Prevalence of Enteropathogenic *Escherichia coli* and Rotavirus Antigen among Diarrheic Children attending Selected Hospitals in Abeokuta, Nigeria: A Comparative study

Abstract

Diarrheal infections are one of the leading causes of sickness and death all over the world. It is the second-most common cause of under-five mortality, accounting for over half a million deaths annually. In Abeokuta, the etiology of diarrheagenic bacteria and diarrheagenic viruses has not been well studied. Hence, this study was carried out to determine the prevalence of Enter opathogenic *Escherichia coli* (EPEC) and Rotavirus Antigen among diarrheic children attending selected hospitals in Abeokuta, Ogun State, Nigeria.

A total of 315 stool samples were collected from children 0–5 years of age across the three selected hospitals. With a wooden spatula, 5ml of fecal sample was scooped and decanted into clean, labeled screw-capped tubes. Rotavirus antigen screening was performed according to the manufacturers' instructions, while EPEC screening was performed using cultural, biochemical, and stereotyping methods.

From the sample screening performed, 30 (37.04%) were EPEC positive, whereas 51 (62.96%) were positive for Rotavirus. Dissemination of children based on age showed that children between 7–12 months had the most elevated predominance of Rotavirus infection 17 (33.33%) while the lowest predominance was observed in children between 0–2 months 4 (7.84%). Furthermore, the highest predominance of EPEC diseases was observed in children between 7–12 months 12 (40%) and the lowest predominance in children between 19–24 months 2 (6.67%).

This study has demonstrated a higher prevalence of Rotavirus infection as compared to EPEC diseases among Diarrheic Children within the study location.

Keywords: Rotavirus, Enteropathogenic *Escherichia coli*-(EPEC), Diarrheic Children

Introduction

Diarrhea is a severe public health problem that has caused morbidity and mortality in both developing and developed countries, particularly in infants and children under the age of five (Mare *et al*.,2021). The World Health Organization (WHO) defines diarrhea as "the passing of loose or watery stools at least three times in a 24-hour period," but stresses the relevance of stool consistency change rather than frequency (Olanira*et al*.,2015). Although this disease primarily affects young children, it also impacts populations with inadequate or poor sanitation, water sources, and medical access. As a result, the geographic location has an impact on the genesis of infectious diarrheal disorders.

E.coli is a diverse microbe, and diarrheagenic strains of *E.coli* are common in infections, particularly in pediatric settings. However, in a pathophysiology dominated by viruses, enteropathogenic *E.-coli* (EPEC) is a bacterial etiological agent (Mare *et al*.,2021). *E.-coli* is spread mostly by the ingestion of contaminated water and foods such as undercooked meats and raw milk. *E.-coli* epidemics can also be triggered by eating certain agricultural products that have been contaminated by animal excrement during production or handling (Jun *et al*.,2022). *E.-coli* infection can also be transmitted by direct contact with livestock and wild animals. *E.-coli* is a gram-negative, facultative, rod-shaped bacteria that can invade the GITs of warm-blooded mammals.

Rotavirus is the leading cause of severe dehydrating diarrhea in young children (Habib *et al*.,2020). Diarrhea's clinical manifestation is determined by the organism and the host's response (Khude*et al*.,2018). The rotavirus can be passed from one person to the next via the feces-oral pathway. It destroys

Commented [a1]: Enteropathogenic

Commented [a2]: Remove it

Commented [a3]: r small

Commented [a4]: diarrheic children

Commented [a5]: remove it

Commented [a6]: The introduction does not fit with the topic of the research, which is focused on the spread and epidemiology of the two pathogens, it was better to focus on their prevalence

villus cells and replaces them with non-absorbing immature crypt cells, causing glucose and salt absorption to be impeded. As a result, there is a loss of water and electrolytes, which can lead to dehydration, acidosis, shock, and even death (Habib *et al.*,2020).-In rotavirus diagnosis, a variety of techniques can be used, including enzyme linked immunosorbent assay (ELISA), electron microscopy, latex agglutination techniques, immunochromatographic test (ICT), and reverse transcriptase polymerase chain reaction (RT-PCR).A correct diagnosis is critical for lowering treatment costs, preventing the spread of drug-resistant microorganisms, the misuse of antimicrobial drugs, and the spread of diarrhea disorders (Khude*et al.*,2018). However, researchers and physicians have recently become interested in antigen detection approaches based on immunological techniques such as ELISA and ICT (Habib *et al.*,2020). The purpose of this study was to compare the prevalence of Enteropathogenic-*E.coli* and Rotavirus antigen among diarrheic children attending some hospitals in Abeokuta, Ogun State.

