Original article

# Rotavirus infection in under-five children in Jimma Hospital, Southwest Ethiopia

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**Abstract**

**Background:** Rotavirus is the leading etiological agent among the causes of acute diarrhea in infants and young children. However, there is no attempt to indicate its significance in other regions of Ethiopia, out of the capital, Addis Ababa. **Objective:** This study is aimed at revealing the prevalence of rotavirus infection among infants and young children in Jimma Hospital.

**Method:** A cross-sectional study was designed and a total of 154 children less than 5 years of age, who had acute diarrhea were studied from January 14 to February 19, 2002 at Jimma Hospital, pediatrics out patient department.

**Result:** Rotavirus was detected in 26.6 % (41/154) of fecal specimens collected from children of < 5 years of age with acute diarrhea, tested by Enzyme Linked Immunosorbent Assay. Of all cases of rotavirus, 90.2% (37/41) occurred in children < 2 years of age. The highest rate of Rotavirus Antigen detection was observed among the 7 to 12 months of age group (34%). Children infected with rotavirus were more likely to have watery stool (90.2% Vs 43.4%), vomiting (31.7% Vs 15.9%) and some (moderate) dehydration (31.7% Vs 12.4%) with P<0.05 than without rotavirus infection. No sociodemographic factors were found to be significantly associated with rotavirus infection among the studied subjects.

**Conclusion:** Rotavirus has been observed as the cause of acute diarrhea among children of < 5 years of age. To our knowledge, this is the first report on prevalence of rotavirus infection among children of Jimma, Southwest, Ethiopia. Therefore, based on this preliminary data further work is needed for a better understanding of rotavirus diarrhea and its impact among children of the region. [*Ethiop.J.Health Dev.* 2004;18(1):19-24]

**Introduction**

Acute gastroenteritis remains to be one of the most important causes of childhood morbidity and mortality and is associated with an estimated 4 million deaths each year worldwide (1). Viral agents account for 75% of these infections, the major pathogen being rotavirus, which is associated with up to 50% of diarrheal episodes among infants and young children (2).

Unlike other causative agents of diarrhea, rotavirus is just as likely to cause diarrhea in industrialized countries, as it infects children in developing countries (3). Hence, gastroenteritis due to rotavirus have come to be a serious public health problem both in developed and developing countries, accounting for more than one million death in infants and young children each year world wide (4).

Rotavirus infection is spread by fecal-oral route, airborne and droplet and is possibly fecal respiratory transmitted (4,5). At entry, the virus infects the absorbing villous cells of small intestine causing an imbalance between secretion and absorption of fluid, leading to an excess secretion followed by watery diarrhea, vomiting, fever, dehydration and even death specially in those malnourished children (6).

Gastroenteritis associated with rotavirus cannot be distinguished from other common diarrheal illnesses on clinical ground (7). However, patients with rotavirus infection have high severity scores than other causes of watery diarrheal illnesses, and accounts for between 40 and 60% of the cases requiring hospitalization in both developed and less developed countries (8).

Even though the illness and severity of diarrhea due to rotavirus is almost the same in every child all over the world, in developed countries it is not life threatening and mortality is very rare (5). Among children of developing countries, a significant proportion of children develop severe conditions between 20 and 40% with severe dehydrating diarrhea and are subsequently at a greater risk of dying (8) with an estimated 870,000 deaths each year.

In Ethiopia, though bacterial and parasitic causes of gastroenteritis are relatively studied, information is scarce about the viral etiologies and most cases remain unidentified due to limited diagnostic methods for the detection of viral agents. However, as some hospital-based studies indicate, in the capital of Ethiopia, Addis Ababa, rotavirus is found to be the major cause of non-bacterial acute gastroenteritis in infants and young children and accounts for 18% up to 27.8% (9,10,11).

There are no reported studies showing the prevalence of rotavirus in other regions of Ethiopia. Hence, the present study is an attempt to determine the prevalence of rotavirus infection in under-five children among acute diarrhea cases in Jimma Hospital pediatrics out-patients.

