

**ORIGINAL ARTICLE**

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## **Rotavirus Infection in Infants and Young Children with Acute Gastroenteritis in Gaza, Palestine.**

### **ABSTRACT**

To detect rotavirus antigen in infants and young children with acute diarrhea and gastroenteritis. Rotavirus is a major cause of gastroenteritis and diarrhea in infants and young children worldwide.

**Method:** Fecal samples from 150 children with ages ranging from 1 month to 5 years, living in Gaza, who presented with acute diarrhea episodes, were analyzed for rotavirus antigen. The analysis was carried out using an immunochromatography-based diagnostic kit (The RotaStick One-Step test, Novamed Ltd, Jerusalem). The study was conducted during the peak diarrheal season (May-August) of the year 2005.

**Results:** Rotavirus was detected in 28 % (42/150) of the fecal specimens examined, and the majority of patients 90% (38/42), who were positive for the virus were 1 to 24 months old, and the infection rate decreased with increasing age. The highest rate of rotavirus antigen detection was observed among the 12 to 24 months age group 41.9%. Children infected with rotavirus were more likely to have watery stool (95.2%), vomiting (92.9%), moderate dehydration (14.3%) and fever has low frequency (73.8%).

**Conclusions:** The findings of this study demonstrate that rotavirus is one of the most frequently detected, yet a routinely neglected pathogen during stool examinations in Gaza strip health laboratories. Timely diagnosis of rotavirus infection in patients with acute diarrhea helps to determine appropriate treatment, prevents the unnecessary use of antibiotics and minimizes the spread of the disease. To our knowledge, this is the first report on occurrence of rotavirus infection among children of Gaza since 1994.

**Keywords:** Rotavirus, Gastroenteritis, Gaza, Palestine.

## INTRODUCTION

Acute gastroenteritis is one of the leading causes of illnesses and death in infancy and childhood throughout the world, especially in developing countries. In Asia, Africa and Latin America an estimated 1.3 billion diarrhea episodes and 4 to 10 million deaths occur each year in children less than 5 years of age (1,2,3). Viral pathogens account for approximately 70% of episodes of acute infectious diarrhea in children, and rotavirus is the most commonly implicated agent (4,5,6). World wide, group-A rotaviruses are responsible for 30–60% of all cases of severe watery diarrhea in young children (7). Each year, rotavirus causes approximately 111 million episodes of gastroenteritis requiring only home care, 25 million clinic visits, 2 million hospitalizations, and 352,000–592,000 deaths (median, 440,000 deaths) or approximately 2,000 children each day in children <5 years of age.

This accounts for about one quarter of the deaths from diarrhea and about 5% of all deaths among children less than five years of age. Children in the poorest countries account for 82% of rotavirus deaths (3). Timely diagnosis of rotavirus infection in patients with acute diarrhea helps determine appropriate treatment, prevents the unnecessary use of antibiotics and minimizes the spread of the disease (8,9). In Palestine, diarrhea is one of the major causes of many outpatient visits, and hospitalizations. The identification and diagnosis of diarrhea in Palestinian health laboratories is done only for *Salmonella* and *Shigella* species, and the parasites, e.g., *Entamoeba* and *Giardia* are diagnosed by direct microscopic examination. The rotavirus however, is not diagnosed. Moreover, there has been no reported studies regarding this virus since 1994 (10-14).

## MATERIALS AND METHODS

### Study population

During the peak of diarrheal season (May–August of 2005), 150 of the children up to 5 years of age who were admitted with acute diarrheal diseases to ElNasser Pediatric Hospital Gaza (the central pediatric hospital in Gaza strip), were enrolled in the study.

### Sample collection

Fecal samples (one per each subject), from children with diarrhea were collected as soon as the children were admitted to the hospital by the help of their parents. Each stool specimen was collected in a special container, kept at 4°C, and processed within 3 hours of collection. Blood samples collected (2 ml) in heparinized tube or syringe were transported immediately on ice to the laboratory for pH measurement.

### Ethical Considerations

An authorization to carry out the study was obtained from the Helsinki committee (Declaration of Helsinki the most widely accepted guideline on medical research involving human subjects) using an agreement letter prepared from The Islamic university of Gaza. Parents gave their consent for participation in the study and all the information that were

### RESULTS

The study focused on detection of rotavirus antigen in 150 children less than 5 years of age in

obtained about the subjects as well as their parents were kept confidential.

### Laboratory Investigations

#### Rotavirus detection

Stool samples were analyzed for group A rotavirus using RotaStick one step test kit for determination of rotavirus in human feces (Novamed ltd., Jerusalem) following the manufacturer's instructions. Immunochromatography-based methods are reliable and the fastest and easiest to perform and have the sensitivity, the specificity as well as ELISA and other methods and have found a wide use in detection of the rotavirus (15,16).

#### Blood pH determination

Blood pH was determined by the Blood Gas Analyzers-Radiometer ABL 5 (Diamond Diagnostics USA), the sample was processed according to the manufacturer's instructions.

### Data Analysis

The data was entered, sorted and analyzed by a personal computer using SPSS 8.0 statistical package, differences in proportions were assessed by a chi-square test, P values <0.05 were considered statistically significant.

