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ORIGINAL RESEARCH

Determinants of Rotavirus Vaccine Acceptability Among Mothers of Children aged 0-23 Months in Ondo City, Southwest Nigeria

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Abstract

Background: Rotavirus is a leading cause of diarrhoeal deaths in children, with the highest global mortality occurring in Nigeria. This highlights the huge threat of rotavirus diarrhoea to child survival.

Objectives: To assess awareness of rotavirus diarrhoea and the determinants of acceptability of rotavirus vaccine among mothers for their children 0-23 months in a Nigerian tertiary health facility.

Methods: This health facility-based, cross-sectional study was conducted among 309 mothers of children aged 0–23 months attending a Child Welfare Clinic in Nigeria. The respondents were selected using a simple random sampling technique. A structured and validated self-administered questionnaire was used for data collection.

Results: Only 5.2% of 309 mothers had heard of rotavirus diarrhoea, and 16.2% have ever heard of rotavirus vaccine. About 80.6% of mothers would let their children receive the rotavirus vaccine. The determinants of acceptability of rotavirus vaccine for children included having secondary and higher education (adjusted odds ratio [AOR] = 2.60; p = 0.031), being a working mother (AOR = 2.31; p = 0.035), and being married (AOR = 3.16; p = 0.019). Mothers whose children had not previously experienced diarrhoea (before the survey) had 79% lower odds of receiving the rotavirus vaccine (AOR = 0.21; p = 0.006).

Conclusions: This cohort of mothers had poor awareness of both rotavirus-induced diarrhoea and the rotavirus vaccine. However, mothers are highly willing to have their children receive the rotavirus vaccine. This highlights a targeted need for health education and awareness campaigns. The need to increase awareness about rotavirus-induced diarrhoea and vaccines is emphasised.

Keywords: Acceptability, Awareness, Childhood diarrhoea, Maternal education, Rotavirus, Vaccine.

Introduction

Childhood diarrhoea remains a significant health problem for under-five children globally. With nearly 1.7 billion cases of childhood diarrhoea reported annually and 525,000 child deaths each year, the disease continues to contribute to childhood mortality. [1] Of the deaths due to diarrhoea in children, the rotavirus has been reported as a common and leading cause, accounting for almost 37% of all diarrhoea-related admissions and about 215,000 deaths. [2] More than half of these deaths occur mainly in sub-Saharan African countries such as Nigeria.[2] Similarly, the Institute for Health Metrics and Evaluation in 2019 listed Nigeria as the leading contributor to rotavirus mortality globally, [3] highlighting the magnitude of the threat posed by rotavirus diarrhoea to children in the country. In Nigeria, rotavirus accounts for approximately 30% of diarrhoea cases among children under five.[4] Rotavirus diarrhoea can result in life-threatening dehydration, requiring in-patient care and administration of intravenous fluids to affected infants.[5] Differentiating rotavirus diarrhoea from other causes of diarrhoea diseases is often difficult because it involves laboratory test confirmation that is not readily available in our environment. This suggests a first-line preventive strategy like a specific vaccination to prevent the disease.

The World Health Organization (WHO) had, in 2009, recommended introducing the rotavirus vaccine into global immunisation programs, [6] and by 2017, the WHO reiterated that all countries, particularly those with high diarrhoea deaths and burden in children, such as Nigeria, should introduce rotavirus vaccines into their national immunisation programs. [7] Adopting the rotavirus vaccine into the national health programmes of about fourteen Latin American and Caribbean countries was reported to have significantly reduced the burden of rotavirus diarrhoea.[8] Nigeria's request for support from GAVI, the Vaccine Alliance, in introducing the rotavirus vaccine to its National Immunization Programme was approved in 2020 [9]. It took effect in the third quarter of 2022 when the country introduced the rotavirus vaccine into the National Routine Immunizations Schedule. This means that the rotavirus vaccine is now available at no cost in public health facilities and is administered to children at ages 6, 10 and 14 weeks, in addition to other vaccines in the current immunisation schedule of the country, which offers Bacillus Calmette–Guérin (BCG), Poliomyelitis, Pentavalent, Measles, and Yellow Fever vaccines. However, before the full-scale introduction of the rotavirus vaccine into the National Programme on Immunization, the rotavirus vaccine- *Rotarix*, a WHO-approved live attenuated vaccine administered through the oral route, has been commercially available in the country and accessed by families who could afford the cost as high as 47 USD (approximately, twenty thousand Nigerian naira) for just one dose of the three required doses of the vaccine. [7] Access to vaccines at no cost does not necessarily guarantee vaccine uptake by those who require it due to reasons such as poor awareness or lack of knowledge of the need for vaccination, timing, and place of vaccination. Other reported reasons are mistrust of vaccines and fears of side effects. According to the 2021 Multiple Indicator Cluster Survey (MICS) and National Immunization Coverage Survey (NICS), despite the availability of vaccines at no cost for children, only 36.2% of children had received all basic vaccinations, 18% of children in the country had not received any vaccine, and 46% missed some doses.[10] Furthermore, anecdotal evidence suggests a gap in mothers' knowledge about rotavirus as a cause of under-five diarrhoea. Additionally, prior studies had highlighted a lack of awareness among mothers regarding the availability of rotavirus vaccines in the country.

