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

Abstract

Background: 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.

Objective : To determine the prevalence of Enteropathogenic *Escherichia coli* and Rotavirus Antigen among Diarrheic Children attending Selected Hospitals in Abeokuta, Nigeria: A Comparative study

M**ethods:** A total of 315 stool samples were collected from children 0–5 years of age across 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.

Results: From the sample screening performed, 30 (37.04%) were EPEC positive, whereas 51 (62.96%) were positive for rotavirus. Dissemination of children based on ageshowed 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%).

Conclusion: This study had 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 serious public health problem in both developing and developed countries, contributing to morbidity and mortality, particularly in young children and infants under the age of five (Mare et al., 2021). "Diarrhea is still the second leading cause of death in children under the age of five, accounting for 1.3 million deaths each year" (Black et al., 2010). "Because of its high prevalence in both the community and hospital setting, and because it is one of the main causes of persistent diarrhea, enteropathogenic Escherichia coli (EPEC), one of the diarrheagenic Escherichia coli pathotypes, is one of the most significant pathogens infecting children worldwide" (Abba et al., 2009).

EPEC was the second most common cause of inpatient diarrhea after rotavirus (25.4%).In a recent study of hospitalized diarrhea patients in India, EPEC was found in 3.2% of the 648 diarrhea samples in children under the age of five, young children are the most vulnerable to this disease, but it also affects those with limited access to clean water, sanitation, and medical care. As a result, the geographic origin of infectious diarrheal illnesses is influenced. Escherichia coli is a diverse bacterium, that cause diarrhea particularly in pediatric

settings. However, enteropathogenic E. coli (EPEC) is a bacterial etiological agent in a pathophysiology dominated by viruses (Mare et al., 2021). Escherichia coli is primarily spread through the consumption of contaminated food, particularly raw milk and undercooked meat. Eating some agricultural goods that have been contaminated by animal feces during manufacturing or handling can also result in Escherichia coli outbreaks In addition, direct contact with domestic and wild animals may result in E. coli infection transmission (Jun et al., 2022).

Despite improvements in preventive and care. Diarrhea has been ranked as one of the top 10 causes of death and disability since 1990. This was observed across all age groups, and one of the top 5 causes of death and disability in kids under the age of five. In accordance with the findings of the Global Burden of Diseases, which describes the burden of disease, injuries, and risk factors in 195 countries, they looked at how the prevalence of diarrhea has evolved across all groups, a total prevalence of 1,655,944 deaths (95% UI, 1,244,073-2,366,552), including 446,000 (390,894-504,613) deaths in children under the age of five was discovered. Diarrhea-related mortality was 22.4 (95% UI, 16.8-32.0) deaths per 100,000, with higher rates seen in children under the age of five (70.6 [95% UI, 61.9-79.8] deaths per 100,000) and adults over the age of 70 (171.7 [95% UI, 114.1-263.5] deaths per 100,000). “Rotavirus was the leading cause of diarrhea mortality in children under the age of five (128,515 deaths; 95% UI, 105,138-155,133 deaths), as well as in people of all ages (228,047 deaths; 95% UI, 183,526-292,737 deaths). Childhood wasting (low weight for height score), unsafe water, and poor sanitation were the leading risk factors for diarrhea, accounting for 80.4% (95% UI, 68.2%-85.0%), 72.1% (95% UI, 34.0%-91.4%), and 56.4%, respectively. (95% UI, 49.3%-62.7%) of diarrhea-related deaths in 5-year-old children (GBD, 2016) .Overall, the importance of EPECs and rotavirus as pathogens has decreased in published studies over the last few decades” (Okeke, 2008).

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 OgunState, Nigeria.

Study Design

The participants in this study were 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 from the children that were within the targeted age,while children that were above the age were excluded from this study.

Sample Collection

A total of 315 stool samples were collected from children 0-5years of age across selected hospitals. About 5ml of fecal sample was scooped with a wooden spatula and, decanted respectively into clean, labeled screw-capped tubes with the assistance of the laboratory technologist. All samples were transported in ice box to the Department of Microbiology, Sacred Heart Hospital Abeokuta and stored frozen at -20^0Cuntil analyzed.

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 manufacturer'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.

