Seasonal Prevalence of Acute Gastroenteritis, Enteric Adenovirus and Rotavirus Antigen: Immunochromatographic Presence in Children

Serkan Sugeçti[1], Uğur Çelen[2], Pervin Taşkın Azaklı[2], Sevinç Yenice[2], Ferudun Koçer[1]
[1]Department of Biology, Bülent Ecevit University School of Medicine, *Zonguldak, Turkey*
[2]Microbiological Laboratory, Zonguldak Maternity and Children Hospital, *Zonguldak, Turkey*

Abstract

Objective: This study aims to investigate the prevalence of rotavirus (RV) and adenoviruses (EAV) during different seasons in children aged between 0 and 14 years who were diagnosed with acute gastroenteritis.

Materials and Methods: In 2014, the prevalence of rotavirus and adenovirus antigens was investigated using immunochromatographic methods, i.e., rotavirus and adenovirus antigen kits (Ameritek one step rapid test adenovirus/rotavirus complex 2 - panel card test), on 3258 patients who provided their stool samples and were diagnosed with acute gastroenteritis on admission to our hospital. Data were retroactively obtained from the laboratory database.

Results: The viral antigen was detected in 638 (19.6 %) of 3258 patients. Rotavirus was detected in 590 (18.1 %) samples and adenovirus was detected in 48 (1.5 %). Furthermore, this study demonstrated that rotavirus antigen positivity was higher in the spring, while enteric adenovirus positivity was higher in the summer.

Conclusion: It is important to clinically identify the prevalence of rotavirus and enteric adenovirus antigens in stool samples. Moreover, it is considered a necessity to routinely investigate rotavirus and enteric adenovirus antigens because of climate conditions in our region which are susceptible for gastroenteritis cases. *(J Pediatr Inf 2015; 9: 161-5)*

Keywords: Enteric adenovirus, rotavirus, immunochromatography, prevalence

Introduction

Acute gastroenteritis is the third most frequent cause of mortality among the infection diseases in the world. While viruses are in developed countries, bacteria in developing countries are among the acute gastroenteritis causes of acute gastroenteritis (1, 2). It is reported that across the world, around 2.2 million people die due to diarrhoeal diseases and in Turkey, these diseases are responsible for 8.4% of mortality in children aged 0-14 (3). Viral gastroenteritis is the most crucial ones among the infectious diarrhoea. The pathogens encountered in gastroenteritis are primarily rotaviruses as well as adenoviruses, neuro viruses and astroviruses (4, 5).

Rotaviruses are double-stranded RNA viruses belonging to reoviridae family that are transmitted via faecal oral route. In winter season especially, epidemics cause gastroenteritis with a course of fever, vomiting and diarrhoea. Previous studies revealed that rotavirus incidence rate was -25%5 in America, 20-40% in Europe, 30-50% in Asia and 10-65% in Africa (6).

Adenoviruses are the nonenveloped DNA viruses. These viruses cause less fever in comparison to rotaviruses and cause less loss of fluid. Enteric adenovirus is the second most frequent cause of acute and prolonged diarrhoea after rotavirus usually in children aged under 5. It was reported in previous studies that upon getting the infection in childhood period, long term immunity is provided (7, 8). The studies on rotavirus and enteric adenoviruses carried out in many regions of our country are presented in Table 1.

In this study, we aimed to investigate seasonal prevalence of rotavirus and enteric adeno-

Received: 09.03.2015
Accepted: 23.03.2015

Correspondence Address:
Serkan Sugeçti
E-mail:
serkan.sugecti@hotmail.com

DOI: 10.5152/ced.2015.2018

Table 1. Rotavirus and enteric adenovirus studies done in Turkey in different years and age groups

Age group	Month of study	Number of patients	RV %	EAV %	Method	Source
0-5	18 month	148	25.7	4.7	I.K.	Gül et al. (2005) (12)
0-6	6 month	206	12.5	4.5	I.K.	Altındiş et al. (2008) (13)
0->50	12 month	672	18.7	8.9	I.K.	Akan et al. (2009) (7)
0-18	13 month	509	37.3	2.3	I.K.	Gürbüz et al. (2010) (14)
0->50	42 month	2962	16.3	2.6	I.K.	Yousefi Rad and Gözalan (2010) (15)
0-10	11 month	1358	23.7	1.5	I.K.	Bayraktar et al. (2010) (9)
0-14	11 month	426	9.4	1.9	I.K.	Özer et al. (2011) (16)
0-6	24 month	781	28.9	3.3	I.K.	Otağ et al. (2012) (17)
0->50	17 month	1069	22.8	2.9	I.K.	Yazıcı et al. (2013) (11)
0- >50	48 month	2795	9.8	1.3	I.K.	Türk and Fındık (2014) (18)
0-14	12 month	307	13.7	14.9	I.K.	Akıncı et al. (2007) (21)
Average		1108	19.9	4.4		

İ.K.: Immunochromatography

virus antigens in the fresh stool samples taken from 0-14 year-old-children who were diagnosed with acute gastroenteritis and determine their distribution based on some demographic characteristics.

