



## Age Distribution and Seasonal Pattern of Rotavirus Infection in Children Under 5 Years

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### ABSTRACT

**Background:** Rotaviruses are the most common cause of viral gastroenteritis in newborns and young children. The current study intended to investigate the presence of rotavirus antigen in fecal specimens of children with acute diarrhea, to determine its prevalence and to examine its distribution pattern by age, gender and season.

**Objectives:** This was a retrospective investigation of cases with rotavirus antigen-positive fecal specimens from children under 5 years referring to the emergency department with acute gastroenteritis between January 2008 and December 2010. Patient distribution patterns by season, month and age groups were recorded.

**Patients and Methods:** Rotavirus antigen was detected in 412 out of 1500 fecal specimens; 279 of these cases (66%) were male. The presence of rotavirus antigen in fecal specimens was investigated using the immunochromatographic test (VIKIA® Rota-Adeno, bioMérieux® sa, Marcy-l'Etoile/France), following the manufacturer's recommendations.

**Results:** Rotavirus positivity was most common in the 24-36 months age group ( $n = 104$ , 25%) ( $P < 0.001$ ). Positivity was most frequent in January, February and March. The high level determined in January was statistically significant ( $n = 69$ , 17%) ( $P < 0.001$ ). Most of the cases were found in winter months ( $n = 179$ , 43%), and it was also statistically significant ( $P < 0.001$ ).

**Conclusions:** Rotavirus was most common in children with gastroenteritis aged between 24 and 36 months. The high numbers of cases were found in winter, with the highest peak in January. Rotavirus gastroenteritis appeared as a significant infection, particularly in winter months in children under 5 years. Vaccination could be helpful in protecting against the disease, since it imposes a significant burden on the health system.

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### ► Implication for health policy/practice/research/medical education:

Rotavirus is an important cause of acute gastroenteritis in children under 5 years which should be checked routinely, especially in the winter and spring months.

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## 1. Background

Acute gastroenteritis, the second most common cause of high morbidity and mortality in children after lower respiratory tract infections, is a significant health problem in both developed and developing countries such as Turkey (1). Rotavirus is the most important agent of acute diarrhea in children worldwide. Rotavirus constitutes approximately 39% of all severe diarrhea cases across the world, and is responsible for the deaths of more than 600,000 people annually. Rotavirus infection is a universal children disease, irrespective of water and food quality or hygiene (2). Rotavirus infection is transmitted by the fecal oral route. The highest level of rotavirus is seen in children aged under 5, 95% of cases being between 3 and 5. There is a correlation between season and rotavirus infection. The majority of cases in temperate climates are seen in cold winter months. The correlation is lower in tropical and developing countries (3). The principal symptoms of rotavirus gastroenteritis (RSVG) are fever, abdominal pain, numbness, and diarrhea and vomiting that may lead to hypovolemic shock and dehydration (4). Severe cases may be fatal (5).

## 2. Objectives

This study intended to determine the level of RSVG, a viral gastroenteritis agent, by age groups, and also to investigate its distribution pattern by months and seasons. The results might represent a source of reference for future studies on the subject.

## 3. Patients and Methods

Acute gastroenteritis was defined as the excretion of liquid stools three or more times a day. Four hundred and twelve children aged under 5 years, brought to Baskent University, Konya Medical and Research Center Central Turkish Emergency Department between Jan. 1, 2008, and Dec. 31, 2010, were enrolled. These patients' files were investigated retrospectively. Only diarrheic cases undergoing the rotavirus antigen test were included, other cases of diarrhea were excluded. Rotavirus was investigated using the rapid antigen test in fecal specimens taken from patients who were divided into 0-12, 13-24, 24-36, 37-48 and 49-60 months age groups. Cases older than 5 years were also excluded.

Patients' age, gender, month and season of presentation were recorded. The presence of rotavirus antigen in fecal specimens was investigated using the immunochromatographic test (VIKIA® Rota-Adeno, bioMérieux® sa, Marcy-l'Etoile/France), following the manufacturer's recommendations. The manufacturer cites sensitivity and specificity levels of 96.3% and 100%, respectively, for this test.

SPSS 15.0 was employed for statistical analysis. The chi square test was used in data analysis, with significance set at  $P < 0.001$ .

## 4. Results

Rotavirus antigen tests were performed for 1645 (9%) out of 17,804 child patients with gastroenteritis and younger than 5 brought to the emergency department between Jan. 1, 2008, and Dec. 31, 2010. Inclusion criteria were age under 5 and meeting the diarrhea definition of production of liquid stools three times a day or more and that of acute diarrhea, lasting less than 14 days.

Of the cases determined as RSVG, 104 (25%) were aged 25-36 months, 98 (24%) cases were aged 13-24 months, 90 (22%) 37-48 months, 62 (15%) 0-12 months and 58 (14%) 49-60 months (Figure 1). While the greatest number of cases were aged between 24 and 36 months, the fewest cases, 58, were in the 49-60 months range. The highest rotavirus positivity was observed in the 24-36 months group, and the difference between this group and the other groups was statistically significant ( $P < 0.001$ ).

