African Journal of Biology and Medical Research
ISSN: 2689-534X
Volume 7, Issue 1, 2024 (pp. 110-120)
www.abjournals.org

SOCIO-DEMOGRAPHY, CLINICAL FEATURES AND RISK FACTORS OF GASTROENTERITIS CAUSED BY ROTAVIRUS IN DIARRHEIC CHILDREN LIVING IN EDO STATE, NIGERIA

Osazee E. Izevbuwa[1] and Rachel O. Okojie[2]

[1&2]Department of Microbiology, Faculty of Life Sciences,

University of Benin, Benin City, Edo State, Nigeria.

[*]Corresponding Author's Email: osazee.izevbuwa@iuokada.edu.ng

Cite this article:

Osazee E. I., Rachel O. O. (2024), Socio-Demography, Clinical Features and Risk Factors of Gastroenteritis Caused by Rotavirus in Diarrheic Children Living in Edo State, Nigeria. African Journal of Biology and Medical Research 7(1), 110-120. DOI: 10.52589/AJBMR-RXVZ7WXS

Manuscript History

Received: 2 Dec 2023

Accepted: 13 Feb 2024

Published: 7 Mar 2024

ABSTRACT: *Rotaviruses are one of the vital causative agents of acute gastroenteritis (AGE) in young children worldwide. This study aimed to present socio-demographic, clinical features and risk factors of gastroenteritis caused by rotavirus in diarrheic children living in Edo State, Nigeria. This study was done using a descriptive cross-sectional survey of AGE in 400 participants (diarrheic children less than 5 years) admitted to four hospitals in Edo State, Nigeria. A structured questionnaire was used to collect socio-demographic and clinical information from study participants. Rotavirus antigen in stool samples collected from the study participants was detected by the immunochromatographic method. Twenty (5.0%) tested positive for rotavirus antigen out of the 400 stool samples examined. A large proportion of the participants were aged one year (24.3%). A large percentage of the participants were exposed to exclusive breastfeeding (94.8%) while 33.5% of this group were exclusively breastfed for a period ranging from 3 to 6 months. Blood and mucous were present in the stool of 66.5% and 74.5% of participants, respectively. Age and exclusive breastfeeding of the participants were the main factors that were associated with the risk of acquiring rotavirus infection. No significant association was observed between the socio-demographic characteristics of the parents/caregivers of the study participants and rotavirus infection. This study shows a significant decline in the incidence of rotavirus infection among children less than 5 years in Edo State, Nigeria; thus, suggesting that the risk of acquiring rotavirus infection might be abating in this age group in Edo State.*

KEYWORDS: Risk factors, Rotavirus, Gastroenteritis, Children less than 5 years, Prevalence.

Article DOI: 10.52589/AJBMR-RXVZ7WXS
DOI URL: https://doi.org/10.52589/AJBMR-RXVZ7WXS

African Journal of Biology and Medical Research
ISSN: 2689-534X
Volume 7, Issue 1, 2024 (pp. 110-120)

www.abjournals.org

INTRODUCTION

Rotaviruses are non-enveloped RNA viruses belonging to the family Reoviridae [1-2]. They consist of multiple serotypes categorised into 7 groups (A-G) and further classified into subgroups based on antigenic differences [3-4]. Rotaviruses that infect humans are mainly found in Groups A – C [5]. Rotavirus gastroenteritis is a vital health concern that annually affects millions of children [6-7]. It is estimated that rotavirus infection accounts for 39% of annual death caused by diarrhoea, and 50% of hospitalisation due to diarrhoea [8-9]. Based on findings by the World Health Organization (WHO), more than half of the annual deaths caused by rotavirus infection were from Ethiopia, India, Pakistan, the Democratic Republic of the Congo and Nigeria [10-11]. The use of rotavirus vaccine is increasingly becoming a global priority, because of the gravity of disease burden and the inability of sanitation and enhanced water quality to put an end to rotavirus infection [12]. In 2009, WHO recommended the global use of the rotavirus vaccine as a primary public health measure to prevent rotavirus infection, especially in countries with elevated diarrhoea-related mortality [13-14]. The present study was designed to estimate the prevalence of rotavirus among children less than 5 years in Edo State, as well as to identify the clinical features probably linked to rotavirus gastroenteritis and determine probable risk factors associated with rotavirus infection.