**Methods**

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*Study area:* The study was conducted in Jimma Town at Jimma Hospital, which is located 335 km, Southwest of Addis Ababa.

*Study design and period:* A cross-sectional study was conducted from January 14 to February 19, 2002 to determine the prevalence of rotavirus among under-five children in Jimma Hospital.

*Study population:* The study subjects were a total number of under-five children who presented themselves with acute diarrhea of less than 14 days, in Jimma Hospital pediatrics out patient department (OPD) during the study period. Acute diarrhea was defined (according to WHO manual definition) as passage of three or more loose or watery stool in the previous 24 hours (1).

*Sampling Technique:* A total of 154 clinically identified as acute diarrhea cases during the study period were consecutively taken and included under the study.

*Data Collection:* All necessary data was collected using structured and pre-tested questionnaire by trained health personnel including the associated clinical symptoms as assessed by physicians. The questionnaire included the following information; vomiting, fever, upper-respiratory symptom, duration of diarrhea, frequency of diarrhea, type of diarrhea/stool appearance and levels of dehydration. Some of the other factors covered were age and sex of the children as well as their addresses (whether the study subjects are from Jimma Town or out of Jimma). Socioeconomic status of the mothers/caretakers such as ethnicity, religion, marital status, educational status and occupational status were also included in the questionnaire.

Fecal specimens were collected in clean screw capped glass vials. Till transportation, it was stored at $-20^0$c in the laboratory of Jimma University (JU) School of Medical Laboratory Technology. Samples within icebox were sent to the Virology and Rickettsiology laboratory of Ethiopian Health and Nutrition Research Institute (EHNRI), for laboratory testing Addis Ababa. This specimen collection and transportation procedure was done according to Rotavirus test kit instruction as mentioned below.

*Laboratory Investigation:* The laboratory test was performed according to Rotavirus Antigen detection kit:- Enzyme Linked Immunosorbent Assay (ELISA) kit (Dakoppat, Copenhagen, Denmark). In brief, 10% suspension of fecal specimen was prepared. To each 0.1g fecal specimen or 100ul of liquid stool, 1ml of sample diluents (specific buffered saline provided with in the kit) was added. The mixture was homogenized by a vortex and the supernatant was separated by allowing it to settle for about 10 minutes. The test was performed according to the manufacturer's instruction and positive and negative controls provided within the kit were run with each assay. The absorbance was read using spectrophotometer (ELA plate reader) at 450nm and cut-off was calculated and results showing beyond the cut-off value were considered positive.

*Data Analysis***:** The data was entered, sorted and analyzed by computer using SPSS statistical package. The chi-square was used for testing statistical significance and results with less than 0.05 P-value were considered as significant.

*Ethical Considerations*: An authorization to carry out the study was obtained from Jimma Hospital and EHNRI using an agreement letter prepared from JU School of Medical Laboratory Technology. Mothers/caretakers gave their consent for participation in the study and all information that was obtained about the subjects as well as the Mothers/caretakers was kept confidential.

**Results**

Of the 154 patients, 41(26.6%) were found to be positive for rotavirus in their fecal specimen.

One hundred eighteen of the patients (76.6%) were from Jimma Town and 36 (23.4%) were out side Jimma Town (surrounding Jimma Zone). However, there was no significant variation in rotavirus detection rates by area of residence.

Clinical data of children by the socio-demographic characteristics of mothers/cares takers are shown in Table 1. Regarding ethnic groups, 52.6% were Oromo and high rotavirus rates were seen in patients whose mother/caretakers were from Yem (41.2%) and keffa (37.5%) ethnic groups. Nevertheless, there was no significant difference in Rotavirus infection among all groups ($p>0.05$). About 87.7% of the mothers were married and 56.5% were literate. 71.4% (110 of 154) were housewives and few others were daily laborers, governmental employee, merchant, students and farmers as shown in Table 1. Among the aforementioned sociodemographic characteristics of the mothers/caretakers no statistical differences were found pertaining to the presence of rotavirus infection in their children ($p>0.05$).

alone, however, was significantly more common among patients with rotavirus than those with out (31.7% Vs.15.9%, P<0.05). Only 9.8% (4/41) of patients with rotavirus did not present with clinical symptom of both fever and vomiting, which had significant difference with

those patients with out rotavirus (P<0.05). The presence of dehydration was also noted to be significantly more in patients with rotavirus than with out rotavirus ($\chi 2$=7.147, P=0.008). Watery diarrhea was most frequently seen among rotavirus positive patients than with out rotavirus diarrhea with strongly significant differences (P=0.000).

