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PREVALENCE AND RISK FACTORS ASSOCIATED WITH ROTAVIRUS DIARRHOEA IN CHILDREN LESS THAN FIVE YEARS IN KATSINA STATE, NORTHWESTERN NIGERIA.

***[1] Mukhtar, G.L, [2]Aminu, M., [1]Hayatuddeen, M.R. and [3]Bello, I.**
[1]Department of Microbiology, Umaru Musa Yar'adua University, P.M.B 2218 Katsina
[2]Department of Microbiology, Ahmadu Bello University, Zaria- Nigeria
[3]National Biotechnology Development Agency, Bioresources Development Center Katsina.
*Corresponding Author: mukhtar.gambo@umyu.edu.ng (08060839389).

ABSTRACT
Rotavirus is the principal cause of severe diarrhoea, with approximately 95% of children experiencing rotavirus gastroenteritis by 5 years of age. Therefore, a study on the prevalence of rotavirus infection in children aged 0-5 years old was undertaken in Katsina State, Northwestern Nigeria where there is little or no information. A total of 400 stool samples comprising of 322 diarrhoeic and 78 non-diarrhoeic were collected from children aged 0-5 years and screened for rotavirus antigen using ELISA. The socio-demographic information and clinical presentations of the children were noted with the aid of a questionnaire. Rotavirus antigen was detected in 5.3% of the diarrhoiec specimens and none in the non-diarrhoiec specimens. Generally, children < 2 years old were more vulnerable to rotavirus infection, with the peak of infection occurring between 7-12 months of age. There was a significant association between dehydration (P=0.02), source of drinking water (P=0.03) and rotavirus infection.
Keywords: Rotavirus, Prevalence, Risk factors, Diarrhoea, Katsina, Nigeria.

INTRODUCTION

Viral gastroenteritis is a major health problem and continues to be a crucial cause of morbidity and mortality in developing countries (Dominguez *et al.,* 2009). Children under 5 years of age are particularly susceptible, and global estimates indicated a mean of between 3.5 and 7 episodes of severe diarrhoea during the first 2 years of life, and the greatest burden is in the developing countries because of poor sanitation, lack of safe drinking water, and bad sanitary habits (WHO, 2009).

Rotavirus infection is the single most important cause of infectious, severe, dehydrating diarrhoea and death globally in children aged 5 years and below (Ahmed *et al*., 2009). It has been reported to be the leading cause of acute diarrhoea, and is responsible for about 40 per cent of all hospital admissions due to diarrhoea among children under five worldwide (UNICEF/WHO, 2009).

The high incidence of rotavirus diarrhoea mostly in young children is in accordance with the assumption that in under-developed areas the early peak of rotavirus diarrhoea may result from early exposure to contaminated sources as well as over-crowded homes (Junaid *et al.,* 2011). A number of previously studies have reported possible risk factors to rotavirus infection in their geographical area of study (Pennap and Umoh, 2010; Junaid *et al*., 2011).

Rotavirus is transmitted from person to person through the fecal-oral route. It can be transmitted through faecally-contaminated water or food which usually occur when infected food handlers who prepare, salad, sandwiches, carrots and other foods that requires no cooking can spread the disease. In children, it is usually transmitted when stool of infected child is swallowed by another child, that is children become infected if they put their finger in their mouth after touching something such as toys, books, clothing e.t.c., that has been contaminated by stool of an infected person, this usually happen when children forget to wash their hands after using the toilet or before eating. Nosocomial transmission is frequent in pediatric wards and hospitals with poor sewage water treatment and sanitation (Dennehy, 2000).

In Nigeria, a high incidence of childhood diarrhoea is estimated to account for over 160 000 of all deaths in children less than 5 years of age annually and of this number approximately 20% are associated with rotavirus infection (Parashar *et al.,* 2006).

There are little or no studies that have been carried out in Katsina State, Nigeria to determine the role of rotavirus in childhood diarrhoea, hence this study was conducted to provide information with regards to any future introduction of rotavirus vaccine in Katsina State and Nigeria as a whole.