Gaza, Palestine. The results of the study can be summarized as follows:

The children enrolled in the study were divided

into five age groups as illustrated in Table 1. A clear higher incidence of diarrhea in the 0 to 2 years old subjects was observed. Infants below 12 months of age were particularly affected, accounting for 95 cases (63.3%), followed by 31 cases (20.7%) in the age group 13-24 months, Table 1. Rotavirus was detected in 28 % (42/150) of all the fecal specimens examined (Table 1), and the majority of patients who were positive for the virus, 90% (38/42), were 0 to 24 months old, and the infection rate decreased with

increasing age. Most of rotavirus-positive cases 25/42 (59.5%) were in the age group 0-12, followed by 13/42 (31.0%) in the age group 13-24 (Table 1). Moreover the highest rate of rotavirus antigen detection was observed among the 13 to 24 months age group since 13 out of the 31 diarrhea cases (i.e., 41.9%) examined in this age group were positive for rotavirus, followed by the age group 0-12 month (26.3%) and it decreased over age.

Table 1: Distribution of rotavirus infection detected in 0 to 60 months old children with acute diarrhea.

Age	Rotavirus Antigen				
	No of patient examined	Positive		Negative	
		No	%	No	%
0-12 months	95	25	26.3	70	73.7
13-24 months	31	13	41.9	18	58.1
25-36 months	8	2	25.0	6	75.0
37-48 months	7	1	14.3	6	85.7
49-60 months	9	1	11.1	8	88.9
Total	150	42	28	108	72.0

Clinically; children infected with rotavirus were more likely to have watery stool (95.2%) with statistical significance (P value < 0.05), vomiting

(92.9%), fever is less frequency (73.8%) and moderate dehydration (14.3%), Table 2.

Table 2: Clinical presentation of children with and without rotavirus among the cases.

Clinical presentation	Number and percentage of samples				
	Rotavirus positive (n=42)	%	Rotavirus negative (n=108)	%	P-value
Vomiting	39	92.9%	92	85.2%	0.205
Fever	31	73.8%	87	80.6%	0.365
Dehydration	6	14.3%	11	10.2%	0.477
Watery Stool	40	95.2	89	82.4	<b>0.042</b>

Metabolic acidosis was significantly more frequent in rotavirus-positive cases (35.7%),

while metabolic alkalosis was less common (2.4 %), Table 3.

Table 3: Blood pH and rotavirus

Condition	Number and percentage of samples				
	Rotavirus positive (n=42)	%	Rotavirus negative (n=108)	%	P-value
Metabolic acidosis	15/42	35.7%	15/108	13.9%	<b>0.002</b>
Metabolic Alkalosis	1/42	2.4	17/108	15.7	<b>0.002</b>

Slightly more males (89/150) were admitted to the hospital due to diarrhea than females (61/150). The ratio of rotavirus infection,

however, was 1.2 higher in the female subjects, (19/61 of the females and 23/89 of the males) Table 4.

**Table 4:** Rotavirus detection from stool samples in relation to the gender

Variable	Gender		Total
	Female	Male	
Rotavirus Negative	42	66	108
Rotavirus Positive	19	23	42
Total	61	89	150

Most of the children 59.3% (89 of 150) who had diarrhea and were admitted to the hospital came from the Gaza region, 38.0 % (57 of 150) were from the Northern Gaza strip and the rest was from Mid zone

and the Southern Gaza strip. The highest rate of rotavirus antigen detection (36.0%) was observed among the Gaza region group Table 5.

**Table 5:** Rotavirus-positive and negative cases with respect to residence area.

Residence area	Number and percentage of samples				
	Rotavirus positive (n=42)	% of the total	Rotavirus negative (n=108)	% of the total	Total
North Gaza	9	6.0%	48	32.0%	57
Gaza region	32	21.3%	57	38.0%	89
South & mid zone Gaza	1	0.7%	3	2.0%	4
Total	42	28.0%	108	72%	150

**P: value 0.030**

## DISCUSSION

Diarrhea remains one of the most common illnesses of children and one of the major causes of infant and childhood mortality in developing countries. Considering the usually scanty resources available in the third world countries, a reduction in diarrhea-related mortality may be possible by identifying high risk subjects and targeting them for intensive intervention. In the present study, we focused on rotavirus as an important etiologic agent of childhood diarrhea. Rotavirus was detected in 28 % (42/150) of the fecal specimens collected from children of < 5 years of age with acute diarrhea, using an immunochromatographic assay. When compared to other studies the percentage of rotavirus-positive specimen of our study is lower than that reported by many investigators such as the 32.5% of Youssef et al. (2000) in Jordan, the 34.6% of El-Sheikh and El-Assouli (2001) in Saudi Arabia, and the 45.0% of Nguyen et al. (2005) in Vietnam (2,17,18). On the other hand,

