

## Rotavirus Infection among Diarrhoeal Children Attending Kanti Children Hospital, Kathmandu, Nepal

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### Abstract

**Introduction** Rotavirus is one of the causative agents of childhood diarrhoea in winter season in all over the world. However, the prevalence differs from place to place. Rotavirus was found about 27% in diarrhoeic children and 8% in non-diarrhoeic controls in Nepal. This study was conducted to compare the proportionate prevalence between diarrhoeal and non-diarrhoeal children in Kanti Children's Hospital. In addition, it also aims to find out relationship between intestinal parasitic infestation and rotavirus infection and case management practice.

**Objective** This study aims at finding the proportion of children infected with rotavirus among diarrhoeic children, compare the rotavirus infection between diarrhoeal and non-diarrhoeal cases and assess the parasitic infestation related with rotavirus infection.

**Method** This study was carried out from November 2005 to January 2006 in Kanti Children Hospital. The target population were children below 5 years of age with and without diarrhoea and the parents of the children were respondent. During the collection of stool samples, Doctors prescription were strictly followed to determine whether the case were diarrhoeal or non-diarrhoeal.

**Results** A total of 374 stool samples were tested, out of this 262 samples were diarrhoeal and 112 were non-diarrhoeal samples. Out of 262 diarrhoeal samples 125 (47.7%) were positive for rotavirus. Out of 112 non-diarrhoeal samples 15 (13.4%) were positive for rotavirus. Among the diarrhoeal cases highest rate of infection 87/150 (58.0%) were seen in age group 7-24 months. Where as, among the non-diarrhoeal cases highest rate of infection 3/16 (18.7%) were seen in age group 0-6 months. The highest rate of infection 86/169(50.8%) was seen in male children. In comparison, rotavirus infection was significantly higher in diarrhoeal cases 125/140 (89.2%) than non-diarrhoeal cases 15/140 (10.7%) [P-value 0.000, odds ratio (OR) 5.9, at 95% confidence interval (CI)]. The highest rate of infection were seen in the month of January 61/107 (57.0%)

**Conclusion** Rotavirus causes diarrhoea in children below 5 years of age and the highest rate of infection were seen in age group of 7-24 months. Rotavirus infection was statistically significant in diarrhoeal cases than non-diarrhoeal cases. Highest rate of infection were seen in the month of January during study period.

**Keywords** Rotavirus, Diarrhoea.

### Introduction

Rotavirus is a double stranded ribonucleic acid (RNA) virus measuring about 70nm, and considered as a common cause of diarrhoea in children. It has been

detected from all over the countries where it has been looked for, though the prevalence differs from place to place.

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Rota virus is frequently demonstrated in stools of neonates, but in them the infection is generally asymptomatic, probably due to maternal immunity. The disease peaks from the age of six months to two years.

The mode of spread is believed to be faecal-oral route. The incubation period is 2-4 days. Typically, vomiting is a prominent early symptom, often preceding diarrhoea. The stools are watery, sometimes with flakes of mucus. Mild fever and respiratory symptoms may occur<sup>1</sup>. Across the world, rotavirus is thought to be responsible for more than 125 million cases of diarrhoea each year in children and infants. Rotavirus is responsible for the death of as many as 600,000 children each year<sup>2</sup>.

Globally in a year, it is assumed that 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) in children below 5 years of age<sup>3</sup>.

There have been some studies on Rota viral diarrhoeal disease in Nepal<sup>4,5</sup>. Study conducted in Kanti Children Hospital in 1992 showed that 53 (27%) of 198 children were infected with rotavirus and a similar proportion of diarrhoeic children attending general practitioner 14 (27%) of 52 were infected. In contrast, only 7 of 92 (8%) of non-diarrhoeic controls were found to be rotavirus positive<sup>4</sup>.

Rotavirus is a contagious virus and, among children, is the leading cause of severe diarrhoea. In Some infants and children, diarrhoea may be so severe that they become dehydrated and may require emergency care or hospitalization.