Table 3: **Clinical presentation of children with and without rotavirus among acute diarrhea cases in Jimma hospital, Southwest Ethiopia Jan.14 - Feb.19, 2002.**

| Variables | Rotavirus positive n=41 | Rotavirus negative n=113 | $\chi^2$ | P-value |
|---|---|---|---|---|
| Vomiting alone | 13(31.7%) | 18(15.9%) | 4.65 | **0.031** |
| Fever alone | 3(7.3%) | 23(20.4%) | 3.64 | 0.056 |
| Fever and vomiting | 21(51.2%) | 41(36.3%) | 2.79 | 0.095 |
| With out fever and Vomiting | 4(9.8%) | 31(27.4%) | 5.35 | **0.021** |
| Upper respiratory infection | 12(29.3%) | 43(38.1%) | 1.01 | 0.32 |
| **Dehydration** | | | | |
| None | 27(65.9%) | 97(85.8%) | 7.96 | **0.019** |
| Some | 13(31.7%) | 14(12.4%) | | |
| Severe | 1(2.4%) | 2(1.8%) | | |
| Frequency of diarrhea per day(average) | 3.7 | 3.5 | | |
| Duration of diarrhea ≤ 7 days | 40(97.6%) | 98(86.7%) | 3.79 | 0.051 |
| > 7 days | 1(2.4%) | 15(13.3%) | | |
| **Stool Appearance** | | | | |
| Watery | 37(90.2%) | 49(43.4%) | 26.999 | **0.000** |
| Mucoid | 3(7.3%) | 35(30.9%) | | |
| Loose stool | 1(2.5%) | 28(24.8%) | | |
| Bloody | 0(0.0%) | 1(0.9%) | | |



A total of 98 (63.6%) male and 56 (36.4%) female cases of acute diarrhea were examined in this study. Most patients with rotavirus diarrhea (90.2%) were < 2 years of age. As shown in Table 2, the highest isolation rate (34%) of rotavirus occurred in infants aged 7-12 months. The frequency was less (27.5%) and (23.8%) at 0-6 months and 13-24months respectively. Low isolation rate (16%) was seen in the age group 25-59months. However, statistical variation was not noticed in the distribution of rotavirus positive in different age groups (P>0.05).

Rotavirus prevalence was higher in male cases 18 of 56 (32.1%) than in females 8 of 31 (26%) up to the age of 12 months but the reverse is true among >12 months male cases 9 of 42 (21.4%) and female cases 6 of 25 (24%). But there was no significant difference in rotavirus infection by sex ($\chi 2$=0.12, P=0.73).

A comparison of common clinical features between patients with and without rotavirus diarrhea is shown in Table 3. Among these variables a higher percentage 21/41 (51.2%) of vomiting together with fever was observed in patients with rotavirus. But there was no significant difference (P>0.05) compared to patients with out rotavirus. Vomiting

**Discussion**

In this study, rotavirus was isolated from 26.6 % of acute diarrhea cases. The rate of detection of the virus in this finding was higher than that of similar hospital based studies conducted in Addis Ababa at St. Paul Hospital between December 1983 and 1984 (9), and between March 1992 and 1993 at Yekatit 12 Hospital (10). But is comparable with another earlier study (11) done in EthioSwedish Pediatrics Clinic in Addis Ababa between March 1977 and February 1978. However, the previous studies were done over a period of one-year showing different rates of positivity at different months and the rate of detection of our study lies between the ranges of the monthly prevalence. Therefore, we can say that as a cross-sectional study, the present finding is consistent in relation to specified period of those studies. The prevalence is also found to be comparable with a review of hospital-based study conducted from 43 published papers in out patient children of African countries (12).