Materials and Methods

Study Area

The study was carried out in 3 (three) selected hospitals in Abeokuta, Ogun State, Nigeria. The Hospitals selected were State Hospital, Abeokuta; Sacred Heart Hospital, Abeokuta and Federal Medical Centre, Abeokuta, all in Ogun State, Nigeria.

Study Design

The participants in this study are Children under 5 years of age with their parents' consent. A purposive sampling technique was used and a total of-three hundred and fifteen (315) diarrheic-stool samples were collected for this study.

Commented [a7]: were

Commented [a8]: this is not a study design

Sample Collection

A total of 315 stool samples were collected from children-0-5years-of-ageacrossthethreeselected hospitals. About 5ml of fecal sample was scooped with a woodenspatulaand,decantedrespectivelyintoclean,labeledscrew-capped tubes with the assistance of the laboratory technologist. All samples were transported in ice box to the DepartmentofMicrobiology,Sacred Heart Hospital Abeokuta and stored frozen at -20^{0}Cuntil analyzed.

Ethical clearance

Ethical clearance was obtained from the ethical committee of Sacred Heart Hospital ,Abeokuta (Ref no:SHH/EC/02/02/21)Ogun State,Nigeria.

Sample Analysis for Rotavirus

Each 10% fecal suspension was screened for the presence of rotavirus antigens using commercially available True Line Rota/adeno Cassette Test® (Biocare Diagnostic, Zhunzai, China). All screening was performed according to the manufacturers's instructions. The samples and reagents were brought to room temperature before the test was carried out. This test uses a homogenous immunochromotographic system with gold particles and results in approximately 5 to 15 minutes.

Commented [a9]: manufacturer

Sample Analysis for EPEC

Stool samples were cultured on to MacConkey agar and incubated at 37^{0}C for 24 hours. Bacterial isolates were identified morphologically (macroscopically) viz: size, shape, colour, consistency, edges, elevation and opacity. Isolates were further characterized by gram staining and biochemical tests such as catalase, coagulase, indole, motility, citrate, urea, oxidase (Azeez *et al.*,2020), methyl-red, vogesproskauer(Arora *et al.*,2008), sugar fermentation test(Ochei*et al.*,2008) and serotyping (Ochei*et al.*,2008).

Statistical analysis

Commercial statistical software SPSS version 22.0 (SPSS Inc., Chicago, IL, USA) was used to perform descriptive analysis and frequency tables.

Results

Table 1: Prevalence of Enteropathogenic *E.coli*and Rotavirus Antigen according to age at State Hospital Ijaye,-Abeokuta

Age (months)	Number Examined (N)	EPEC Positive n(%)	Negative n(%)	ROTAVIRUS Positive n(%)	Negative n(%)	X^2
0-2	11	0(0.0)	11(100)	2(18.2)	9(81.8)	
3-6	23	3(13.0)	20(87.0)	4(17.7)	19(82.3)	
7-12	35	4(11.4)	31(88.6)	6(17.1)	29(82.9)	
13-18	21	1(4.8)	20(95.2)	5(23.8)	16(76.2)	
19-20	15	0(0.0)	15(100)	2(13.3)	13(86.7)	
Total	**105**	**8(8.6)**	**97(91.4)**	**19(18.1)**	**86(81.9)**	**0.01**

Table 2: Prevalence of Enteropathogenic *E.coli*and Rotavirus Antigen according to age at Sacred Heart hospital, Abeokuta

Age	Number	EPEC	ROTAVIRUS	X^2 P-

(months) Value	Examined (N)	Positive n(%)	Negative n(%)	Positive n(%)	Negative n(%)	
0-2	10	0(0.0)	10(100)	1(10.0)	9(90.0)	
3-6	40	5(12.5)	35(87.5)	7(17.5)	33(82.5)	
7-12	30	2(6.7)	28(93.3)	4(13.3)	26(86.7)	
13-18	20	2(10.0)	18(90.0)	3(15.0)	17(85.0)	
19-20	15	1(6.7)	14(93.3)	2(13.3)	13(86.7)	
Total	**105**	**10(9.5)**	**95(90.5)**	**17(16.2)**	**88(83.8)**	**0.02**