Transmission of rotavirus most frequently occur through faecal-oral contact. Usually, this occurs from poor hand washing or from ingestion of contaminated food or drinking water. The virus may also be transmitted through the respiratory tract or by other body fluids, but these routes are less common. The virus may live on inanimate surfaces, such as doorknobs, toys and hard surfaces, for quite sometime. This may cause out breaks in child care centres and households where things are shared. Therefore hospitalized children need to be separated from the rest and quarantined.

The most obvious symptom of rotavirus ranges from mild to severe dehydration. Similarly, other common symptoms are nausea, vomiting, fever, abdominal pain, diarrhoea and dehydration.

The rota-viral diarrhoea can be diagnosed by medical history and physical examination, immunological test and stool culture for isolation of virus. There is no specific treatment for rotavirus infection, so treatment is based on symptoms and supportive therapy to prevent dehydration<sup>2</sup>.

Rotavirus transmission can be prevented by proper hygiene such as hand washing, cleaning hard surfaces, toys, doorknobs, proper handling and proper disposal of dirty papers<sup>6</sup>.

This study was conducted between November 2005 to January 2006 to determine the proportionate prevalence of rotavirus infection among diarrhoeic and non-diarrhoeic children below 5 years of age attending Kanti Children Hospital. The prevalence of infection between the groups was compared to determine the severity of the infection. In addition, relationship between intestinal parasites and rotavirus and data on case management practice was collected to find out the significance of the relation and standard case management practice.

## Materials and Methods

This was a cross sectional study. The study was carried out in Kanti Children Hospital of Kathmandu. Children below five years old with diarrhoea and without diarrhoea attending Kanti Children Hospital were the target population and the parents of the children were the respondent for the study.

A Total of 262 (Two hundred and sixty two) diarrhoeic samples and 112 non-diarrhoeic samples were collected during the study period. Diarrhoeal and non-diarrhoeal stool samples were collected for comparing proportion of rotavirus among them. Diarrhoeal samples were collected from Emergency, Observation, OPD and Oral rehydration therapy ward and non-diarrhoeal samples were collected only from the children attending OPD. During the collection of stool samples Doctor's prescription was strictly observed to determine whether the case was diarrhoeal or non-diarrhoeal. Interview was taken with parents of the children, after interview, stool samples of the children were collected in a container provided by researcher.

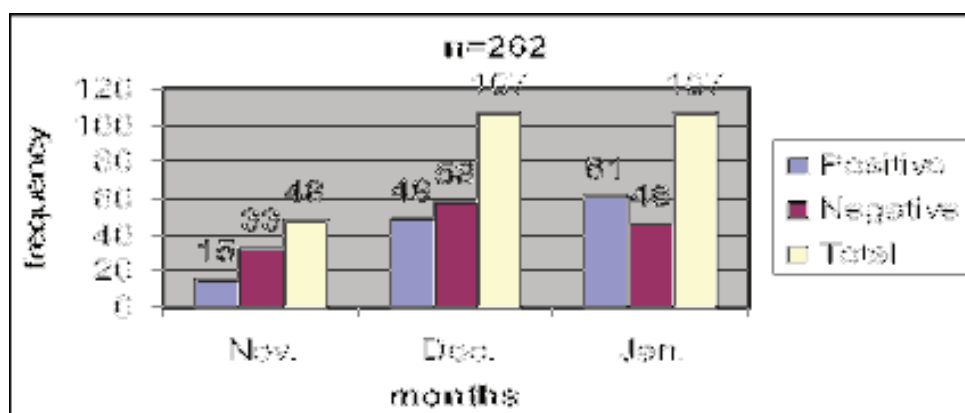
Collected stool samples were processed for rotavirus and other parasites detection. EIA technique was applied to detect antigen of rotavirus, samples were stored at -30°C till the test was conducted. Microscopic examination was done by using saline and iodine preparation to detect other intestinal parasites.

## Results

A Total of 262 (Two hundred and sixty two) diarrhoeic samples and 112 non-diarrhoeic samples between November 2005 to January 2006. Over all rotavirus infection was found in 140 (37.4%) samples among the total of 374. Among the total of 262 diarrhoeal

cases 125 (47.7%) samples were positive for rotavirus. Likewise, 15 (13.4%) samples were positive for rotavirus out of 112 non-diarrhoeal samples. Highest number of infection was seen in the month of January among the study period (Figure 1).