Sample Analysis for EPEC

Stool samples were cultured on to MacConkey agar and incubated at 37^0C 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, methyl-red, vogesproskauer sugar fermentation test and serotyping (Arora *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 RotavirusAntigen according to age at State Hospital Ijaye,Abeokuta

Age (months)	Number Examined (N)	EPEC Positive n(%)	EPEC Negative n(%)	ROTA VIRUS Positive n(%)	ROTA VIRUS 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 RotavirusAntigen according to age at Sacred Heart hospital, Abeokuta

Age (months)	Number Examined (N)	EPEC Positive n(%)	EPEC Negative n(%)	ROTA VIRUS Positive n(%)	ROTA VIRUS Negative n(%)	X^2	P-Value
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 RotavirusAntigen according to age at Federal Medical Centre (FMC), Abeokuta

Age (months)	Number Examined (N)	EPEC Positive n(%)	EPEC Negative n(%)	ROTA VIRUS Positive n(%)	ROTA VIRUS Negative n(%)	X^2 Value
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 RotavirusAntigen according to gender

Age (months)	Number Examined (N)	EPEC Positive n(%)	EPEC Negative n(%)	ROTA VIRUS Positive n(%)	ROTA VIRUS 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**	

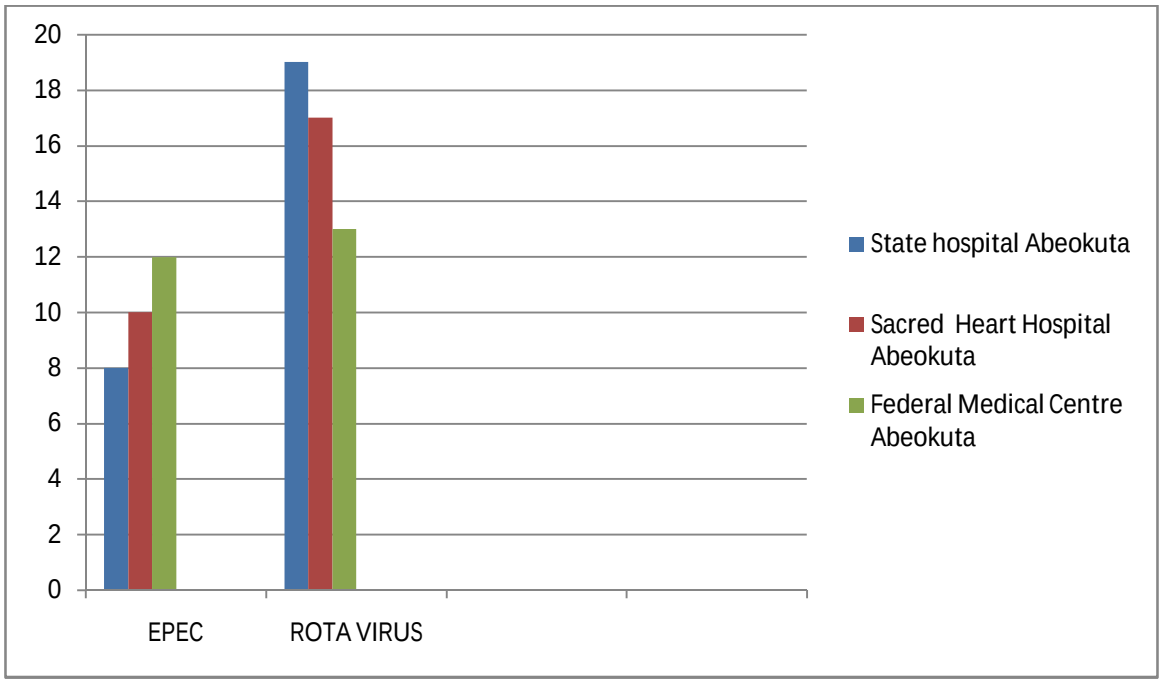

Fig 1: Prevalence of Enteropathogenic *Escherichia coli* and Rotavirus Antigen among Diarrheic Children based on location

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 Rota virus positive. 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 found that rotavirus infections were more common than EPEC among children with diarrhea in the study area, with a greater preponderance in children aged 7 to 12 months. Furthermore, when compared to the male gender, the female gender had a higher rate of infection. The government is advised, however, to establish standard observation and control techniques (such as the provision of safe drinking water), which is critical in reducing/eliminating the number of diarrhea cases caused by EPEC and Rota viruses in the state.

Ethical Approval

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

Consent

As per international standard, parental written consent has been collected and preserved by the author(s).

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