MATERIALS AND METHODS

Study sites

The study sites included hospitals from all the geo-political zones in Edo State, Nigeria. They were the General Hospital, Agbede, Edo North Senatorial District, Specialist Hospital, Irrua, Edo Central Senatorial District, Central Hospital, Benin City and Igbinedion University Teaching Hospital, Okada, Edo South Senatorial District.

Ethical Approval and Consent

Informed consent was obtained from the parents of study participants before samplings were carried out. The study participants were diarrheic children less than 5 years of age who met the inclusion criteria. Criteria for the inclusion of study participants were based on the World Health Organization (WHO) case guideline for acute gastroenteritis which recommends an episode within 24 hours of at least three loose stools, and/or two or more vomiting episodes associated with diarrhoea, in the 7 days before the medical visit; the episode must have been preceded by a symptom-free period of 14 days. All participants included in the study were also non-vaccinated against rotavirus. Ethical approval was obtained from the Medical Research Ethics Committee of the hospitals.

Study Design

A descriptive cross-sectional study was carried out using a structured questionnaire. The questionnaire was designed to collect socio-demographic data, feeding and rotaviral immunizations, and the medical history of study participants. A total of 400 diarrhoeic children less than 5 years, consisting of 100 study participants from each of the four hospitals selected for this study, were enrolled.

Article DOI: 10.52589/AJBMR-RXVZ7WXS
DOI URL: https://doi.org/10.52589/AJBMR-RXVZ7WXS

Sample Collection

A total of 400 stool samples, consisting of 100 stool samples from each of the four hospitals selected for this study, were collected from November 2021 to December 2022. Samples were collected aseptically in sterile commercial stool containers adequately labelled (patient ID and date of collection) by the caregivers or the hospital staff from each child with instructions on the proper method of collection. All the stool samples were then transported under a cold chain to the Medical Microbiology Laboratory at Igbinedion University Teaching Hospital, Okada, Edo State. Upon receipt of the stool samples at the Microbiology Laboratory, they were stored at -80^{o}C, until serological analysis.

Detection of Human Rotavirus by Immunochromatographic Assay

Stool suspensions of 10 to 20% were prepared in phosphate-buffered saline (pH 7.2). Each faecal suspension was then analysed by the immunochromatographic method using a commercially available test kit (Aria, USA) specific for rotavirus to demonstrate the presence of rotavirus antigens in the stool samples.

Statistical Analysis

The differences in proportions were determined by the Chi-Square test. The test of the hypothesis was considered statistically significant if the achieved level of significance (p) was less than 0.05.

RESULTS

Tables 1a and 1b show the socio-demographic characteristics of diarrheic children less than 5 years of age (participants). 16.50% of the participants were less than 1 year of age. The highest number of participants (24.30%) was 1 year old while the lowest number of participants (6.50%) was 5 years old. Participants that were 2 years, 3 years and 4 years old accounted for 22.80%, 17.80% and 12.30% of the total participants, respectively.

Table 1: Socio-demographic Characteristics of Respondents

Variables	Frequency	Percent
Age of Participants (years) (n=400)		
< 1 Year	66	16.5
1	97	24.3
2	91	22.8
3	71	17.8
4	49	12.3
5	26	6.5
Gender of Participants (n=400)		
Male	132	33.0
Female	268	67.0

Article DOI: 10.52589/AJBMR-RXVZ7WXS
DOI URL: https://doi.org/10.52589/AJBMR-RXVZ7WXS

Location of Respondents (n = 400)		
Agbede	100	25.0
Irrua	100	25.0
Benin	100	25.0
Okada	100	25.0
Total	400	100.0
Type of Community (n = 400)		
Urban	100	25.0
Suburban	102	25.5
Rural	198	49.5

