

## Original Article

## Prevalence and clinical characteristics of rotavirus diarrhea in Mataram, Lombok, Indonesia

Wayan Sulaksana Sandhi Parwata<sup>1</sup>, Wayan Sukardi<sup>1</sup>, Abdul Wahab<sup>2</sup>, Yati Soenarto<sup>3</sup>

### Abstract

**Background** Rotavirus is the most common cause of severe diarrhea and dehydration among children aged <5 years in developed and developing countries, including Indonesia. There have been few studies on the prevalence of rotavirus diarrhea in Mataram.

**Objective** To determine the prevalence and characteristics of rotavirus diarrhea in children under five years of age with acute diarrhea in Mataram.

**Methods** A cross sectional study using the *WHO Generic Protocol for Rotavirus Surveillance* was conducted in the Nusa Tenggara Barat (NTB) General Hospital, Mataram, as part of a multicenter study by the *Indonesian Rotavirus Surveillance Network (IRSN)* for children under five years of age. Subjects were diagnosed with rotavirus diarrhea based on stool sample examinations, using RT-PCR for genotyping. They were admitted to the Pediatrics Ward of the NTB Provincial General Hospital from January to December 2010.

**Results** Of 329 children admitted with acute diarrhea, 210 (63.8%) had rotavirus positive stool specimens. For the year 2010, the highest incidence of rotavirus infection was in the month of January (86.4%). Rotavirus infections were found in children less than 2 years of age (65.4%), with the highest prevalence in the age group of 6 to 23 months (68.5%). In addition to clinical symptoms of watery diarrhea, there was a significantly greater percentage of vomiting in rotaviral vs. non-rotaviral diarrhea (67.7% vs. 32.3%, respectively;  $P < 0.05$ ). The majority of G and P genotypes found were G1 (86%), G2 (12%), P[8] (66%), P[4] (12.8%), and P[6] (8%).

**Conclusion** Rotavirus infections are the most common cause of acute diarrhea in children aged <2 years in Mataram, Indonesia. [Paediatr Indones. 2016;56:118-23].

**Keywords:** diarrhea, rotavirus, immunoassay

Rotavirus diarrhea is one of the main causes of severe diarrhea and death among children in both developed and developing countries. Rotavirus was responsible for 20-70% of diarrhea in children who were hospitalized, and 20% of all diarrhea-related deaths in children under five around the world.<sup>1</sup> The 2009 WHO Global Surveillance Network report found that of 43 participating countries, rotavirus infection caused 25-47% of acute diarrhea in children aged less than 5 years.<sup>2</sup>

In both developed and developing countries, morbidity and mortality from rotavirus disease are high. In tropical regions, rotavirus diarrhea lasts throughout the year and peaks in the dry season of July to August.<sup>3</sup> Data obtained from the *Asian Rotavirus Surveillance Network (ARSN)*, showed that rotavirus was the cause of 45% of pediatric diarrhea in Asia. The *Indonesian Rotavirus Surveillance Network (IRSN)* in 2006 showed that 60% of 2,240 hospitalized children

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From the Department of Child Health, Mataram University Medical School/West Nusa Tenggara Provincial General Hospital of Mataram<sup>1</sup>, Department of Community Health and Nutrition Research Laboratorium<sup>2</sup> and Department of Child Health, Gadjah Mada University Medical School/Dr. Sardjito Hospital, Yogyakarta, Central Java, Indonesia<sup>3</sup>.

**Reprint requests to:** dr. Sukardi, SpA. Department of Child Health, Mataram University Medical School/West Nusa Tenggara Provincial General Hospital, Jalan Raya Pejanggalik, Mataram, Nusa Tenggara Barat. E-mail: drsukardi\_spa@yahoo.com.

had rotavirus-positive diarrhea, and 41% of rotavirus-positive children were treated as outpatients. This figure represents the highest incidence of rotavirus among developed and developing countries. As a cause of death, rotavirus causes 2% of deaths of children under five in Indonesia; and Indonesia ranked fifth among countries with regards to the largest number of deaths due to rotavirus.<sup>4-6</sup>

Rotavirus is transmitted by oro-fecal route or through droplets. The incubation period is generally between 24 to 72 hours. Rotavirus infection can be asymptomatic or symptomatic. The symptoms include fever, vomiting, and watery diarrhea, which may cause severe dehydration and death. Rotavirus diarrhea lasts for 4 to 7 days, and 5% of cases may be accompanied by seizures.<sup>3,7</sup>

