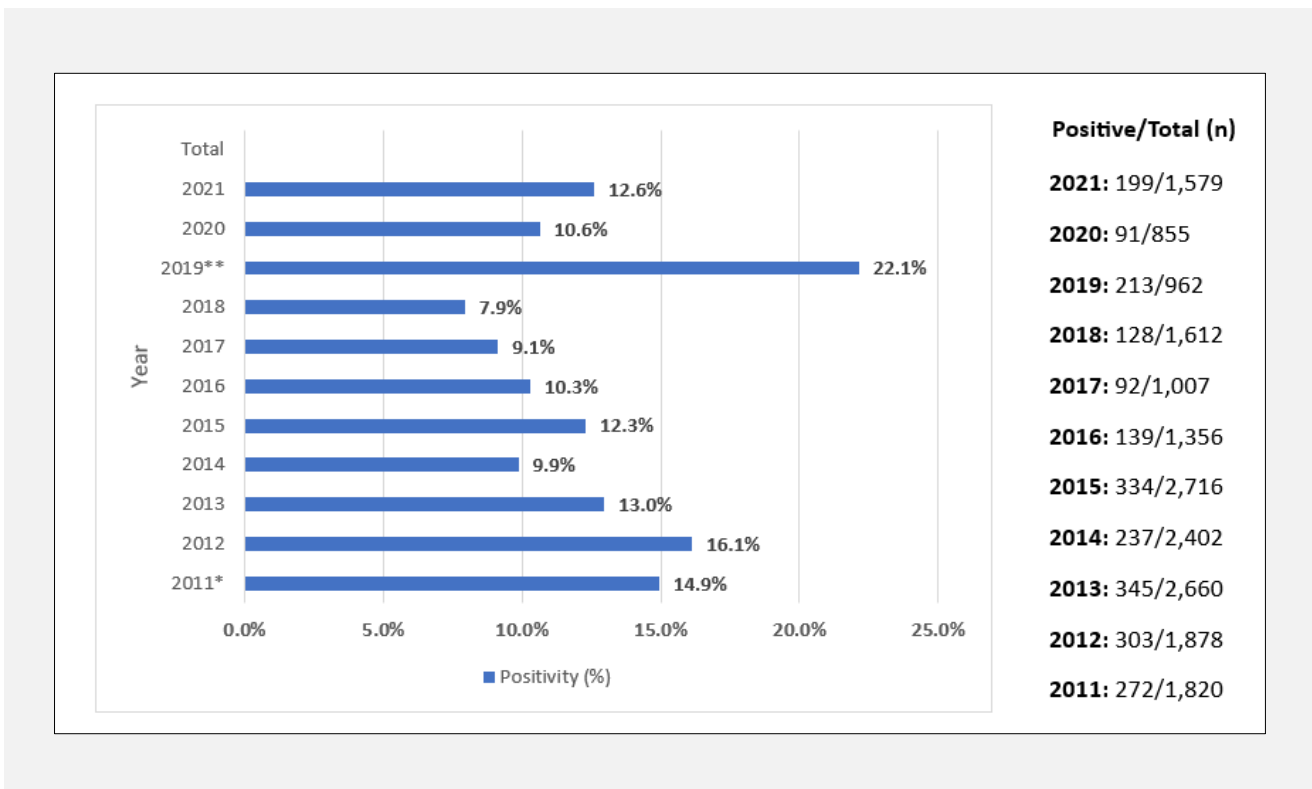


Figure 1. Distribution of rotavirus positivity by year (%).

* - Started from March.

** - No results between May to September due to diagnostic kit constraints.

21]. Durmaz et al. [12] stated that the majority of stool samples collected for genotyping purposes were sent between September and May from all over Turkey. Regional studies conducted in our country have generally reported high rotavirus positivity rates in winter and spring months [10-13,15,20]. According to a study

conducted at our hospital between 2006 and 2010, the rotavirus infection season started in December and ended in May [18]. In this study, however, it was found that the season started in November, one month earlier, and ended in May, consistent with the aforementioned studies indicating that rotavirus gastroenteritis contin-