Table 1b: Socio-demographic Characteristics of Respondent

Variables	Frequency	Percent
Parent/Guardian Education Status(n = 400)		
No Formal Education	74	18.5
Primary Education	67	16.8
Secondary Education	256	64.0
Tertiary Education	3	0.8
Parent/Guardian Employment Type(n = 400)		
Self Employed	132	33.0
Private	104	26.0
Government	30	7.5
Unemployed	134	33.5
Monthly Income of Parent/Guardian in Naira [#] (n = 400)		
Below #15,000	67	16.8
#15,000 - #30,000	103	25.8
#30,000 - #45,000	32	8.0
#45,000 - #60,000	66	16.5
#75,000 - #90,000	132	33.0

The female participants (67.00%) were recruited more than the male participants (33.00%). Equal numbers of participants from the four different study sites (General Hospital, Agbede, Specialist Hospital, Irrua, Central Hospital, Benin City and Igbinedion University Teaching Hospital, Okada, Edo State) amounting to 400 participants were selected. Most of the participants (49.50%) resided in rural communities. 25.00% and 25.00% of the participants resided in urban and suburban communities. The majority of the parents/guardians of the participants (64.00%) were educated up to the secondary school level. Only 0.8% of the parents/guardians of the participants had education up to tertiary level. 16.80% and 18.50% of

Article DOI: 10.52589/AJBMR-RXVZ7WXS
DOI URL: https://doi.org/10.52589/AJBMR-RXVZ7WXS

the parents/guardians of the participants had primary education and no formal education, respectively. 33.50% and 33.00% of the parents/guardians of the participants were unemployed and self-employed, respectively. 7.50% of the parents/guardians of the participants had government employment while 26.00% were employed by private organisations. Most of the parents/guardians of the participants (33.00%) had a monthly income of between 75000 – 90000 Naira, while 16.80% had a monthly income below 15000 Naira.

The feeding and rotavirus immunisation history of the participants are presented in Table 2. Most of the participants (94.80%) were exclusively breastfed. 33.50% and 24.50% of the participants were exclusively breastfed for 3 – 6 months and 6 – 9 months, respectively; while 17.00% were exclusively breastfed above 9 months. 24.50% of participants were fed with bottled breast milk and water, while 17.0% were fed with solid food before weaning. All the 400 participants had no history of previous vaccination for rotavirus. 49.30% of the participants were being administered antibiotics at the time of study. The majority of the participants (49.00%) drank borehole water.

Table 2: Feeding and rotavirus immunisation history of the respondents

Variables	Frequency	Percent
Exclusive Breastfeeding(n = 400)		
Yes	379	94.8
No	21	5.3
Duration of exclusive breastfeeding? (n = 379)		
Less than 3 Months	94	24.8
3 - 6 Months	127	33.5
6 - 9 Months	93	24.5
Above 9 Months	65	17.2
Duration of Breastfeeding before weaning (n = 400)		
None	32	8.0
Less than 3 Months	36	9.0
3 - 6 Months	128	32.0
6 - 9 Months	136	34.0
Above 9 Months	68	17.0

Article DOI: 10.52589/AJBMR-RXVZ7WXS
DOI URL: https://doi.org/10.52589/AJBMR-RXVZ7WXS

Mode of feeding (n = 400)		
Breast milk	100	25.0
Bottled breast milk	32	8.0
Bottled breast milk and water	98	24.5
Bottled breast milk, formula and water	102	25.5
Solid food	68	17.0
Previous vaccination for rotavirus(n = 400)		
No	400	100.0
Presently administering antibiotics(n = 400)		
Yes	197	49.3
No	203	50.8
Source of drinking water(n = 400)		
Tap	74	18.5
Well	63	15.8
Borehole	196	49.0
Sachet water	34	8.5
Rain water	33	8.3

Table 3 shows the medical history of the participants. Blood was present in the stool of 66.50% participants. Mucous was also present in the stool of 74.50% participants. Outpatient and inpatient participants respectively accounted for 49.80% and 50.20% of all participants for this study. 39.80% of the participants had diarrhoea that lasted for 5 days. Only 1.00% of participants had diarrhoea that extended beyond 5 days but was under 7 days. Most of the participants (40.30%) used the water closet toilet facility. 8.80% and 25.50% participants used pit latrine and open defecations, respectively. Diapers were used by 17.00% participants while 8.5% used baby potty.