MATERIALS AND METHODS

Study design

The study was a cross-sectional hospital survey of children between 0 and 5 years of age with or without diarrhoea. Those without diarrhoea served as a control. Informed consent was obtained from the parent/guardian of each child.

Two hospitals were selected from each of the three senatorial districts of the state.

Inclusion and Exclusion criteria

The inclusion criteria were any child between 0-5 years old, of both sexes, who were presented with or admitted for diarrhoea illness in the selected hospitals and whose care giver consented.

The exclusion criteria were children above 5 years old, of both sexes, and whose caregiver did not consent.

Approval

Ethical approval (Appendix 1) was obtained from the Ethical Committee of Katsina State Ministry of Health.

Sample size

The sample size for the study was determined using the formula of Sarmukaddam and Gerald (2006) at 95% confidence level and a reported prevalence of 18% Rotavirus infection in children with diarrhea in four in Northwestern Nigeria (Aminu *et al.,* 2008). The calculated sample size was 226.8; hence a total of 400 samples were collected from the children with and without diarrhoea and used for the study.

Sample collection

Three hundred and twenty two (322) faecal specimens were collected from children between the ages of 0-5 years that were presented or admitted at clinics or hospitals for acute diarrhoeal illness, and seventy eight (78) from non diarrhoeic patients as controls. The specimens were collected in clean, labeled, screw-capped tubes and transported immediately in ice-cooler boxes to Postgraduate Microbiology Laboratory Ahmadu Bello University, Zaria and stored at 4^{o}C.

The socio-demographic information and clinical presentations of the children were noted with the aid of a questionnaire.

Viral Antigen Detection using ELISA

All the four hundred (400) feacal specimens collected were analysed for the presence of rotavirus antigens using commercially available enzyme immunoassay (Diagnostic Automation, Inc, USA) ELISA kits. The assay was carried out according to the manufacturer`s instructions.

Data analysis and presentation

Analysis of rotavirus infection in children according to age, sex and risk factors studied was done using GraphPad Statistical Software. Chi-square test was used and P values < 0.05 were considered statistically significant.

RESULTS

A total of 400 stool samples were screened for rotavirus antigen. Of the 322 children that presented with diarrhoea, 5.3% (17/322) were positive for rotavirus and no viral antigen was detected in the 78 non-diarrhoeic samples (Table 1). Rotavirus was significantly associated with diarrhoea in this study (χ^2= 4.3008, df= 1, p= 0.038095).

There was no significant association (P= 0.4186) between rotavirus infection and age-group in this study. However, most of the positive cases of rotavirus gastroenteritis were under 2 years of age with highest prevalence in children 7-12 months of age and no positive case of rotavirus infection was found among the children in the 0-6 months old (Table 2).

Analysis of the result by sex among the children showed that rotavirus shedding occurred more frequently in males (5.5%: 10/182) than in females (5.0%: 7/140). However the differences in the prevalence according to sex was not significant (P= 0.8441) (Table 3).

Among the possible risk factors examined, rotavirus infection was found to be significantly associated (P= 0.03) with source of drinking water, it was however not associated (P>0.05) with socioeconomic status, level of education of a child's parent, type of toilet and previous history of diarrhoea (Table 4).

Table 1: Prevalence of Rotavirus Infection in Diarrhoeic and Non-diarrhoeic Children aged 0-5 Years Old in Katsina State, Nigeria

Population	Positive (%)	Negative (%)	Total
Diarrhoeic	17 (5.3)	305 (94.7)	322
Non-Diarrhoeic	0 (0.0)	78 (100)	78
Total	**17 (5.3)**	**383 (95.7)**	**400**

Rotavirus: χ^2 = 4.3008, df= 1, p= 0.03

Table 2: Age Distribution of Rotavirus Infection among Children less than 5 years with Diarrhoea in Katsina State, Nigeria