Table 3: Prevalence of Enteropathogenic *E.coli*and Rotavirus Antigen according to age at Federal Medical Centre (FMC), Abeokuta

Age (months) Value	Number Examined (N)	EPEC Positive n(%)	EPEC Negative n(%)	ROTAVIRUS Positive n(%)	ROTAVIRUS Negative n(%)	X^2
0-2	7	1(14.3)	6(85.7)	1(14.3)	6(85.7)	
3-6	36	3(8.3)	33(91.7)	4(11.1)	32(88.9)	
7-12	42	6(14.3)	36(85.7)	7(16.7)	35(83.3)	
13-18	10	1(10.0)	9(90.0)	2(20.0)	8(80.0)	
19-20	10	1(10.0)	9(90.0)	1(10.0)	9(90)	
Total	**105**	**12(11.4)**	**93(88.6)**	**15(12.4)**	**92(87.6)**	**21.34**

Table 4:-Prevalence of Enteropathogenic *E.coli*and Rotavirus Antigen according to gender

Age (months)	Number Examined (N)	EPEC Positive n(%)	EPEC Negative n(%)	ROTAVIRUS Positive n(%)	ROTAVIRUS Negative n(%)	X^2 P-Value
Male	126	13 (40.63)	113(39.93)	21 (42.86)	105(39.47)	
Female	189	19 (59.37)	170(60.07)	28 (57.14)	161(60.53)	
Total	**315**	**32**	**283**	**49**	**266**	**0.02**

Table 5: Prevalence of Enteropathogenic *E.coli*and Rotavirus Antigen according to age groups

Age	0-2	3-6 (%)	7-12 (%)	13-18 (%)	19-24 (%)	Total (months) (%)	
EPEC	1(3.33)	11(36.67)	12(40)	4(13.33)	2(6.67)	30(100)	X^2
Rotavirus	4(7.84)	15(29.41)	17(33.33)	10(19.61)	5(9.81)	51(100)	
Total	**5**	**26**	**29**	**14**	**7**	**81**	

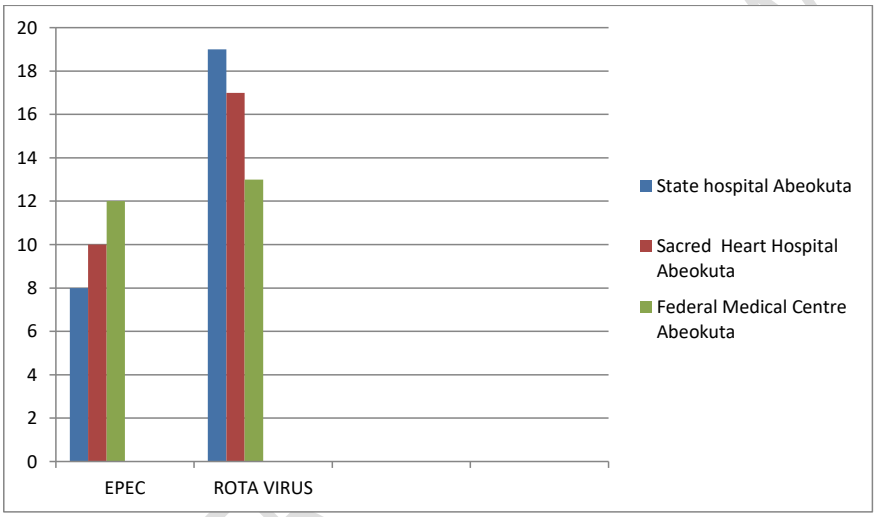

Fig 1: Prevalence of Enteropathogenic *Escherichia coli* and Rotavirus Antigen among Diarrheic Children based on location

Discussion

One hundred and five (105) stool samples were collected from each selected hospital to make a total of Three hundred and fifteen (315) samples used in this study. Out of the 315 stool samples collected, 126 were male stool samples and 189 were female stool samples. Children age group 7-12 months had the highest prevalence of EPEC infections 12(40%), closely followed by 3-6 months 11(36.67%), 13–18 months 4(13.33%) and the lowest prevalence was observed in the age group 19–24 months 2(6.67%).