Material and Methods

In this study, the patients were selected among those diagnosed with acute gastroenteritis upon admission to policlinic, neonatal intensive care unit, paediatric surgery and emergency service of Zonguldak for twelve months between 01 January 2014 - 31 December 2014. The records of 3250 paediatric patients aged 0-14 were investigated retrospectively. Laboratory findings of these cases together with some demographic data recorded. The patients' data in whose stool samples parasites (parasitological diagnostic tests, etc.) were detected were excluded from the investigation. The presence, sensitivity and specificity of rotavirus and enteric adenovirus antigens in the fresh stool samples were investigated by the qualitative immunochromatographic test kit (Ameritek-USA one step rapid test adenovirus / rotavirus complex 2- panel card test) reported to be %100 compatible. Internal quality control of the test kit was obtained by using one rotavirus and enteric adenovirus positive control antigens for every 10 tests.

Application of the test

Before their use, the tests, samples, buffer and/or controls were kept at room temperature (20±5°C). Stool sample was mixed in the extraction buffer and 3-drop solution (120-150 µL) of the prepared mixture, was placed in the sample space of the device and examined without waiting. Rotavirus, enteric adenovirus and control results were evaluated within 10 minutes. The formation of the positive control and test bands on the tapes was evaluated to be positive, and only on the control ban to be negative ; when it was formed not on the control band, but only on the test band, the test was not included into the evaluation.

Statistical analysis

For the evaluation of the data, at Department of Biology, Bülent Ecevit University Institute of Science and Technology, "SPSS" package program was used. For comparison of categorical variables, Chi-square test was used. The comparison of positivity rate according to months and seasons, Chi-square trend test was used. $p<0.05$ was considered statistically significant.

Results

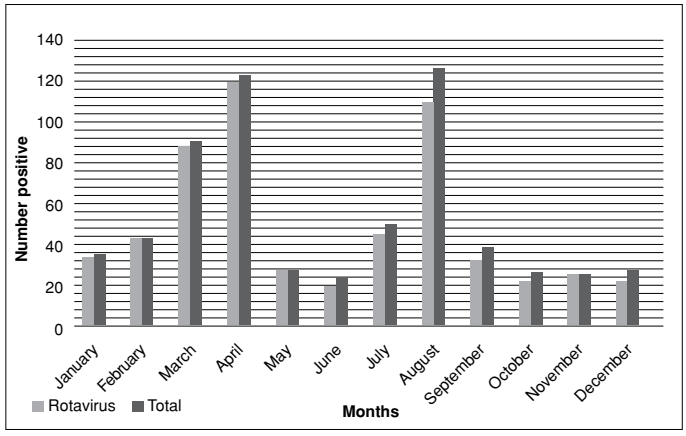
Viral antigen was detected in the stool of 638 patients (%19.6) out of the total of 3258. It was found that rotavirus was positive in 590 (18.1%) and enteric adenovirus in 48 (1.5%) of these samples. It was observed that 347 of the antigen-detected patients were female (54.38%) and 291 (45.61%) male; no significant difference was found between male and female patients with regards to viral antigen positivity ($p=0.974$).

N and percentage values according to months for rotavirus antigen positivity and enteric adenovirus antigen positivity are presented in Table 2. No significant difference was found according to months with regards to rotavirus and enteric adenovirus antigen positivity ($p=0.833$, $p=0.920$) (Table 2, Figure 1).