The rotavirus diarrhea incidence is similar in both developed and developing countries. This fact suggests that improved water supply, hygiene, and sanitation cannot necessarily eliminate rotavirus. The WHO recommends rotavirus immunization to prevent severe and fatal rotavirus disease.<sup>1,3,8,9</sup> For this purpose, the *Rotavirus Surveillance* data is needed to determine the circulating rotavirus strains for each region in Indonesia. As there has been no data in Lombok, Indonesia, previously, we aimed to determine the characteristics of rotavirus strains and the clinical manifestations of rotavirus diarrhea in this area, which is one of the six sites covered by the *Indonesian Rotavirus Surveillance Network* (IRSN).

## Methods

This cross sectional study was carried out according to the WHO Generic Protocol for Rotavirus Surveillance and standardized by IRSN.<sup>10</sup> Subjects were children aged <5 years who were diagnosed with acute diarrhea and hospitalized at the NTB Provincial General Hospital, Mataram, from January to December 2010 (**Figure 1**).

Acute diarrhea was defined as an increased frequency of defecation of three times or more per day with or without mucus or blood, and lasting less than 14 days. Exclusion criteria were children with unavailability or inadequacy of stool specimens or parental refusal to participate. At the time of hospital admission, the data recorded consisted of age, gender, nutritional status, symptoms of disease, history of treatment, and dehydration status. The final diagnosis was made in accordance with the Indonesian Rotavirus Surveillance Network guidelines. Subjects' stool specimens were obtained, stored in sterile containers at 4-8<sup>o</sup> C, sent to the Microbiology Laboratory of Gajah Mada University in refrigerated boxes, then stored at -70<sup>o</sup> C. Rotavirus was detected using an enzyme immunoassay technique (*Dakopatts*, Dako International). All positive stool samples were examined for types of rotavirus strains.

Data were first described as proportion. We also performed a univariable analysis on the association of certain patients' characteristics and the likelihood of having rotavirus diarrhea using RT-PCR and



**Figure 1.** Location map of West Nusa Tenggara General Hospital, Mataram, Lombok

enzyme immunoassay. A P value of less than 0.05 was considered statistically significant. The study was approved by the Ethics Committee for Health Studies at Gadjah Mada University Medical School/ Dr. Sardjito Hospital, Yogyakarta.

## Results

During January to December 2010, 328 children aged < 5 years were diagnosed with acute diarrhea. One child was excluded from the study because the stool specimen was not adequate for rotavirus examination. Of the 328 stool specimens examined by enzyme immunoassay technique, 210 (63.8%) were rotavirus-positive and 118 (36.2%) were rotavirus-negative (Table 1). During the study, there were no deaths due to diarrhea.

The percentage of rotavirus-positive stool specimens in each age group was high. However, there were significantly greater percentages of rotavirus-positive children aged 12 to 23 months (42.4%), than rotavirus-negative children (OR 3.62; 95%CI 1.199 to 10.915, P <0.05). Children between 24-25 months of age also tended to have a higher risk of rotavirus diarrhea, although this was not statistically significant.

Our acute diarrhea patients comprised of more boys than girls (54.6% vs. 45.4%, respectively), but gender did not significantly differ between rotavirus-positive and -negative (P>0.05). Significantly more children in the rotavirus-positive group had vomiting than in the rotavirus-negative group (67.7% vs 32.3%, respectively) [OR 2.23; 95%CI 1.239 to 3.99; (P<0.05)]. Other symptoms were observed in our subjects, such as fever (63.6% vs. 36.4%, respectively) and dehydration (63.9% vs. 36.1%, respectively). But neither of these symptoms significantly differed between the rotavirus-positive and -negative groups (P>0.05) (Table 2).

At the Mataram Rotavirus Network site, rotavirus infection was found throughout the year 2010, with peak incidence occurring in January (86.4%), followed by monthly decreases until October (44.4%). In this study, there was no variation of rotavirus infection between the wet and dry seasons (Figure 2).