Age (Months)	Positive (%)	Negative (%)	P-value
0-6	0 (0.0)	25 (100)	
7-12	5 (7.7)	60 (92.3)	
13-18	1 (3.0)	32 (97.0)	0.598
19- 24	8 (7.0)	107 (93.0)	
25- 36	2 (4.0)	48 (96.0)	
37- 60	1 (3.0)	33 (97.0)	
Total	**17 (5.3)**	**305 (94.7)**	

χ^2=3.666, df=5, p=0.598

Table 3: Distribution of Rotavirus Infection in Relation to Sex in Diarrhoiec Children 0-5 years old in Katsina State, Nigeria

Sex	Positive (%)	Negative (%)	P-value
Males	10 (5.5)	172 (94.5)	
Females	7 (5.0)	133 (95.0)	0.944
Total	**17 (5.3)**	**305 (94.7)**	

χ^2=0.005, df=1, p=0.944

Table 4: Relationship between Some Possible Risks Factors Studied and Rotavirus Infection in Children aged 0-5 Years in Katsina State, Nigeria

Factor	Rotavirus positive No. (%)	Rotavirus Negative No. (%)	P-value
Socio-economic status			
High	5 (4.8)	99	0.74
Low	12 (5.5)	206	
Mother`s level of education			
None	9 (5.5)	153	
Primary	4 (5.2)	73	0.06
Secondary	3 (5.1)	57	
Tertiary	1 (4.8)	19	
Source of drinking water			
Public well	9 (8.7)	95	
Bore-hole	3 (7.9)	35	
Pipe-borne	2 (3.3)	51	0.03
Private well	1 (1.2)	80	
River/stream	2 (7.1)	26	
Others	0 (0.0)	10	
Type of toilet			
Pit-latrine	9 (4.0)	214	
Water-closet	5 (8.0)	57	0.32
Open-field	3 (8.1)	34	0.12
Previous history of diarrhea			
Yes	10 (4.9)	195	0.66
No	7 (6.0)	110	0.32

DISCUSSION

In this study, rotavirus infection occurred in 5.3% of children 0-5 years old that presented with diarrhoea and did not occur in the control group. This implies that rotavirus is significantly associated with diarrhoea. The prevalence of rotavirus infection in this study is comparable to the report of Kuta *et al* (2014) where a prevalence of 4.5% was reported in their study in three North Central States and Federal Capital Territory Abuja, Nigeria. However, the result is lower than those previously reported in other parts of the country such as 13.0% in Ibadan, 11.0% in Jos, 11.9% in Maiduguri, 18.0% in Northwestern Nigeria, 16.3% in Zaria and 13.8% in Jos (Ojeh *et al*., 1995; Nimzing *et al*., 2000; Adah *et al*., 2001; Aminu *et al.,* 2006; Pennap and Umoh 2010; Junaid *et al*., 2011).

Rotavirus infection was observed to be slightly higher in male (5.5%) than in female children (5.0%), with no statistically significant difference (0.8441). The reason for the lack of significance difference in detection rate between male and female children may be the fact that at younger age, both sexes have little or no major differences in their life style. This result is similar to the report of previous studies in Nigeria (Aminu *et al.,* 2006, Pennap and Umoh 2010; Junaid *et al*., 2011). Similar studies in other countries such as South Western Iran (Kajbaf *et al.,* 2013) and in Sudan (Magzoub *et al*., 2013) have reported higher detection rates of rotavirus infection in male than in female children. However, a study from Cameroon have reported higher detection rates in female (45.3%) than in male children (40.8%) (Ndze *et al.,* 2012).

In this study, most of the children positive for rotavirus infection were under two years of age, emphasizing the fact that rotavirus infection occurs early in life. This finding is in consistent with a number of similar studies in Nigeria (Audu *et al*., 2002; Aminu, 2006; Junaid *et al*., 2011; Anochie *et al*., 2013) and most parts of the world (Basu *et al*., 2003; Kargar *et al*., 2012; Almusawi *et al*., 2013; Magzoub *et al.,* 2013; Karakus *et al*., 2014) where they reported higher prevalence of rotavirus infection mostly in children less than two years old. The highest prevalence of rotavirus infection occurred in the age-group 7-12 months (7.7%). This age-group distribution is comparable to previous studies by Junaid *et al,* (2011) and Kajbaf *et al,* (2013) who reported higher prevalence in children 7-12 months old. The absence of positive case among the children in the age-group 0-6 months may be attributed to breast feeding which may provide partial protection due to present of maternal antibodies in breast milk.