our percentage is higher than that reported by many other authors; 6.8% by Sallon et al (1994) in Gaza, Palestine, 8.8% by Yoshida et al. (1998) in Japan, 11.9% Rohner et al., (1997) in Switzerland, 14% by Dagan et al. (1990) in Southern Israel, 15.3% by Modarres et al (1995) in Iran, 19.2% by Orlandi et al. (2001) in Brazil, and 19.6% by Ballal and Shivananda (2002) in India (14,19-24). Meanwhile, our finding is nearly congruent with that Battikhi (2002) in Jordan and Ali et al. (2005) in Zliten, Libya, where they reported that 26.6% of their samples had rotavirus infection, 28.6% by Pazzaglia et al. (1993) in Alexandria, Egypt, and 27% by Buser, et al. (2001) in Switzerland (10,25-27). The low or high rates of rotavirus infections presented by different investigators can be explained by several factors including, the study population, the incidence rate of the virus in different environments, the living conditions and standards of the study group, and the season on

which the study was conducted. Out of the 150 diarrheal patients enrolled in the study, 64.0% were less than 1 year of age, and 84.0% were less than 2 years of age. This shows a strong tendency of diarrhea to occur among children less than 2 years of age. This finding is consistent with other studies conducted in the middle east countries and other various developing countries, (2,17,18) where the major burden of diseases due to rotavirus occurs in the first and second year of life. The children enrolled in this study were divided into five age groups, 90% of all the cases of rotavirus occurred in children  $\leq$  2 years of age, which is in agreement with many other studies done in most parts of the world and which showed why these age groups represent the highest morbidity and mortality from rotavirus diarrhea. The prevalence of rotavirus infection in this age group emphasizes the importance of rotavirus vaccines, which have been undergoing field trials for several years (4,28). Moreover, our study indicated that there was a trend of decreasing rates of rotavirus infection in the older children. This might partly be explained by the fact that older children acquired protective immunity during previous, probably subclinical, exposures to rotavirus and therefore become more resistant to infection with this agent (29). A total of 89 (59.3%) male and 61 (40.7%) female cases of acute diarrhea were examined in this study Table 4. Slightly more males were admitted to the hospital due to diarrhea. Rotavirus prevalence was higher in female cases 19 of 61 (31.1%) than in males 23 of 89 (25.8%), no reasonable explanation has yet been given for this distribution but it is possible that the cultural or behavioral norms in our study area are contributing factors. For example it is a common practice in many families of preferentially seeking medical care for boys. It is not possible to distinguish diarrhea caused by rotavirus clinically, because diarrhea, vomiting, fever, and dehydration are not absolutely associated with rotavirus infection, through, and as reported by the current study, some clinical symptoms are more common in rotavirus infection such as vomiting, dehydration and metabolic acidosis (2,30-32). Most of the patients (89/150 ; 59.3%) admitted with acute gastroenteritis were from the Gaza region, 38.0% (57/150) were from Northern Gaza Strip, and 2.7% (4/150) were

from Mid zone and Southern Gaza Strip. It is important to note that there is no pediatric hospital in Northern Gaza Strip. The low number of cases admitted from the Mid zone and Southern Gaza Strip is due to the continuous closures and separation of Gaza from the southern area by the Israeli occupation, and the presence of some hospitals in that area. The present study revealed that rotavirus was the microorganism associated most frequently (36.0%) with gastroenteritis in Gaza region, (15.8%) found in Northern Gaza Strip. Many authors have shown that rotavirus infection is more common in urban area as compared to rural areas. The reason of increased rotavirus prevalence in Gaza city can be due to nosocomial infections in neonatal nurseries, particularly more common in the urban area than the rural one, and the management of rotavirus infection is difficult (3,21). The incidence of rotavirus disease was observed to be similar in both industrialized and developing countries, suggesting that adequate control may not be achieved by improvements in water supply, hygiene, and sanitation. Consequently, the development, trial, and widespread use of rotavirus vaccines is highly recommended in order to prevent severe and fatal rotavirus disease (3). No specific treatment of viral infection is available nor it is really required. The severe symptoms and fatal outcome from rotavirus diarrhea are due to dehydration, the acute loss of fluid and electrolytes. This can be treated with rehydration therapy, ie. replenishing the fluids and electrolytes that have been lost. For children who are not severely dehydrated, oral rehydration solution is the treatment of choice whereas for children who are severely dehydrated, in shock, and are unable to drink, intravenous therapy can be lifesaving. Antibiotics are not required and are contraindicated, use of antimicrobials adds to the cost of treatment, risks adverse reactions and enhances the development of resistant bacteria (8,9). Timely diagnosis of rotavirus infection in patients with acute diarrhea helps determine appropriate treatment, prevents the unnecessary use of antibiotics and minimizes the spread of the disease. It is worth noting here that the detection of rotavirus in stool specimen by the employed method requires only 30 minutes to perform.

## **CONCLUSION AND RECOMMENDATION**

Rotavirus vaccines is highly recommended in order to prevent severe and fatal rotavirus disease and to detect rotavirus antigen in stool specimen

as soon as possible to determine appropriate treatment, prevents the unnecessary use of antibiotics and minimizes the spread of the

disease. Based on the preliminary data presented by this study, further work is needed in order to provide a broader picture of the burden of

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rotavirus in children less than 5 years old all over Gaza strip.

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