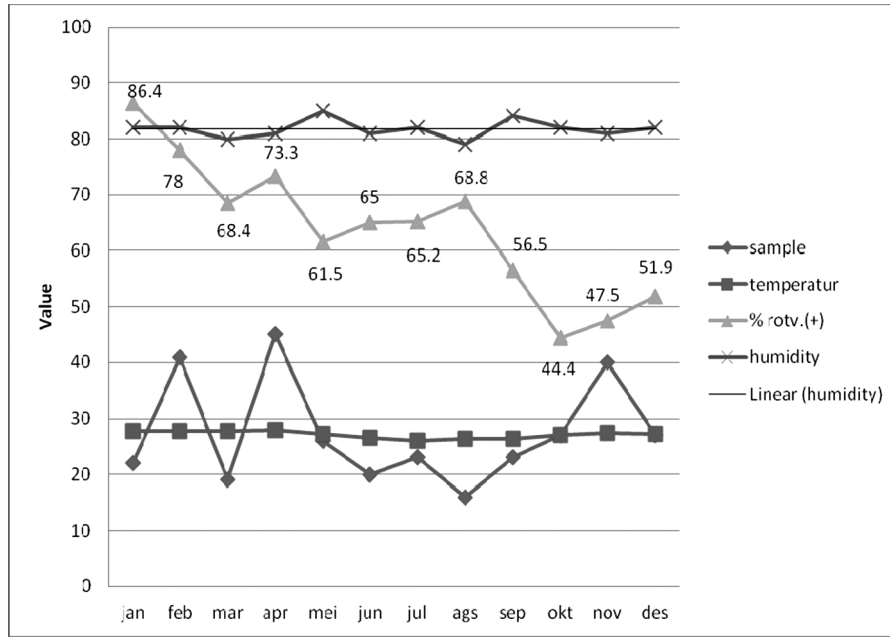
We performed genotype examinations on the 210 rotavirus-positive stool specimens. The G genotype was detected in 50 specimens, comprised of G1 (86%), G2 (12%) and 1 mixed G1 + G2 (2%). The P genotype was also detected in 50 specimens: P[8] (66%), P[4] (12%), P[6] (8%), and mixed P genotype (14%) (Figure 3).

**Table 1.** Characteristics of hospitalized children aged <5 years with acute diarrhea

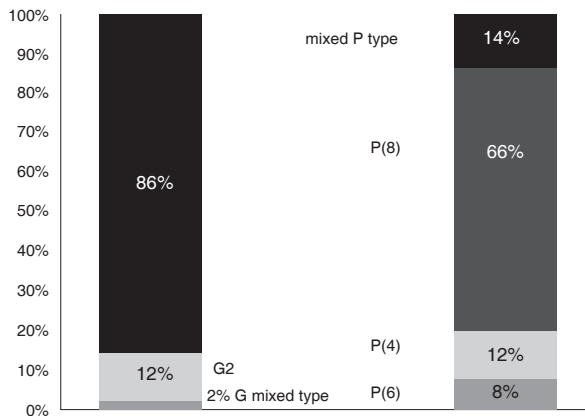
Characteristics	N=328	Diarrhea		Odds ratio (95% CI)	P value
		Rotavirus (+) n=210	Rotavirus (-) n=118		
Gender, n(%)					
Male	179	113 (53.8)	66 (55.9)	0.92 (0.568 to 1.481)	0.711
Female	149	97 (46.2)	52 (44.1)	Ref	
Age, n(%)					
0-5 mo.	48	29 (13.8)	19 (16.1)	2.54 (0.767 to 8.438)	0.114
6-11 mo.	113	71 (33.8)	42 (35.6)	2.96 (0.979 to 8.941)	0.044
12-23 mo.	130	89 (42.4)	41 (34.7)	3.62 (1.199 to 10.915)	0.015
24-35 mo.	21	15 (7.1)	6 (5)	4.17 (0.936 to 18.555)	0.042
36-59 mo.	16	6 (2.9)	10 (8.5)	Ref	-

**Table 2.** Clinical symptoms of hospitalized children aged <5 years with acute diarrhea

Clinical symptoms	Diarrhea		Odds ratio (95% CI)	P value
	Rotavirus (+) n(%)	Rotavirus (-) n(%)		
Vomit, n=263	178 (67.7)	85 (32.3)	2.23 (1.239 to 3.99)	0.004
Fever, n=242	154 (63.6)	88 (36.4)	0.97 (0.559 to 1.660)	0.903
Dehydration, n=269	172 (63.9)	97 (36.1)	0.98 (0.515 to 1.82)	0.946