Rotavirus infection was significantly associated with source of drinking water. Most of the patients (8.7%: 9/104) were found depending on public well as their source of drinking water. This emphasizes the transmission of rotavirus by feacal-oral means. Parashar *et al,* (2006) noted that while diarrhoeal disease incidence has reduced in recent years, due in part to improved hygiene practices and sanitation, the incidence of rotavirus infection continues to increase.

The socio-economic status of the child`s parent, type of toilet, previous history of diarrhea, mother's level of formal education were not significantly associated with rotavirus infection (P>0.05). These observations have been reported by studies carried out in other parts of the country (Pennap and Umoh 2010; Junaid *et al*., 2011).

CONCLUSION

The findings of this study showed that rotavirus is an important cause of diarrhoea in children 0-5 years old in Katsina State, Nigeria and rotavirus infection peaked in children 7-12 months. Source of drinking water was found to be risk factor for rotavirus infection in the study.

RECOMMENDATIONS

Continued rotavirus surveillance and investigation of the most common circulating strains amongst this group in this area is therefore needed.

Government at all levels should provide portable and safe drinking water.

REFERENCES

Adah, M.I., Wade, A. and Taniguchi, K. (2001). Molecular Epidemiology of Rotaviruses in Nigeria Detection of unusual strains with G2P (1) and G8P (1) Specificities. *Journal of Clinical Microbiology*, **39**:3969-3975.

Ahmed, S., Kabir, A.R.M., Rahaman, A., Hussain, M. and Khatoon, S. (2009). Severity of rotavirus diarrhoea in children: One year experience in a children hospital of Bangladesh. *Iran Journal of Pediatrics*, **19**:108-116.

Al Musawi, M., Zainaldeen, H., Shafi, F., Anis, S. and De-Antonio, R. (2013). Rotavirus Gastroenteritis in Children under 5 Years in the Kingdom of Bahrain: hospital-based surveillance. *Journal of Clinical Epidemiology,* **5**:269-275.

Aminu, M. (2006). Molecular Epidemiology of Rotaviruses, Astroviruses and Adenoviruses Associated with Gastroenteritis in Children in Northwestern Nigeria. PhD. Dissertation, Department of Microbiology, Ahmadu Bello University Zaria, Nigeria.

Aminu, M., Ahmad, A.A. and Umoh, J.U. (2008). Rotavirus Infection in four States in Northwestern Nigeria. *Nigerian Journal of Medicine,* **17**(3):285-290.

Audu, R., Omilabu, S.A., Peenze, I. and Steele, D. (2002). Isolation and Identification of Adenovirus Recovered from the Stool of Children in Lagos Nigeria. *African Journal of Health Sciences*, **9**:105-111.

Anochie, P.I., Onyeneke, E.C., Asowata, E.O., Afocha, E., Onyeozirila, A.C., Ogu, A.C. and Onyeneke, B.C. (2013). The role of rotavirus associated with gastroenteritis in a general hospital in Lagos, Nigeria. GERMS, **3**(3):81-89.

Basu, G., Rossouw, J., Sebunya, T.K., Gashe, B.A., De Beer, M., Dewar, J.B. and Steele, A.D. (2003). Prevalence of Rotavirus, Adenovirus and Astrovirus Infection in Young Children with Gastroenteritis in Gaborone, Botswana. *East African Medical Journal,* **80**(12):652-655.

Dennehy, P.N. (2008). Rotavirus Vaccines: An Overview. *Clinical Microbiology*. Rev.21: 798 -808.

Dominguez A, Godoy P, Torner N, Cardenosa N, Martinez A, (2009). The viral gastroenteritis: a public health problem. *Rev. Esp. Salud Publica* 83:679-687.