A mother's knowledge of the cause of a disease and the availability of health services for treating such a disease may strengthen her resolve to utilise such services to prevent or treat the disease. Adequate knowledge and information regarding disease and the benefit of vaccination among mothers are crucial to vaccination uptake and the success of immunisation programmes. To prevent distrust and avoid apathy and low vaccine uptake, especially for a newly introduced vaccine, the proper knowledge concerning the disease and vaccine, from the public point of view, is necessary, even for a free vaccination programme. It is, therefore, essential to evaluate the level of awareness about rotavirus diarrhoea and the factors associated with the acceptability of the vaccine. The study's findings will assist policymakers in making informed decisions and ensure the successful integration of the rotavirus vaccine into the National Immunization Programme. This study, therefore, assessed the awareness of rotavirus diarrhoea and the determinants of acceptability of rotavirus vaccine among mothers for their children aged 0-23 months in Ondo City southwest Nigeria.

Methods

Study area

The study was conducted at the University of Medical Sciences Teaching Hospital, Ondo City, a tertiary health facility in Ondo State, southwest Nigeria. The teaching hospital comprises three large complexes in different towns and offers a wide range of specialised medical care across various specialities. Additionally, the hospital serves undergraduate and postgraduate medical training.

Study design and participants

The study adopted a health facility-based, cross-sectional design. It was conducted among mothers of children aged 0–23 months attending the Child Welfare Clinic for immunisation services and treatment of common ailments. The sample size was estimated using the Leslie Kish formula, with a prevalence of 76%, [11] an error margin of 5%, and a 95% confidence interval, given a possible 10% non-response rate. [12] The minimum estimated sample size was 309 respondents. Thus, the study enrolled 309 mothers aged 18 years and above, with an index child aged 0-23 months. The index child refers to the child aged 0-23 months brought to the clinic, on whom the mother provided information for the study.

Inclusion and exclusion criteria

The researchers included mothers of children 0–23 months in the study since the age for rotavirus vaccination was children less than one year. According to the National Policy on Immunisation in Nigeria, the age group 0-23 months was expected to have completed all the recommended vaccinations for that age group.[10] Non-consenting mothers and those with severely ill children were excluded from the study at the time of data collection.

Sampling technique

The study participants were selected using a simple random sampling technique. First, a list of mothers with index children attending the child welfare clinic was generated daily to form the sampling frame. The participants were selected from the frame using a simple random sampling technique by balloting. The selection process was repeated in every Child Welfare Clinic session until the targeted number of participants was obtained. This sampling technique was chosen to give all eligible mothers an equal opportunity to be selected for the study.

Data collection instruments

A purpose-designed, structured and validated self-administered questionnaire was used for data collection. The questionnaire was pre-tested on selected mothers of children 0-23 months at another health facility, with necessary modifications done afterwards. The final questionnaire used in the study had three sections. The first section was related to the participants' sociodemographic characteristics.

The second section assessed awareness about rotavirus diarrhoea and the vaccine, while the third section assessed participants' acceptance of rotavirus vaccine for their children.

Study variables

The dependent variable was the acceptability of the rotavirus vaccine. In contrast, the independent variables were mothers' awareness of rotavirus diarrhoea, vaccine, age, occupation, education, age and sex of the child, mother's source of information, and religion.