Positivity rate in males in spring season was 21.16% (n=135), in summer 15.67% (n=100), in autumn 8.15% (n=52), and in winter 9.40% (n=60); there was significant statistical difference between seasons in terms of positivity rates ($X^2=50.885$ $p<0.05$). Positivity rate in females in spring season was 16.77% (n=107), in summer 15.67%

Table 2. Rotavirus and enteric adenovirus positivity by months number (n) and percentage (%) value

Months	January		February		March		April		May		June		July		August		September		October		November		December	
Number/Percent	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Rotavirus	34	5.33	43	6.7	89	13.95	120	18.81	28	4.39	20	3.13	45	7.05	110	17.24	32	5.02	22	3.45	25	3.92	22	3.45
Adenovirus	1	0.16	0	0	2	0.31	3	0.47	0	0.00	4	0.63	4	0.63	17	2.665	6	0.94	4	0.63	1	0.16	6	0.94
Total	35	5.49	43	6.7	91	14.26	123	19.28	28	4.39	24	3.76	49	7.68	127	19.91	38	5.96	26	4.08	26	4.08	28	4.39



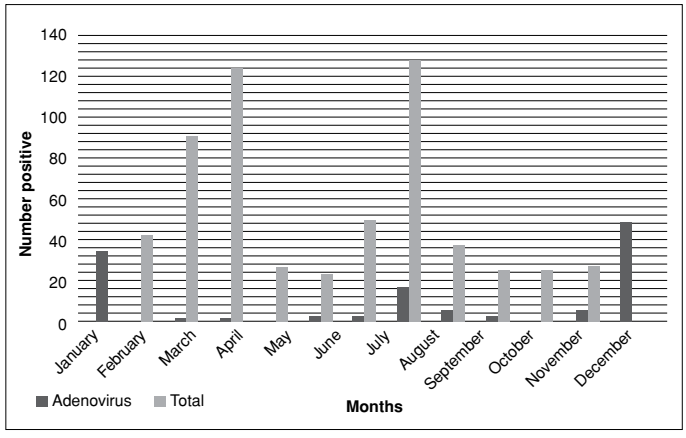


Figure 1. Enteric adenovirus and positivity rotavirus by months

(n=100), in autumn 5.95% (n=38), and in winter 7.21% (n=46); there was significant statistical difference between seasons in terms of positivity rates (X^2=52.589 p<0.05). Regarding general viral antigen positivity according to seasons, in the spring season, it was 37.93% (n=242), in summer 31.35% (n=200) %, in autumn 14.11% (n=90), and in winter 16.61% (n=106); there was significant statistical difference between seasons in terms of positivity rates (X^2=101.509 p<0.05) (Figure 2).

N and percentage values according to seasons for rotavirus antigen positivity and enteric adenovirus antigen positivity are presented in Table 3. No significant difference was found according to seasons with regards to rotavirus and enteric adenovirus antigen positivity (p=0.518, p=0.951) (Table 3, Figure 3).

When viral antigen positivity rates were evaluated regarding the age groups, it was identified that 413

Table 3. Rotavirus and enteric adenovirus positivity by seasons number (n) and percentage (%) value

Seasons	Adenovirus		Rotavirus		Total	
	n	%	n	%	n	%
Spring	5	0.78	237	37.15	242	37.93
Summer	25	3.92	175	27.43	200	31.35
Autumn	11	1.72	79	12.38	90	14.11
Winter	7	1.10	99	15.52	106	16.61
Total	48	7.52	590	92.48	638	100.00

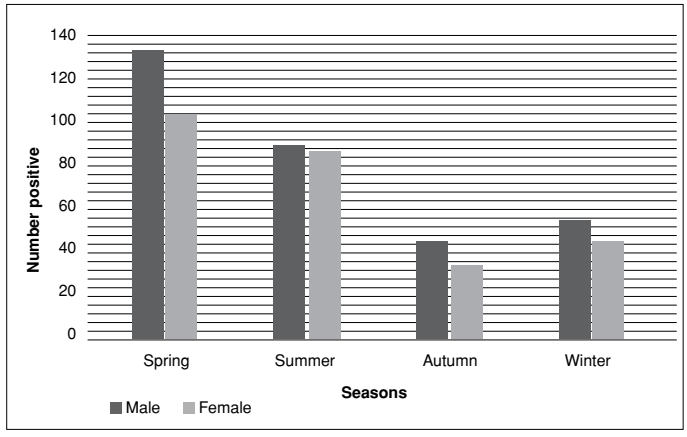


Figure 2. Seasonal distribution of rotavirus positivity by gender

patients (64.7%) were under 5 year old, 157 between 6-10 years old (24.60%), and 28 (4.38%) 11 years old and above. In our study, no significant difference was found between the age groups with regards to rotavirus positivity (p=0.961).