Article DOI: 10.52589/AJBMR-RXVZ7WXS
DOI URL: https://doi.org/10.52589/AJBMR-RXVZ7WXS

African Journal of Biology and Medical Research
ISSN: 2689-534X
Volume 7, Issue 1, 2024 (pp. 110-120)

www.abjournals.org

The test of association between risk factors and rotavirus infection in Edo State is presented in Table 4. Amongst the risk factors examined, only age and exclusive breastfeeding were significantly associated ($p < 0.05$) with rotavirus infection. Other risk factors such as mode of feeding, source of drinking water, toilet facilities, proximity of kitchen to toilet facilities and proximity of toilet facilities to sources of drinking water were not significantly associated ($p > 0.05$) with rotavirus infection.

The prevalence of rotavirus in the stool samples is shown in Figure 1. Twenty rotavirus antigen-positive samples were detected from the 400 stool samples examined, respectively, corresponding to eight, six, two and four rotavirus antigen-positive samples obtained from General Hospital, Agbede, Specialist Hospital, Irrua, Central Hospital, Benin City and Igbinedion University Teaching Hospital, Okada, Edo State, Nigeria.

Table 3: Medical History of the Respondent

Variable	Frequency	Percent
Blood In Stool		
Yes	266	66.5
No	134	33.5
Mucous in stool		
Yes	298	74.5
No	102	25.5
Nature of Admission		
Inpatient	201	50.3
Outpatient	199	49.8
Duration of Diarrhoea		
One day	62	15.5
Two days	14	3.5
Three days	77	19.3
Four days	84	21.0
Five days	159	39.8
Above five days but under seven days	4	1.0
Toilet Facility		
Pit latrine	35	8.8
Water closet	161	40.3
Open defecation	102	25.5
Diapers	68	17.0
Baby potty	34	8.5
How Close to the Kitchen		
1m - 5m	63	15.8

Article DOI: 10.52589/AJBMR-RXVZ7WXS
DOI URL: https://doi.org/10.52589/AJBMR-RXVZ7WXS

6m - 10m	34	8.5
11m - 15m	268	67.0
16m - 20m	1	0.3
Greater than 20	34	8.5
How Close to the Source of Drinking Water		
1m - 5m	30	7.5
6m - 10m	66	16.5
11m - 15m	100	25.0
16m - 20m	69	17.3
Greater than 20	135	33.8
Rota result		
Negative	380	95.0
Positive	20	5.0

Table 4: Test of Association between risk factors and Rotavirus infection in Edo State

Risk factors	P Value	Decision
Age(years)	0.0000*	Significant Association
Gender of participant's parent/guardian	0.205	No Significant Association
Monthly Income of participant's parent/guardian	0.691	No Significant Association
Employment of participant's parent/guardian	0.963	No Significant Association
Exclusive Breastfeeding	0.0000*	Significant Association
Mode of feeding	0.796	No Significant Association
Source of drinking water	0.578	No Significant Association
Type of Toilet facility	0.811	No Significant Association
Proximity of Kitchen to Toilet facility	0.840	No Significant Association
Proximity of Toilet facility to source of drinking water	0.557	No Significant Association

*Values were considered significant at $P < 0.05$

Article DOI: 10.52589/AJBMR-RXVZ7WXS
DOI URL: https://doi.org/10.52589/AJBMR-RXVZ7WXS

African Journal of Biology and Medical Research
ISSN: 2689-534X
Volume 7, Issue 1, 2024 (pp. 110-120)
www.abjournals.org