**Fig 1: Month-wise frequency of rotavirus positive in diarrhoeal cases**



## Age-wise distribution of Rotavirus infection

The highest rate of infection were seen among age group 7-24 months 87(58.0%) in diarrhoeal cases, where as the highest rate of infection were seen among

age group 0-6 months 3 (18.7%) in non-diarrhoeal cases (Table 1).

**Table 1: Age-wise distribution of rotavirus**

Age group in month	Diarrhoeal cases			Non-diarrhoeal cases		
	Frequency	Rotavirus positive	%	Frequency	Rotavirus positive	%
0-6	75	30	42.8	16	3	18.7
7-24	150	87	58.0	56	7	12.5
25-60	37	8	21.6	40	5	12.5
Total	262	125	47.7	112	15	13.3

## Sex-wise distribution of Rotavirus infection

Highest rate of infection were seen among males 86(50.80%) in diarrhoeal cases, where as highest rate

of infection were seen among females 6(16.2%) in non-diarrhoeal cases (Table2)

**Table 2: Sex-wise distribution of rotavirus**

Sex	Diarrhoeal cases			Non-diarrhoeal cases		
	Frequency	Rotavirus positive	%	Frequency	Rotavirus positive	%
Male	169	86	50.8	75	9	12.0
Female	93	39	41.9	37	6	16.2
Total	262	125	47.7	112	15	13.3

### Age and rotavirus infection in diarrhoeal case

Age was found statistically significant with rotavirus infection (Table 3).

**Table 3: Age group and rotavirus infection**

Age group in Month	Rotavirus infection		Total	P-value	df
	Positive	Negative			
0-6	30 (40.0%)	45 (60.0%)	75	0.000	2
7-24	87 (58.0%)	63 (42.0%)	150		
25-60	8 (21.6%)	29 (78.4%)	37		
Total	125	137	262		

### Father's education and Rotavirus infection in diarrhoeal cases

Father's education was found statistically significant with rotavirus infection. Odds ratio indicates that illiterate father's child was two times more prone to get rotavirus infection than literate father (Table 4).

**Table 4: Father's and Mother's education and rotavirus infection**

Education	Father			Mother		
	Positive	Negative	P-value	Positive	Negative	P-value
Illiterate	29 (61.7%)	18 (38.2%)	0.033	61 (59.2%)	42 (40.8%)	0.002
Literate	96 (44.7%)	119 (55.3%)		64 (40.2%)	95 (59.7%)	
Total	125	137		125	137	

### Rotavirus infection and vomiting in diarrhoeal cases

Vomiting is statistically significant with rotavirus infection. Odds ratio indicates that occurrence of vomiting was nearly four times higher in rotavirus infected child (Table 5).

**Table 5: Vomiting and rotavirus infection**

Vomiting	Rotavirus infection			Total	P-value	OR	CI at 95%
	Positive	Negative					
Yes	114 (53.5%)	99 (46.5%)		213	0.000	3.98	1.84-8.76
No	11 (22.4%)	38 (77.6%)		49			
Total	125	137		262			

### Rotavirus infection and occurrence of diarrhoea in Children

Rotavirus infection was found statistically significant with occurrence of diarrhoea. Odds ratio (OR) indicates that chance of occurring diarrhoea among rotavirus infected child was nearly six times higher than non-infected child (Table 6).

**Table 6: Rotavirus infection and occurrence of diarrhoea**

Rotavirus	Diarrhoeal	Non-diarrhoeal	Total	P-value	OR	CI at 95%
	cases	cases				
Positive	125 (89.2%)	15 (10.7%)	140	0.000	5.9	3.15-11.21
Negative	137 (58.5%)	97 (41.5%)	234			
Total	262	112	374			

### Intestinal parasitic infestation and Rotavirus infection

Intestinal parasitic infestation and rotavirus infection was not statistically significant. The  $\chi^2$  (chi-square)

value was obtained after Yates correction (Table 7).