Discussion

Viruses comprise majority of the gastroenteritis in the childhood period (9). Rotavirus incidence rates were found 10-30% in studies carried out in different regions of Turkey (8).

Some studies reported that rotavirus in females and adenoviruses in males were more frequent (3). Previous studies revealed that while enteric adenovirus was present in all age groups, rotavirus infections were frequently seen in children aged 0-5 (10-19).

In the studies done in Turkey, it was found that rotavirus on average was 19.9% and adenovirus 4.4% (Table 1). 18.1% rotavirus antigen positivity found in our study is

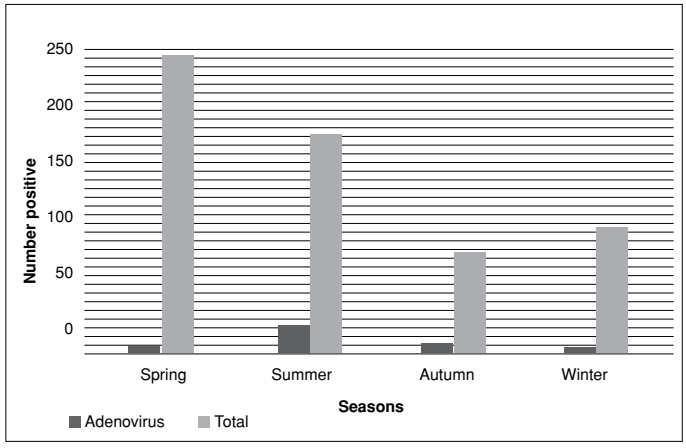


Figure 3. Seasonal number of enteric and rotavirus cases

similar to the one found in previous studies. Furthermore, it was found that enteric adenovirus positivity was 1.5%. This result is significantly lower than the previous studies (Figure 1). It is thought that this is caused by the seasonal parameters, especially the changes in the amount humidity.

In a study done in İstanbul in 2010 on different age groups, it was reported that enteric adenovirus incidence was 1.5% (9). In our study, enteric adenovirus positivity was detected in the summer season; this shows that our results are compatible with those of others.

It is observed that in mild-climate regions, rotavirus epidemics increase especially during the winter months; increased infection incidence in winter months suggests spread through the respiratory tract. Crowded environment and lack of sanitation increases the risk of infection. Intake of the virus is easier in winter in indoor and damp areas and the virus spreads easily. Vomiting followed by diarrhoea develop in most of the paediatric cases (11-20). Mild climatic structure of the region and the fact that the region is mild in terms of its climatic structure and infections transmitted by sea in the summer suggest an increase in the enteric diseases.

Ethics Committee Approval: Ethics committee approval was not obtained due to the retrospective nature of this study.

Informed Consent: Written informed consent was not obtained from patients due to the retrospective nature of this study.

Peer-review: Externally peer-reviewed.

Author Contributions: Concept - S.S., U.Ç.; Design - F.K.; Supervision - S.Y.; Funding - S.S., F.K.; Materials - U.Ç., P.T.A.; Data Collection and/or Processing - U.Ç., P.T.A.; Analysis and/or Interpretation - F.K., S.Y.; Literature Review - S.S., F.K., S.Y.; Writing - S.S., S.Y.; Critical Review - S.Y., S.S., U.Ç., P.T.A.; Other - U.Ç., P.T.A.

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: The authors declared that this study has received no financial support.