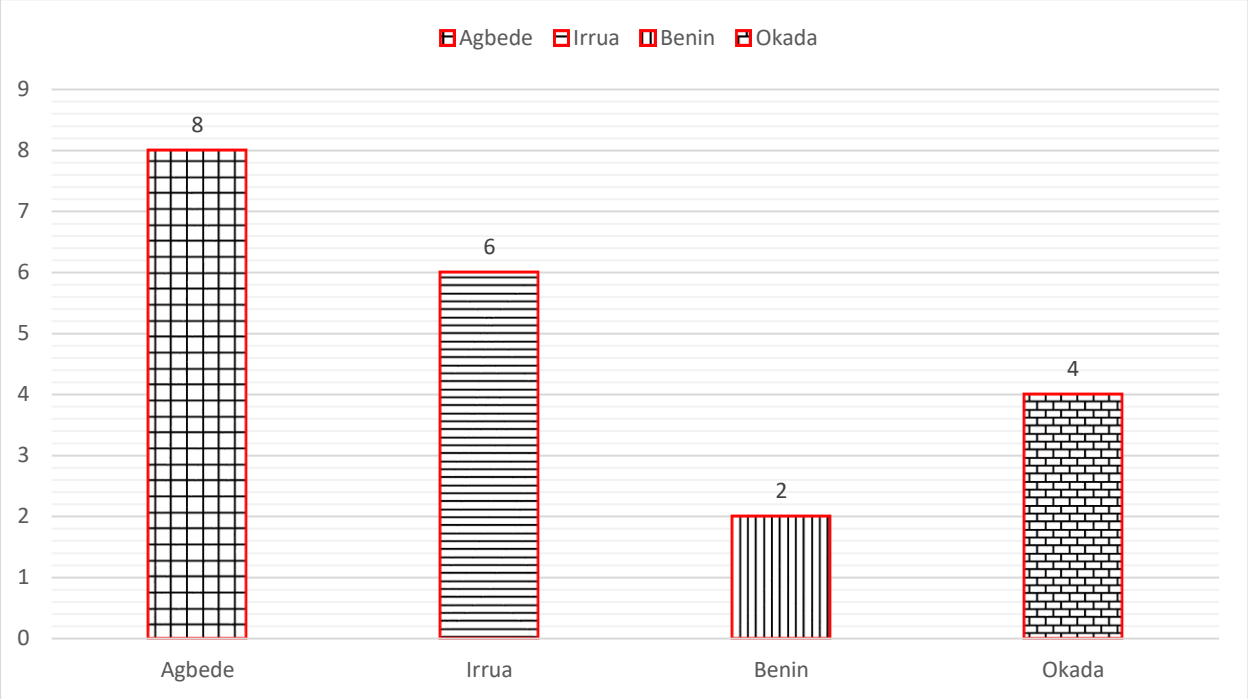

Figure 1: Prevalence of rotavirus infection in the study locations

DISCUSSION

The rate of rotavirus infection among diarrheic children less than five years who participated in this study was 5.00%. This finding was at variance with the studies of Omatola *et al.* [15] who published a prevalence of 18.50% among children in Ibadan, as well as those from Israel (18.40%) and Tanzania (18.00%) carried out by Grisaru-Soen *et al*. [16] and Moyo *et al.* [17], respectively. This present finding may be a pointer to the potential reduction in the burden of rotavirus infection, particularly in Edo State, Nigeria. Besides diarrhoea among rotavirus-positive children, other noticeable symptoms seen in the participants included dehydration, vomiting and fever, as well as fever or vomiting alone. However, children with rotavirus infection presented with increased fever, dehydration and vomiting when compared to those children without rotavirus infection. Identical observations had been reported in the studies of Pennap and Umoh [18] and Sanjay *et al*. [19]. No significant association was observed between the socio-demographic characteristics of the parents/caregivers of the study participants and rotavirus infection. This finding implies that socio-economic classes have no direct impact on the risk of acquiring rotavirus infection. Similar findings among children in Jos and Ibadan, Nigeria have been reported by Junaid *et al*. [20] and Omatola *et al.* [15], respectively. Age and exclusive breastfeeding of the participants were the main factors that were associated with the risk of acquiring rotavirus infection. Passively acquired maternal IgA anti-rotavirus antibodies significantly decline with an increase in the age of these participants [21], thereby exposing these children to a high likelihood of acquiring rotavirus infection. Also, the absence or inadequate practice of exclusive breastfeeding could most likely increase the risk of rotavirus infection at this age in life [22-23]. The omnipresence of rotavirus and its ability to remain infectious for prolonged periods on fomites found in the majority of homes without deactivation makes it strenuous to prevent children from exposure.