Screening of the stool samples revealed that 30(37.04%) were EPEC positive, while 51 (62.96%) were positive for Rota virus. This report is lower than the prevalence rate reported by Olanipekun (1996) among children with diarrheal attending University Teaching Hospital, Jos, Nigeria and the prevalence of 68.5% reported by Ifeanyi *et al*.,(2010) among diarrhea children in the Federal Capital Territory of Abuja, Nigeria. This variation in prevalence rate might be due to differences in the standard of living and also the maintenance of personal hygiene among the various states in the country.

The prevalence rate obtained for EPEC 30(37.04%) in this study is higher than the 4.8% reported by Cho *et al*. (2006) in Korea. However, it is lower than the 63.3–71.83% reported in Tanzania, 50–60% in other developing countries, the 45% reported by Jafari *et al*.,(2008) among patients admitted in different hospitals in Tehran, Iran, and the 56% reported by Svenungsson*et al*.,(2000) among adult patients presenting with acute diarrhea in Swedish.

Children aged 7-12 months had the highest prevalence rates of EPEC and Rotavirus infections, at 40% and 33.33%, respectively, followed by children aged 3-6 months, who had a prevalence rate of 36.67% for EPEC and 29.41% for Rotavirus infections. The lowest prevalence was observed in children aged 0–12 months (3.33%) and 19–24 months old (respectively). With respect to sex, females had the highest prevalent rate of 19 (59.4%) than their counterpart males, 13 (40.6) for EPEC infection. The same higher prevalence rate was also observed in Rotavirus virus with the following figures: 21 (42.9) in males and 28 (57.1) in females. The result of this study is in contrast to the finding of Jafari *et al*. (2008), who reported a prevalence rate of 53.2% in males and 46.8% in females among patients attending different hospitals in Tehran. However, no significant difference was observed between the sexes and the prevalence of the infection. The present study revealed that the prevalence of EPEC among hospitalized children in the study hospitals in Abeokuta, Ogun-State, Nigeria, was 9.52% and 62.96%. for EPEC and rotavirus respectively. also showed that a higher prevalence was recorded among children between 7 and 12 than the other age groups. Females' prevalent rate outnumbers their male counterparts. Therefore, governments are advised to establish standard surveillance and control strategies (such as provision of adequate potable drinking water, etc.), which is important in alleviating/eliminating the number of diarrhea cases due to EPEC in the State.

Conclusion

This study uncovered that the predominance of EPEC and Rotavirus infection among hospitalized diarrheic children was 37.04% and 62.96% respectively. A higher predominance was recorded among children between 7 and 12 months when compared with other age groups. Furthermore, the Female gender exhibited an elevated rate of infection than the male gender.

Commented [a10]: this is not conclusion, change it please

The government is however advised to set up standard observation and control techniques (such as arrangement of satisfactory consumable drinking water etc.), which is vital in alleviating/eliminating the number of diarrhea cases due to EPEC and Rota viruses within the State.

References:

Habib, F.; Rahman, M.; Haque, M.; Sinha, S.; Dey, S.; Tanni, N; Nabi, M; Jhuma, A. & Hasan, M. (2020). A Comparative Study of Rotaviral Antigen Detection by ELISA and ICT in Children below Five Years with Acute Diarrhoea in A Tertiary Care Hospital. *Bangladesh Medical Journal*. 49(1).

Jun Bong, L.; Se Kye, K. and Jang Won, Y. (2022). Pathophysiology of enteropathogenic Escherichia coli during a host infection. *Journal of veterinary science* 23(2): 28.

Khude, N.; Dash, L.; Save, S.; Samal, B. and Shastri, J. (2018). Rotavirus in diarrhoeic children under-five attending a tertiary care hospital in Mumbai, India. *International Journal of Contemporary Pediatrics* 5(5):1863-1868.

Mare, A.; Ciurea, C.; Man, A.; Tudor, B.; Moldovan, V.; Decean, L. & Toma, F. (2021). Enteropathogenic *Escherichia coli* - A Summary of the Literature. *Gastroenterology. Insights* 12, 28–40.

Olaniran, O.; Japheth,O.; Asinwa, H.; Olajokun-Hassan,H.; Awoyeni, E. & Adekunle, O. (2015). Isolation and evaluation of E.coli in diarrhoeic stool samples from children in Ile-Ife, Nigeria. *Journal of Disease and Global Health* 4(4): 145-151.

.