References

1. Winn W, Allen S, Janda W, et al. Koneman's Color Atlas and Textbook of Diagnostic Microbiology. 6th ed. Philadelphia: JB Lippincott 2006: 79-82.
2. Svraka S, Duizer E, Vennema H, et al. Etiological role of viruses in outbreaks of acute gastroenteritis in the Netherlands from 1994 through 2005. J Clin Microbiol 2007; 45: 1389-94. [CrossRef]
3. İnan N, Ünsur EK, Demirel A, Mamçu D, Sönmez E, Arısoy A. Akut Viral Gastroenterit Ön tanılı Vakalarda Rotavirus, Adenovirus Ve Norovirus Sıklığının Araştırılması. Ankem Derg 2014; 28: 14-9. [CrossRef]
4. Farkas T, Jiang XI. Rotaviruses, Caliciviruses, Astroviruses, Enteric Adenoviruses and Other Diarrheic Viruses, "Murray PR, Baron EJ, Jorgensen JH, Landry ML, Pfaller MA (eds). Manual of Clinical Micriobiology, 9. Baskı, ASM Pres, Washington DC, 2007; pp. 1453-69.
5. Ferreira MS, Xavier Mda P, Tinga AC, et al. Assessment of gastroenteric viruses frequency in a children's day care center in Rio De Janeiro, Brazil: a fifteen year study (1994-2008). PLoS One 2012; 7: 1-7. [CrossRef]
6. Tate JE, Panozzo CA, Payne DC, et al. Decline and change in seasonality of US rotavirus activity after the introduction of rotavirus vaccine. Pediatrics 2009; 124: 465-71. [CrossRef]
7. Akan H, İzbırak G, Gürol Y, et al. Rotavirus and adenovirus frequency among patients with acute gastroenteritis and their relationship to clinical parameters: a retrospective study in Turkey. Asia Pac Fam Med 2009; 8: 1-8. [CrossRef]
8. Balkan ÇE, Çelebi D, Çelebi Ö, Altoparlak Ü. Erzurum'da 0-5 yaş arası çocuklarda rotavirus ve adenovirus sıklığının araştırılması. Türk Mikrobiyol Cem Derg 2012; 42: 51-4.
9. Bayraktar B, Toksoy B, Bulut E. Akut gastroenteritli çocuklarda rotavirus ve adenovirus saptanması. Klimik Dergisi 2010; 23: 15-7. [CrossRef]
10. Yazısı A. Akut Gastroenteritli Çocuk Hastalarda Rotavirus ve Adenovirus Sıklığı. ACU Sağlık Bil Derg 2014: 121-4.
11. Yazıcı V, Manzur Y, Akbulut A. Akut Gastroenteritli Olgularda Rotavirus ve Enterik Adenovirus İnfeksiyonlarının Sıklığının Araştırılması. Klimik Dergisi 2013; 26: 13-6. [CrossRef]
12. Gül M, Garipardıç M, Çıragil P, Aral M, Karabiber H, Güler İ. 0-5 yaş arası gastroenteritli çocuklarda rotavirus ve adenovirüs tip 40/41 araştırılması. Ankem Derg 2005; 19: 64-7.
13. Altındiş M, Bestepe G, Ceri A, Yavru S, Kalaycı R. Frequency of rotavirus and enteric adenovirus infection in children with acute gastroenteritis. Med J SDU 2008; 15: 60-3.
14. Gürbüz F, Tezer H, Şaylı TR. Akut gastroenterit nedeniyle hastaneye yatan hastalarda etkenler ve klinik bulgular: Epidemiyolojik çalışma. Türkiye Çocuk Hastalıkları Dergisi 2010; 4: 211-8.

15. Yousefi AR, Gözalan A. Detection of Rotavirus and Enteric Adenovirus Antigens in Outpatients with Gastroenterits. J Med Sci 2010; 30: 174-9.
16. Özer TT, Yula E, Deveci Ö, et al. Frequency of Rotavirus and Enteric Adenoviruses among children with acute gastroenteritis in a district hospital. J Microbiol Infect Dis 2011; 1: 64-7. **[CrossRef]**
17. Otağ F, Direkel Ş, Özgür D, Delialioğlu N, Aslan G, Emekdaş G. Akut Gastroenteritli Çocuklarda Rotavirüs ve Enterik Adenovirüs Antijenlerinin Hızlı İmmunokromatografik Yöntemle Araştırılması. Mersin Üniversitesi Sağlık Bilimleri Dergisi 2012; 5: 18-23.
18. Dağı HT, Fındık D. Akut gastroenteritli hastalarda rotavirüs ve adenovirüs antijenlerinin araştırılması. J Clin Exp Inves 2014; 5: 256-60.
19. İlktaç M, Şahin A, Nazik H, Öngen B. Akut gastroenteritli çocuklarda rotavirus sıklığının araştırılması ve rotavirus sezonunun takibi: beş yıllık sonuçların değerlendirilmesi. ANKEM Derg 2012; 26: 25-9.
20. Oğuz S, Kurt F, Tekin D, Aldemir Kocabaş B, İnce E, Suskan E. Çocuk Acil Servisinde Rotavirus Gastroenteritlerinin Yükü. J Pediatr Inf 2014; 8: 99-104.
21. Akıncı N, Erener Ercan T, Yalman N, Eren A, Severge B, Ercan G. Akut Gastroenteritli Çocuklarda Adenovirus ve Rotavirus. J Pediatr Inf 2007; 1: 98-101.