**Table 7: Intestinal parasites and rotavirus infection**

Intestinal parasite	Rotavirus infection		Total	$\chi^2$ (Chi-square)	P-value
	Positive	Negative			
Yes	1 (12.5%)	7 (87.5%)	8	2.77	0.095
No	124 (48.8%)	130 (51.2%)	254		
Total	125	137	262		

### Some of the practices followed by children as responses given by respondents in diarrhoeal cases (n=262)

Based on response given by respondents in hospital, following practices were seen as contributing factors

for acquiring rotavirus infection in diarrhoeal cases (Table 8).

**Table 8: Various practices followed by children and Rotavirus infection**

Practices	Frequency	Rotavirus infection	%
Drinking tap water directly without any treatment	115	61	53.0
Open air defecation	23	12	52.2
Cleaning with paper after defecation	7	5	71.4
Playing with pet animals	20	9	45.0
Spoon feeding	77	38	49.4
Children cleaning hand themselves	4	4	100.0

### Discussion

Rotavirus is known as a causative agent of winter diarrhoea. In this study, overall rotavirus infection was seen 37.4 percent. In diarrhoeal cases was 47.7 percent and in non-diarrhoeal cases 13.4 percent. In hospital based studies the varying percentages of rotavirus infection have been found. A study conducted in urban Kathmandu valley was found up to 40 percent in diarrhoeal cases<sup>5</sup>. A hospital based study conducted in US showed up to 54 percent in winter months. The exact cause of increasing infection by rotavirus in winter months is not known but may be due to poor hygienic condition such as hand washing and improper food handling. The meteorological factors indirectly influence

human rotavirus infection, in particular low temperature and low indoor relative humidity may be key factors behind high rota-viral infection in winter season<sup>6,7</sup>.

The high incidence of diarrhoea and rotavirus positive cases by months was observed in winter December, January and February<sup>5</sup>. Infection of rotavirus is very much related with changes in environmental temperature, this suggest that relatively modest changes in temperature may be associated with appreciable changes in the number of patients hospitalized with rotavirus gastroenteritis. A study shows that in colder November and December months

54 percent hospitalized cases were positive for rotavirus, comparing to 40 percent after the set of relatively warmer November and December months<sup>7</sup>. Infection of rotavirus was seen as much as 72 percent in January comparing to 7.4 percent in September<sup>8</sup>. This study also showed that rotavirus infection increased as much colder months set in i.e. in November 31.3 percent, December 45.8 percent and January 57.0 percent.

This study showed that the highest rate of rotavirus infection was seen in hospitalized patients than the patients who visited OPD and visited emergency for sometime. In hospitalized cases rotavirus infection was seen 59.9 percent, which was significantly higher than in non-hospitalized cases it is 30.9 percent (P-value 0.000). A higher percentage of gastroenteritis patients tended to be hospitalized with rotavirus infection in the month after the colder January<sup>9</sup>. A Study in south India indicates that 22 to 66 percent of hospitalized cases of diarrhoea were associated with rotavirus<sup>10</sup>. The proportion of rotavirus positive cases was always higher among hospitalized children than non-hospitalized children with acute gastroenteritis<sup>11</sup>.

Rotavirus infection is commonly prevalent in between age group 0-5 years<sup>1,4,5</sup>. Infection was predominantly seen in age group 7-24 months. This study showed that in age group 7-24 months the rotavirus infection was highest (58.0%) comparing to age group 0-6 month (42.8%) and age group 25-60 month (21.6%). But in non-diarrhoeal cases highest percentage of infection was seen in age group 0-6 months (18.7%); in age groups 7-24 (12.5%) and in age group 25-60 months (12.5%). Rotavirus was a major cause of paediatric gastroenteritis and responsible for causing half of the cases to be suffered with acute diarrhoeal illness among hospitalized patients of 6-24 months of age<sup>1,2,4,5</sup>.

This study showed that educational status of mother was seen associated with rotavirus infection (P-value 0.002). The study showed that some practices which were related with mother showed higher incidence of rotavirus infection such as cleaning baby after defecation 47.0 percent (117/249), feeding child with her own hand 47.3 percent (79/167). This may be considered due to inadequate hygienic practice of mothers. Rotavirus is the one which is considered to be transmitted through poor hygienic practice such as poor hand washing<sup>2</sup>.