Mothers' education, working status and other sociodemographic characteristics did not have significant association with rotavirus infection of the children in this study. The finding concerning working status is in agreement with the study done by Samir, et al. (13) where as in contrast

with the educational status that their study showed significant association with higher education than lower or no education. However, our finding is in agreement with studies done both in developing and developed countries that socio-demographic characteristics of mothers did not influence rotavirus infection of the children (14). But clearly it would be desirable to extend these observations with further studies in the Zone. Ninety percent of all cases of rotavirus occurred in children < 2 years of age which is in agreement with studies (11,12,15,) done in most parts of the world and which showed how these age groups could be found with the highest morbidity and mortality from rotavirus diarrhea.

Although there was no significant difference, higher detection rate of rotavirus was observed from cases of diarrhea in 6-12 months age group, which is consistent with a number of similar studies carried out in Addis Ababa (10,11) and other developing countries (15,16). This can be explained by early exposure to environment, over crowding and poor sanitation results in contamination through supplementary diets



especially in children of developing countries.

We have observed that after the age of two, the rate of rotavirus positivity dropped. This might be due to natural immunity, which was suggested by the repeated occurrence of episode of rotavirus diarrhea in a child and decreased sincidence of disease with increased age (17).

The detection rate of rotavirus did not differ significantly between male and female groups (27.6% Vs 25%), which is comparable to the reported ratio of 1:1 by Abebe, et al. (10) from Addis Ababa.

In terms of clinical presentations, watery diarrhea had a strong association with rotavirus infection (P=0.00) in this study, which is the major clinical feature of rotavirus infection and many studies revealed that the more the case has severe condition and watery diarrhea the higher the detection rate of rotavirus (12,14). Vomiting appeared to be significantly more common in children with rotavirus infection, which is in agreement with a study done by Unicomb, et al. (15) which showed that children with rotavirus had severe vomiting (>10 episodes). Fever alone, however, was seen less frequently in children with rotavirus infection.

Vomiting followed by fever appears to be more common in children with rotavirus diarrhea in studies done in Addis Ababa (9,10). In our study also high rate of vomiting together with fever was noticed in children with rotavirus infection, but there was no significant difference with nonrotavirus infected children.

Dehydration was found to be significantly associated with rotavirus infection than with out (P<0.05). This is in agreement with different studies (8,9,14). That is due to the loss of enormous amount of fluid, which is more than 90% of cases had watery diarrhea as explained above. Regarding the level of dehydration, this study revealed only one case of severe dehydration in children with rotavirus infection, while two cases with out rotavirus infection, requiring intravenous rehydration. We observed this situation in small number of cases, other studies, however, indicate that rotavirus infected children have more severe dehydration compared to other enteric pathogens (8,18). In spite of all these common clinical symptoms in acute diarrhea cases as in other reports, no characteristic features could be found to distinguish rotavirus diarrhea from that caused by other agents with out laboratory aid (9,15). However, the value can increase with the rise in prevalence. Thus making it possible to suspect rotavirus enteritis in such situations and take measures to prevent complications from rotavirus.

In this study, of the 154 diarrhea cases 27 patents with a symptom of some dehydration were treated with the administration of ORS at ORT corner and 3 patients who were severely dehydrated were admitted and intravenous rehydration were given. The rest of the cases were prescribed with ORS and advised to give more fluids at home.

Due to various constraints we couldn't investigate for other possible etiological agents for rotavirus negative cases in this study.

**Conclusion and recommendation**

This finding indicates that 26.6% of less than five years old children of Jimma Zone, with acute diarrhea is suffering from rotavirus infection. Knowing the magnitude of the problem might bring about awareness among clinicians, pediatricians as well as the community to manage the diarrhea due to rotavirus infection. Moreover, this data, being the first study conducted out side of Addis Ababa would be a corner stone for further related studies and consideration of viral acute gastroenteritis in the region as well as in other regions of the country. Accordingly the following recommendations are forwarded.