Junaid, S.A., Chijioke, U., Atanda, O.O. and Jim, B. (2011). Incidence of Rotavirus Infection in Children with Gastroenteritis Attending Jos University Teaching Hospital, Nigeria. *Virology Journal*, **8**:233.

Kajbaf, T.Z., Shamsizadeh, A., Kalvandi, G. and Macvandi, M. (2013). Relative Frequency of Rotavirus and Adenovirus Among Children Aged 1-60 Months Hospitalized with Acute Diarrhoea in South-Western Iran. *Jundishapur Journal of Microbiology*, **6**(1): 47-50.

Karakus, Y.T., Bircan, S. and Saime, E.D. (2014). Incidence of rotavirus and adenovirus 40/41 in children and infants. *European Journal of Medical Sciences*, **1**(1):22-25.

Kargar, M., Zare, M. and Najafi, A. (2012). Molecular Epidemiology of Rotavirus Strains Circulating Among Children with Gastroenteritis in Iran. *Iranian Journal of Pediatrics*, **22**(1):63-69.

Kuta, F.A., Damisa, D., Uba, A.,Yusuf, I.Z. and Adamu, A. (2014). Genetic combination of human rotavirus strains involved in gastroenteritis among children (0-5 yrs) in three North Central States and Federal Capital Territory, Nigeria. *Journal of Medical and Applied Biosciences,* **2**(1):42-47.

Nimzing, L., Geyer, A. and Sebata, T. (2000).Epidemiology of Adenoviruses and Rotaviruses Identified in Young Children in Jos, Nigeria. *South African Journal Epidemiology Infect*, **15**:40-42.

Ndze, V.N, Achidi, A.G.,Hortense, K.L., Emilia,Enjema, M.D., Esona, K.B. and Obama, A.M. (2012).Epidemiology of Rotavirus Diarrhoea in Children under 5 years in Northern Cameroon. *The Pan African Medical Journal,* 11:73

Ojeh, C.K., Atti, D.J. and Omotade, O.O. (1995). Comparison of the genome dsRNA of human rotavirus strains in parts of Ibadan, *Nigeria. African Journal of Medical Sciences,* **24**:359-363.

Parashar, U.D., Breese, J. and Glass, R. (2006). Rotavirus and severe childhood diarrhoea. *Emerging Infectious Diseases,* **12**: 304-306.

Pennap Grace and Umoh Jerald (2010). The prevalence of group A rotavirus infection and some risk factors in pediatric diarrhea in Zaria, North central Nigeria. African Journal of Microbiology Research, **4**(14), pp. 1532-1536.

UNICEF/WHO (2009). Diarrhoea: Why children are still dying and what can be done. http://www.unicef.org/media/files/final-diarrhoea-report-october2009-final.pdf (Accessed 1st February, 2014).

APPENDIX I: RESEARCH ETHICAL APPROVAL

MINISTRY OF HEALTH
KATSINA STATE

TEL" Hon. Commissioner 065-434537(DL).
434518(DL)

State secretariat Complex,
I.B.B. Way Dandagoro
P.M.B.2075,Katsina

Permanent Secretary 065-35554
Our Ref

17th June, 2013

Mukhtar G. Lawal,
Dept of Microbiology,
A.B.U. ZARIA.

APPROVAL OF THE DIARRHEA RESEARCH

I have been directed to convey to you the approval of the honorable commissioner on your research proposal "Epidemiology of enteric viruses associated with diarrhea in children 0-5 Years old in Katsina state". That was after the state ethics subcommittee had gone through the proposal and recommended it to the state ORAC which deliberated on it and finally recommended it for approval by the commissioner.
Kindly adhere to all principles guiding ethical conduct of research in Nigeria and we wish to inform you that ORAC will as usual require your logistic support in monitoring this activity. We also would like to share the findings.
Please accept the Hon. Commissioner's highest regards.

Dr Idriss A. H
For
Hon Commissioner

"Home of Heritage and Hospitality"