Some of the hygienic practices such as drinking water without treatment 53 percent (61/115), open air defecation 52.2 percent (12/23) and cleaning with paper after defecation 71.4 percent (5/7) were found to be causing higher incidence of rotavirus infection in diarrhoeal cases. Since this was a hospital based study, the results

regarding these practices of the children and their mothers can not be strongly correlated for transmission of rotavirus. However, it can be presumed that these practices could have contributed in transmission of rotavirus.

The symptoms of rotavirus infection range from mild fever, nausea, vomiting, abdominal pain, diarrhoea and dehydration. The study also showed that nausea (p-value 0.000) and vomiting (P-value 0.000) were associated with rotavirus infection, where as fever (P-0.335) and abdominal pain (P-value 0.611) were not significant. This may be due to that fever is not consistent with rotavirus infection<sup>2</sup>, where as, regarding abdominal pain questionnaires were taken from parents which may not be exactly representative with the cases since most of the infants were not able to communicate.

In this study, dehydration was not found to be significant (P-value 0.091). This may be due to some type of rehydration had already started by the time the child was brought to the hospital. The study showed that at least breast feeding was continued to diarrhoeic children 49 percent, where as 37percent provided ORS to child before taking to hospital. This may be the cause of low percentage of some and severe dehydration i.e. 43 percent and 7 percent respectively. Among the diarrhoeic patients who visited hospital for the treatment, 92 percent (240/262) of them were treated with ORS. From the study it was seen that in the hospital there was no laboratory investigation facility for identification of rotavirus. Therefore, when a patient comes to hospital with diarrhoea they were just told to do routine stool examination to find out whether any intestinal parasite is present or not. If in routine stool examination any intestinal parasite was found, the patient was treated with respective medicine and ORS. Otherwise, they were just treated with ORS therapy. Some of the patients were also treated using antibiotic, IV fluid and other medicine (anti-protozoal). Since the proportion of rotavirus infection was found 47.7 percent in diarrhoeal cases and occurrence of diarrhoea due to rotavirus is statistically significant (P-value 0.000), this indicates that most of the winter diarrhoea was occurring due to rotavirus. Since, there was no specific treatment for rotavirus; the treatment is supportive only<sup>2</sup>. The disease is self-limiting and recovery occurs within 5-10 days. Mortality due to rotavirus is low. Rehydration was one of the most effective treatments for rotavirus infection<sup>1</sup>. The study also showed that 92 percent of cases were treated by using ORS. Therefore the existing practice on rota-viral diarrhoeal management seems the most appropriate treatment at present situation. Though this is usual practice but this study further strengthens the appropriateness of existing pattern of practice.

In this study it was found that presence of intestinal parasite and occurrence of rotavirus infection did not co-existed. That means, intestinal parasitic infestation and rotavirus infection were independent of each other. Intestinal infestation was found low this may be due to winter season because in winter season occurrence of water borne diseases are considered to be low<sup>11</sup>.

In non-diarrhoeal cases age, father's education and mother's education are not significant to occurrence of rotavirus infection. This may be due to lower rotavirus infection among non-diarrhoeal cases. Among them who were rotavirus positive but not having diarrhoea may be due to earlier immunity. Infection is not infrequent in neonates, but they seldom develop diarrhoea, perhaps because of maternal passive immunity. By the age of five years, most children have had clinical or sub-clinical infection, so that rotavirus diarrhoea is very uncommon in older children and adults<sup>1</sup>.

### Conclusion

Rotavirus is a most common causative organism of winter diarrhoea in children. It commonly affect children below 5 years of age and most prevalent in age group 6 to 24 months. Meteorological factors indirectly influence human rotavirus infection. In particular low temperature and low indoor relative humidity may be key factors behind high rota-viral infection in winter season. It is considered to be transmitted through poor hygienic practice such as poor hand washing. Symptoms of rotavirus infection range from mild fever, nausea, vomiting, abdominal pain, diarrhoea and dehydration. There is no specific treatment for rotavirus; the treatment is supportive only. The disease is self-limiting and recovery occurs within 5-10 days.

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