**Figure 2.** Correlation between climate and prevalence of rotavirus in January-December 2010



**Figure 3.** Distribution of G and P genotypes of rotavirus strains

## Discussion

This study shows that rotavirus infection caused the majority of acute diarrhea cases in children under five years of age in the NTB General Hospital. Of the 328 children hospitalized with acute diarrhea, 63.8% were

identified as rotavirus-positive and 36.2% as rotavirus-negative. We observed a higher percentage of children with rotavirus than that reported by Sunarto *et al.* (IRSN) in 2006 (60%), the WHO Global Surveillance Network in 2009 (25-47%), and the Asian Rotavirus Network in 2004 (45%) in children hospitalized with diarrhea.<sup>2,4,6</sup>

A previous study in Brazil reported that rotavirus-positive diarrhea was found in three times more outpatients than in hospitalized patients.<sup>11</sup> Sunarto *et al.* reported that 41% of the children in their study were outpatients with rotavirus diarrhea.<sup>5</sup> In our study, data and stool specimens from pediatric outpatients with acute diarrhea were difficult to obtain, because of inaccurate home addresses and by the time they visited the hospital they no longer had diarrheal symptoms.

In countries with four seasons, rotavirus infections usually occur in the winter. However, in tropical countries such as Indonesia rotavirus infections take place throughout the year, with the highest incidence in the dry season around July and August.<sup>3,5</sup> In our study, rotavirus infections were found throughout all months in 2010. The peak occurred in January (86%) followed by declines each month to 44.4% in October.

We found no variations in rotavirus infection between the wet and dry seasons (**Figure 2**).

Overall, the majority of rotavirus diarrhea cases were found in children aged less than 2 years (90%), and most were in children aged 6 to 23 months (76.2%). The percentage of rotavirus-positive children was low in those younger than 6 months and over 23 months. The incidence of rotavirus-positive diarrhea was low in children aged <6 months, possibly due to the presence of transplacental neutralizing IgG and IgA antibodies in children who are exclusively breastfed. Human breast milk also contains several important components including milk mucin, that have been shown to inhibit the binding and replication of rotavirus.<sup>4</sup> Another study showed that exclusive breastfeeding provided better protection against severe rotavirus infection than partial or no breastfeeding.<sup>12</sup> The low incidence of rotavirus in children aged > 2 years can also be explained by the presence of natural antibodies arising from recurrent infections of rotavirus.<sup>13</sup>

Clinical manifestations of rotavirus infection include being asymptomatic, or having watery diarrhea and frequent vomiting, that can develop into mild to severe dehydration. In our study, the predominant symptom of vomiting was found to be significantly higher in the rotavirus-positive group than in the negative group ( $P < 0.05$ ). Vomiting represents a challenge for the administration of oral rehydration salt and may increase reliance on intravenous fluid therapy, thus leading to higher treatment costs.<sup>3,7,8</sup>

Group A rotavirus is a major cause of the majority of viral diarrhea in children aged less than 5 years. Based on rotavirus capsular protein, rotavirus group A were divided into 2 types: the G types (glycoprotein) and P types (protease-sensitive protein). A previous study found 27 G types and 35 P types.<sup>14</sup> The genotypes most commonly found in Indonesia were G9 (30%) and P[6] (56%).<sup>4,5</sup> The following genotypes were found in Mataram: G1 (86%), G2 (12%), G1 + G2 (2%), P[8] (66%), P[4] (12%), P[6] (8%), and mixed P genotypes (14%). The G9 genotype was not found in this study.

Rotavirus diarrhea morbidity is high in children aged <2 years in both developed and developing countries, including Indonesia, and especially in Lombok. Improved water supply, hygiene and sanitation cannot limit rotavirus infection.<sup>1,2,3</sup> In

2009, the WHO recommended that all national immunization programs include rotavirus vaccines to prevent severe rotavirus infection and fatality.<sup>2,6,9</sup> In Indonesia, rotavirus vaccines have only recently been included in the national immunization program. It is administered orally to children at the ages of 2, 4, and 6 months.<sup>1,3,7</sup>

In conclusion, rotavirus infection remains the most common cause of acute diarrhea in children aged < 2 years in Mataram. Besides watery diarrhea, the dominant clinical manifestations are vomiting and dehydration. Our findings suggest that immunization is necessary to prevent severe and fatal rotavirus infection in children.

## Conflict of Interest

None declared.

## Acknowledgments

We would like to thank the Microbiology Laboratory staff of the Gajah Mada University Medical Faculty, the Yogyakarta: (Pediatric Research Office) of the Department of Pediatrics, Gajah Mada University, Yogyakarta, the Department of Pediatrics, University of Mataram, the Director of NTB General Hospital, Mataram, Lombok, and all those who helped in the implementation of this study.

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