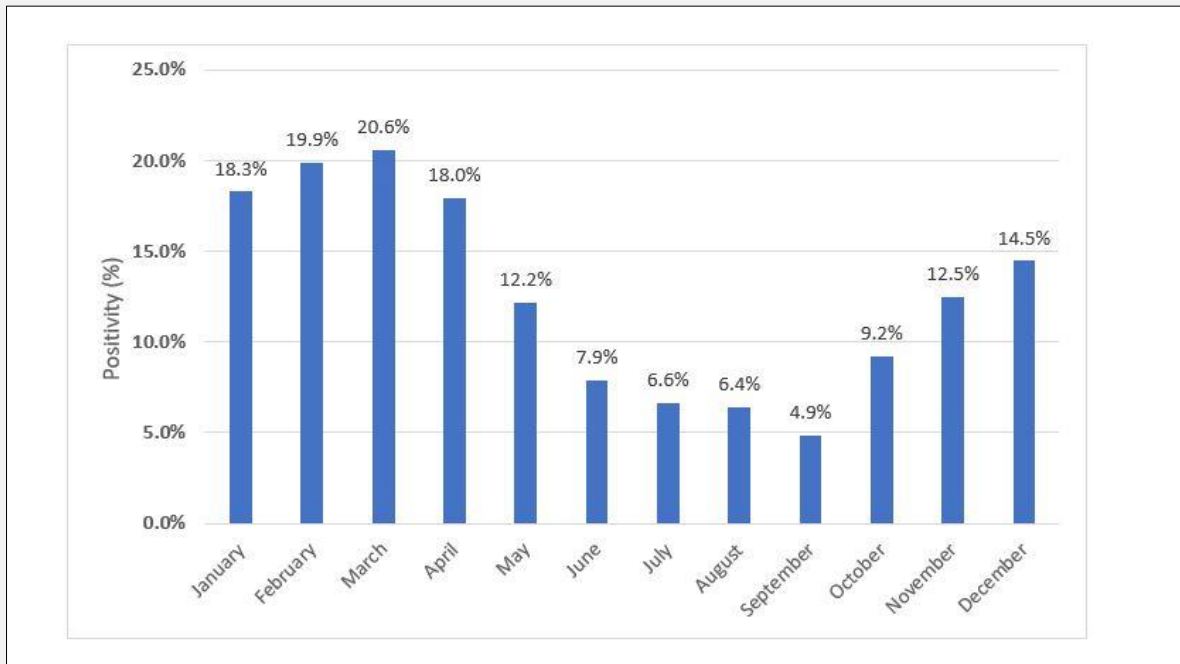


Figure 2. Distribution of rotavirus positivity by month (%).

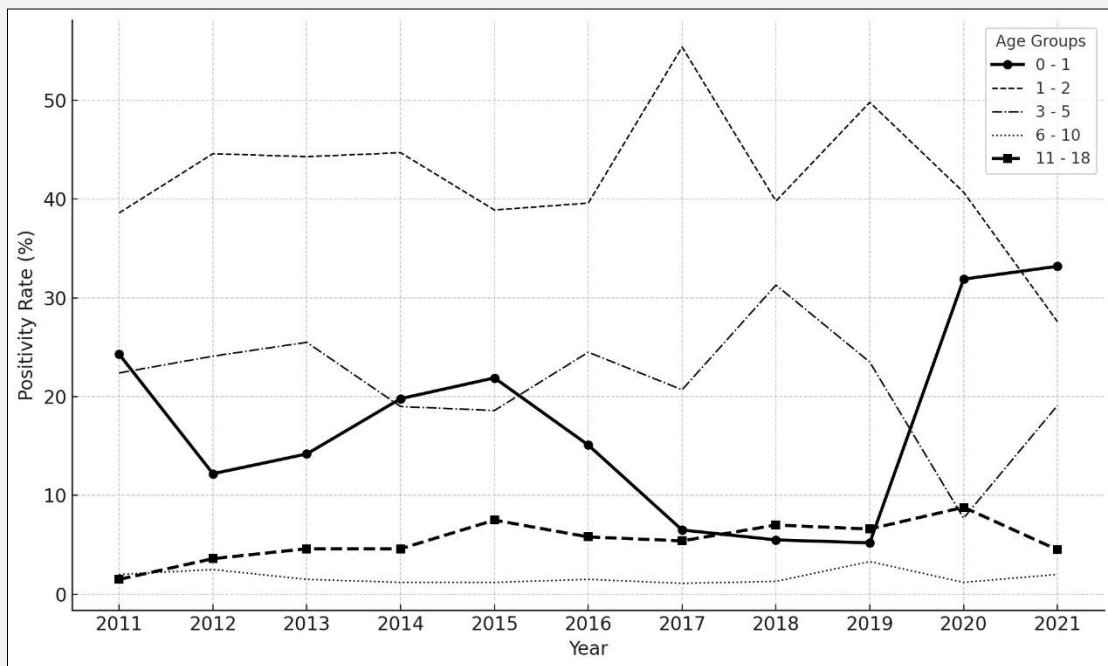


Figure 3. Yearly changes in rotavirus positivity rates by age group.