Article DOI: 10.52589/AJBMR-RXVZ7WXS
DOI URL: https://doi.org/10.52589/AJBMR-RXVZ7WXS

CONCLUSION

This study shows a significant decline in the incidence of rotavirus infection among children less than 5 years in Edo State, thus suggesting that the risk of acquiring rotavirus infection might be abating in this age group in Edo State. The study also demonstrated that age and exclusive breastfeeding were the main risk factors associated with contracting rotavirus infection in children less than 5 years in Edo State, Nigeria. However, an extensive study considering the urban and rural spread of rotavirus disease is recommended, as it would enable the estimation of a more realistic burden of rotavirus disease in both settings.

REFERENCES

[1] Bass, E. S., Pappano, D. A., & Humiston, S. G. (2007). Rotavirus. *Paediatrics in Review*, *28*(5), 183-191.

[2] Pang, Z., Hao, P., Qu, Q., Li, L., Jiang, Y., Xiao, S., ... & Li, C. (2022). Interferon–Inducible Transmembrane Protein 3 (IFITM3) Restricts Rotavirus Infection. *Viruses*, *14*(11), 2407.

[3] Clark, B., & McKendrick, M. (2004). A review of viral gastroenteritis. *Current opinion in infectious diseases*, *17*(5), 461-469.

[4] Matthijnssens, J., Ciarlet, M., Rahman, M., Attoui, H., Bányai, K., Estes, M. K., ... & Van Ranst, M. (2008). Recommendations for the classification of group A rotaviruses using all 11 genomic RNA segments. *Archives of virology*, *153*, 1621-1629.

[5] Becerra, A., Iša, P., Gutiérrez-Escolano, A. L., Velázquez, F. R., Torres, J., Arias, C. F., & Estrada-Garcia, T. (2023). Differential virome composition and richness between children's diarrheagenic stools kept at ultra-low temperatures for long-term. *The Journal of Infection in Developing Countries*, *17*(01), 93-101.

[6] Parashar, U. D., Hummelman, E. G., Bresee, J. S., Miller, M. A., & Glass, R. I. (2003). Global illness and deaths caused by rotavirus disease in children. *Emerging infectious diseases*, *9*(5), 565.

[7] Ahmed, S., Kabir, L., Rahman, A., Hussain, M., Khatoun, S., & Hannan, A. (2009). Severity of rotavirus diarrhoea in children: one year experience in a children hospital of Bangladesh. *Iranian Journal of Pediatrics*, *19*(2), 107-116.

[8] Tate, J. E., Haynes, A., Payne, D. C., Cortese, M. M., Lopman, B. A., Patel, M. M., & Parashar, U. D. (2013). Trends in national rotavirus activity before and after introduction of rotavirus vaccine into the national immunisation program in the United States, 2000 to 2012. *The Paediatric infectious disease journal*, *32*(7), 741-744.

[9] Asare, B. A., & Asare, G. (2023). A health surveillance data-based assessment of the impact of routine paediatric rotavirus vaccination on all-cause acute childhood diarrhoea. *Health Sciences Investigations Journal*, *4*(1), 435-442.

[10] Lungayo, C. L., Burke, R. M., Cikomola, A., Mukamba, E., Burnett, E., Tate, J. E., ... & Jouffroy, R. (2022). Epidemiology and pre-vaccine burden of rotavirus diarrhoea in Democratic Republic of Congo (DRC): Results of sentinel surveillance, 2009–2019. *Vaccine*, *40*(41), 5933-5941.