Previous studies on rotavirus were but no other reported studies are carried out before a decade ago in the capital, Addis Ababa available in other regions of the country. This shows that no attempts were made for further investigation of rotavirus in different regions. Therefore, based on this preliminary data, further work is needed to provide a broader

picture on the burden of rotavirus in children through long-term community-based surveys and epidemiological studies at regional as well as national levels. This will lead for further serotyping study of rotaviruses that could contribute for future rotavirus vaccine development worldwide. Hence, this might initiate policy makers and the national Control of Diarrheal Diseases (CDD) towards the implementation of rotavirus diarrhea prevention and management in the country.

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Table 1: **Socio demographic characteristics of mothers/caretakers whose children had acute diarrhea in Jimma Hospital, Southwest Ethiopia, Jan.14 - Feb.19, 2002.**

| Variables | Total N(%) | Rotavirus Positive n(%) | $\chi^2$ | p-value |
|---|---|---|---|---|
| **Residence** | | | | |
| Jimma town | 118(76.6) | 32(27.1) | 0.063 | 0.80 |
| Outside Jimma | 36(23.4) | 9(25.0) | | |
| **Ethnicity** | | | | |
| Oromo | 81(52.6) | 22(27.2) | | |
| Amahara | 30(19.5) | 5(16.7) | 9.53 | 0.30 |
| Yem | 17(11.1) | 7(41.2) | | |
| Gurage | 11(7.1) | 2(18.2) | | |
| Keffa | 8(5.2) | 3(37.5) | | |
| Others | 7(4.5) | 2(28.6) | | |
| **Religion** | | | | |
| Muslim | 80(52.0) | 21(26.3) | 0.14 | 0.93 |
| Orthodox | 61(39.6) | 17(27.9) | | |
| Protestant | 13(8.4) | 3(23.1) | | |
| **Marital status** | | | | |
| Single | 11(7.1) | 3(27.3) | 0.95 | 0.81 |
| Married | 135(87.7) | 37(27.4) | | |
| Others | 8(5.2) | 1(12.5) | | |
| **Educational status** | | | | |
| Illiterate | 67(43.5) | 20(29.9) | 0.63 | 0.43 |
| Literate | 87(56.5) | 21(24.1) | | |
| **Occupation** | | | | |
| House Wife | 110(71.4) | 33(30.0) | | |
| Daily laborer | 16(10.4) | 5(31.3) | 7.82 | 0.17 |
| Governmental employee | 11(7.1) | 2(18.2) | | |
| Merchant | 8(5.2) | 1(12.5) | | |
| Student | 5(3.2) | 0(0.0) | | |
| Farmer | 4(3.2) | 0(0.0) | | |
| **Total** | **154(100)** | **41(26.6)** | | |

Table 2: **Prevalence of Rotavirus infection by age and sex among acute diarrhea cases in Jimma Hospital, Southwest Ethiopia, Jan.14 - Feb.19, 2002.**

| Age in months | Total tested | Positive n (%) | Male | | Female | |
|---|---|---|---|---|---|---|
| | | | Nº of tested | Positive n (%) | Nº of tested | Positive n (%) |
| 0-6 | 40 | 10(25) | 28 | 8(28.6) | 12 | 2(16.7) |
| 7-12 | 47 | 16(34.0) | 28 | 10(35.7) | 19 | 6(31.5) |
| 13-24 | 42 | 11(26.2) | 27 | 7(25.9) | 15 | 4(26.7) |
| 25-60 | 25 | 4(16.0) | 15 | 2(13.0) | 10 | 2(20.0) |
| | $\chi^2$=2.48 | | $\chi^2$=6.69 | | $\chi^2$=3.73 | |
| | p=0.48 | | p=0.082 | | p=0.29 | |
| | 154(100.0) | 41(26.6) | 98(63.6) | 27(27.6) | 56(36.4) | 14(25) |

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