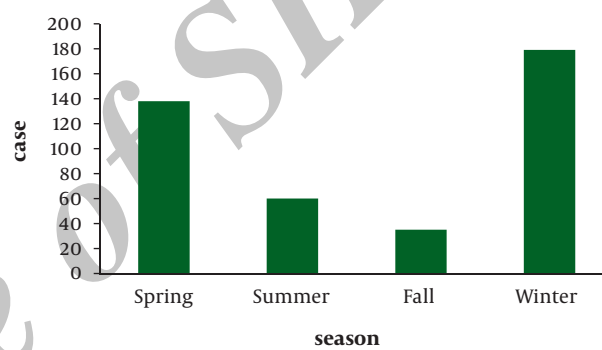


Figure 1. Age Distribution of Rotavirus Gastroenteritis

Rotavirus antigen was positive in 412 (25%) cases and negative in 1233 (75%). Of the cases determined as RSVG, 273 (66%) were male and 179 (44%) female. The greatest numbers of cases were found in winter ( $n = 179$ , 43%). One hundred and thirty-eight (33%) cases were diagnosed in spring, 60 (15%) in summer and 35 (9%) in the fall (Figure 2). The seasonal difference was statistically significant ( $P < 0.001$ ).

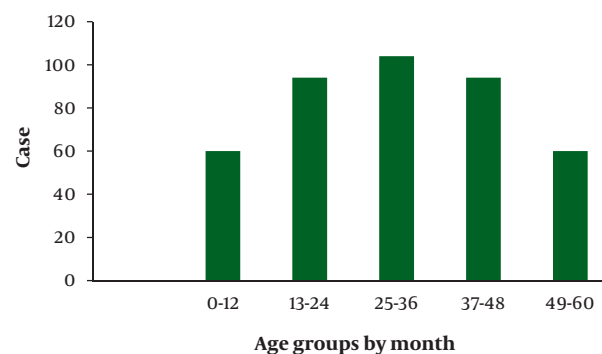
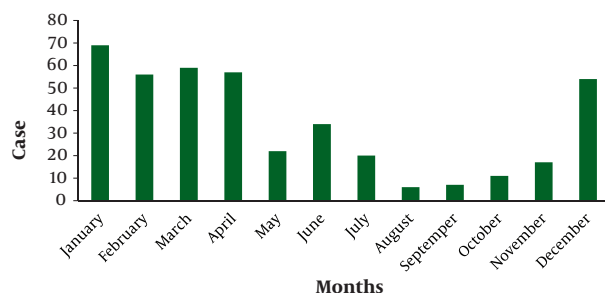


Figure 2. The Seasonal Distribution of Rotavirus Gastroenteritis

Rotavirus antigen was negative in 1233 (75%) cases. The greatest numbers of cases were found in spring ( $n = 407$ ,

33%). Three hundred and fifty-two (28%) cases were diagnosed in winter, 264 (22%) in summer and 210 (17%) in the fall. There were seasonal differences between rotavirus positive and rotavirus negative cases.

The months with the greatest RSVG were January ( $n = 69$ , 17%), March ( $n = 59$ , 14%), April ( $n = 57$ , 14%), February ( $n = 56$ , 13.5%) and December ( $n = 54$ , 13%). August ( $n = 6$ , 1.45%), September ( $n = 7$ , 1.7%), October ( $n = 11$ , 2.6%) and November ( $n = 17$ , 4.1%) had the lowest rotavirus positivity. January was the month with the highest rotavirus positivity. The lowest rotavirus positivity was found in August (Figure 3). The elevated level in January was statistically significant ( $P < 0.001$ ).



**Figure 3.** The Monthly Distribution of Rotavirus Gastroenteritis

## 5. Discussion

Acute gastroenteritis is a major public health problem in both developed and developing countries. Rotavirus is one of the most common pathogens that children under 5 encounter. A number of studies have shown rotavirus incidences in many parts of the world. The differences among incidence levels are thought to be associated with geographical regions (6). Different studies have reported rotavirus positivity levels in gastroenteritis of 16% in Germany, 17%-69% in the USA, 30% in Saudi Arabia, 20%-28% in India and 35% in Italy (6). The level in Turkey varies from 10% to 30% (7). This study identified a rotavirus incidence of 25% in children with acute gastroenteritis aged up to 5 years. The results indicated that there is no significant difference in rotavirus incidence between developed and developing countries. Similar levels of rotavirus infection show that improved personal and societal hygiene and sanitation measures are highly effective in preventing rotavirus infection. Vaccination is therefore the main protective measure to be taken against rotavirus infection.

Studies have reported that RSVG is most commonly seen under the age of 2 (8). Variation has been reported between age groups in studies in different countries. The most frequent rotavirus positivity has been reported at 3-5 years in Taiwan (44%), 13-15 months in Saudi Arabia, 2 years in Turkey (70%) and 2 years in Brazil (72%) (7, 9-11). the most frequent rotavirus positivity was found to be among the 24-36 months (25%) age group.

Studies have reported that climatic variations are deci-

sive in the occurrence of RSVG. Studies have shown that in America (12), Italy (13), Taiwan (11), Bulgaria (14) and China (15), the peak is in winter, and dry months in Brazil (9) and summer and winter in Japan (16). Rotavirus epidemics are seen in the cold months of the year in temperate climate regions such as Central Europe and Turkey. The peak is in winter in America and Europe and exhibits similar characteristics. Seasonal differences are less evident in tropical climates, and RSVG can be seen there throughout the year (17). It was found that RSVG peak is in winter, followed by the spring. There were several limitations to the study. Only the patients referring to the emergency department with RSVG were included. The sample size was limited as this was a single centre local study.

Precautionary measures should be taken bearing in mind that, particularly in childhood, viral agents may be involved in acute diarrhea, as well as bacteria and parasites. In addition, reliable and effective vaccinations have been developed for RSVG, as an inevitable disease in early childhood. Vaccination has proved to reduce hospitalization times and the need for referring to the emergency department significantly. RSVG should be particularly borne in mind in applications in the infant age group and in winter months. This approach will also prevent the unnecessary administration of antibiotics.

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## Authors' Contribution

None declared.

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