[11] Marijam, A., Schuerman, L., Izurieta, P., Pereira, P., Van Oorschot, D., Mehta, S., ... & Standaert, B. (2022). Estimated public health impact of human rotavirus vaccine (HRV) and pneumococcal polysaccharide protein D-conjugate vaccine (PHiD-CV) on child

Article DOI: 10.52589/AJBMR-RXVZ7WXS
DOI URL: https://doi.org/10.52589/AJBMR-RXVZ7WXS

morbidity and mortality in Gavi-supported countries. *Human Vaccines & Immunotherapeutics*, 2135916.

[12] Fischer, T. K., Viboud, C., Parashar, U., Malek, M., Steiner, C., Glass, R., & Simonsen, L. (2007). Hospitalizations and deaths from diarrhoea and rotavirus among children< 5 years of age in the United States, 1993–2003. *The Journal of Infectious Diseases*, *195*(8), 1117-1125.

[13] Tate, J. E., Patel, M. M., Steele, A. D., Gentsch, J. R., Payne, D. C., Cortese, M. M., ... & Parashar, U. D. (2010). Global impact of rotavirus vaccines. *Expert Review of Vaccines*, *9*(4), 395-407.

[14] Das, J. K., Siddiqui, F., Padhani, Z. A., Khan, M. H., Jabeen, S., Mirani, M., ... & Bhutta, Z. A. (2023). Health behaviours and care seeking practices for childhood diarrhoea and pneumonia in a rural district of Pakistan: A qualitative study. *Plos one*, *18*(5), e0285868.

[15] Omatola, C. A., Olusola, B. A., & Odaibo, G. N. (2016). Rotavirus infection among under five children presenting with gastroenteritis in Ibadan, Nigeria. *Archives of Basic and Applied Medicine*, *4*(1), 3-8.

[16] Grisaru-Soen, G., Engelhard, D., Pearl, S., Schlesinger, Y., Shtein, M., & Ashkenazi, S. (2008). Hospitalizations associated with rotavirus gastroenteritis in Israel--a retrospective study. *Harefuah*, *147*(1), 8-11.

[17] Moyo, S. J., Gro, N., Kirsti, V., Matee, M. I., Kitundu, J., Maselle, S. Y., ... & Myrmel, H. (2007). Prevalence of enteropathogenic viruses and molecular characterization of group A rotavirus among children with diarrhoea in Dar es Salaam Tanzania. *BMC Public Health*, *7*(1), 1-6.

[18] Pennap, G., & Umoh, J. (2010). The prevalence of group a Rotavirus infection and some risk factors in paediatric diarrhoea in Zaria, North central Nigeria. *African Journal of Microbiology Research*, *14*, 1532–1536.

[19] Sanjay, C. C., Sharad, A., & Dipali, S. C. (2013). Prevalence of rotavirus diarrhoea among children hospitalised in a tertiary care hospital in Western India. *International Journal of Pharmaceutical and Biomedical Science*, 4(1), 4-7.

[20] Junaid, S. A., Umeh, C., Olabode, A. O., & Banda, J. M. (2011). Incidence of rotavirus infection in children with gastroenteritis attending Jos university teaching hospital, Nigeria. *Virology journal*, *8*(1), 1-8.

[21] Jean, D. T. S. (2022). *Policy-Relevant Estimates of Oral Rotavirus Vaccine Performance in Low-and Middle-Income Countries* (Doctoral dissertation, The University of North Carolina at Chapel Hill).

[22] Abdulla, F., Hossain, M. M., Karimuzzaman, M., Ali, M., & Rahman, A. (2022). Likelihood of infectious diseases due to lack of exclusive breastfeeding among infants in Bangladesh. *Plos one*, *17*(2), e0263890.

[23] Rajesh, V., Hegde, A., Shetty, V., Garg, M., Kamath, A., Ballal, M., ... & Kumar, V. (2023). Implications of exclusive breastfeeding and complementary feeding practices on gastrointestinal health and antibiotic exposure: A questionnaire-based assessment. *Clinical Epidemiology and Global Health*, *21*, 101281.

Article DOI: 10.52589/AJBMR-RXVZ7WXS
DOI URL: https://doi.org/10.52589/AJBMR-RXVZ7WXS