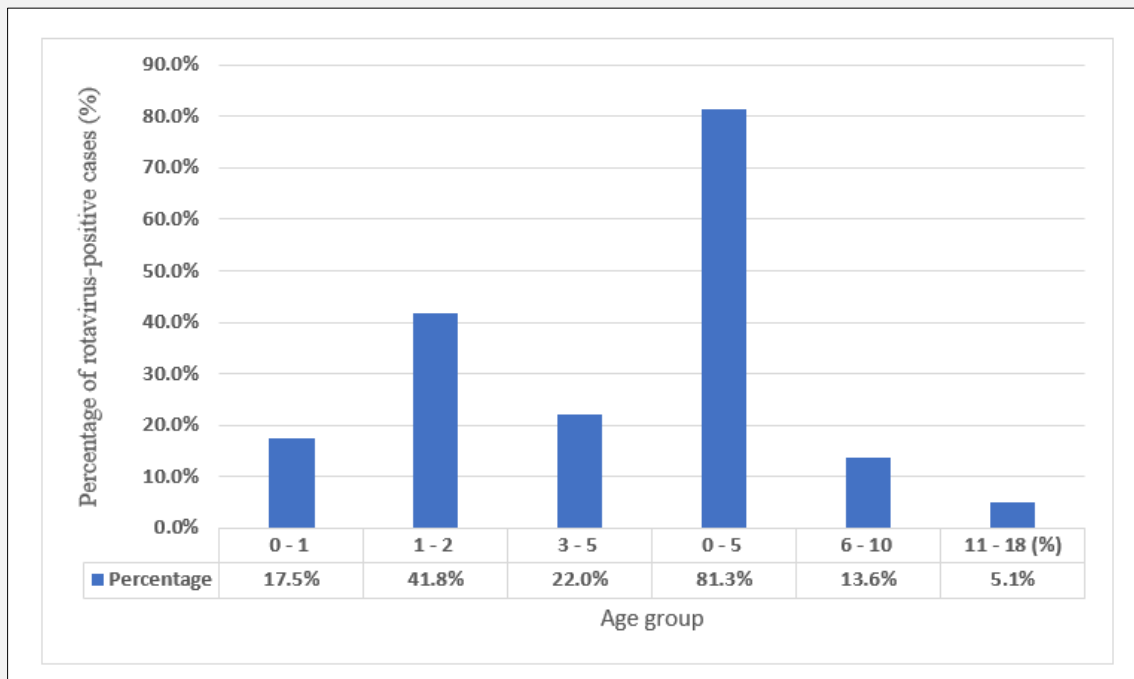


Figure 4. Distribution (%) of rotavirus-positive cases by age group.

ues to be more prevalent in winter and spring compared to other seasons. January, February, and March exhibited the highest mean positivity rates, suggesting a seasonal peak in rotavirus infections during these months.

Studies conducted in Turkey have reported that rotavirus infections are most commonly seen in children under two years old [10-13,15,20]. Durmaz et al. [12] also emphasized this common finding in studies reported from Europe and our country, but in their comprehensive study, collecting samples from all seven regions of Turkey, they noted that the highest frequency of rotavirus occurred in the 13 - 36 months age group. Therefore, they suggested that studies targeting children under five years old rather than under two years old would be beneficial. One of the strengths of our study is the inclusion of a wide age range (0 - 18 years). In our study, the highest rotavirus positivity (81.3%) was observed in the under five age group. According to age groups, positivity rates decreased in the following order: 1 - 2 years (41.8%), 3 - 5 years (22%), under 1 year (17.5%), 6 - 10 years (13.6%), and 11 - 18 years (5.1%). Post-hoc analysis showed that the 1 - 2 years age group had a significantly higher positivity rate compared to the other age groups.

Following the introduction and inclusion in some countries' routine vaccination schedules, significant reduc-

tions in rotavirus infections and hospitalizations due to infection have been reported [22,23]. When the results of previous studies conducted in our country and hospital are evaluated alongside the results of our current study, it is possible to say that rotavirus positivity has decreased over the years [7,15,17-19]. One of the reasons for this decrease could be the increasing implementation of rotavirus vaccination in our country despite not being included in the routine vaccination schedule [16].

CONCLUSION

Our study demonstrates that rotavirus remains a significant cause of gastroenteritis in children in our country. Monitoring the epidemiology of rotavirus, especially in countries like ours where rotavirus vaccine is not included in routine vaccination schedules, is considered important.

Declaration of Interest:

None.

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