Statistical methods

The data were analysed using IBM SPSS ver. 22.0 (IBM Corp., USA). Frequencies and percentage distributions were used to express sociodemographic variables. Mothers' acceptance of the rotavirus vaccine for their children was presented as a bar graph. For bivariable analysis, maternal age was re-grouped into 15–24 years, 25–34 years, and ≥35 years, while maternal education level was classified into no formal education and primary, secondary and higher education. Bivariable analysis using the Pearson Chi-Squared test was performed to assess crude association between, awareness of rotavirus vaccine, sociodemographic characteristics, and the acceptability of rotavirus vaccine among mothers for their children aged 0-23 months. Multivariable logistic regression was used to assess the determinants of mothers' acceptability of rotavirus vaccine for their children. Factors with p-values less than 0.25 [13] in bivariable analysis were included in multivariable analysis. The adjusted odds ratios (AORs) and 95% confidence intervals (CIs) were used to estimate the association between mothers' acceptability of the rotavirus vaccine and each studied independent variable. Statistically significant *P* value was set at <0.05.

Ethical consideration

The Institutional Review Board of the University of Medical Sciences, Ondo City, Nigeria (NHREC/TR/UNIMED-HREC-Ondo St-22/06/21) approved the study protocol. Written or verbal informed consent was obtained from each participant. The research ensured the confidentiality of the participants.

Results

Sociodemographic characteristics of Mothers and their Children

A total of 309 mothers participated in the study. Most respondents (55%) were aged 25-34 years, and a large percentage (91.6%) were married. Only 4.5% of the mothers were without formal education. Most of the mothers were employed (84.1%) and mainly were Christians (90.3%) (Table I).

Prevalence of diarrhoea and awareness of rotavirus diarrhoea.

Less than one-fifth (17.8%) of mothers reported that their children had diarrhoea within the preceding two weeks. Only 5.2% of these mothers have heard of rotavirus diarrhoea, and just 16.2% were aware of the rotavirus vaccine (Table II). The primary sources of information about the vaccine were health workers and other mothers (82%), with the mass media accounting for 18%.

Vaccine acceptability among mothers and associated factors

Most mothers (80.6%) were willing to allow their children to take the rotavirus vaccine (Figure 1). On bivariable analysis, a higher proportion of mothers whose children had diarrhoea before the survey (92.7%) were willing to accept the vaccine than those whose children did not (p = 0.012). In addition, a significant association was found between mothers' marital status and willingness to vaccinate children (p = 0.010), with a higher proportion of married mothers (82.3%) willing compared to unmarried mothers (61.5%). Similarly, a higher percentage of mothers with secondary and higher levels of education (82.6%) were willing to vaccinate their children against rotavirus (p = 0.019). Furthermore, maternal occupation also showed a significant association with willingness to vaccinate (p = 0.011). Religion was significantly associated

with willingness to vaccinate children (p = 0.043).

Table I: Sociodemographic characteristics of study participants (n=309)

Variable	*Frequency*	*Percentage*
Maternal age range (Years)		
15-24	67	21.7
25-34	170	55.0
≥ 35	72	23.3
Marital status		
Unmarried	26	8.4
Married	283	91.6
Maternal education		
No formal education	14	4.5
Primary education	25	8.1
Secondary education	136	44.0
Tertiary education	134	43.4
Maternal employment status		
Not formally- employed	49	15.9
Formally- employed	260	84.1
Child's age (months)		
0-11	197	63.8
12 -23	112	36.2
Sex of the child		
Male	164	53.1
Female	145	46.9
Religion		
Christianity	279	90.3
Islam	30	9.7

However, awareness of rotavirus diarrhoea (p = 0.562), maternal age (p = 0.064), child's age (p = 0.601) and gender of the child (p = 0.250) had no association with willingness to vaccinate their children.

Multivariable analysis to assess the determinants of acceptability of rotavirus vaccine for children among the study participants revealed, as shown in Table III, that 79% lower odds of accepting rotavirus vaccination among mothers whose children had not previously had diarrhoea before the survey (AOR = 0.21; 95% CI = 0.07-0.63, p = 0.006). However, the odds of accepting the rotavirus vaccine for children were three times higher among married mothers than unmarried mothers (AOR = 3.16; 95% CI = 1.79-4.85, p = 0.019). Similarly, the odds of vaccine acceptability were 2.6 times higher among mothers with secondary education and higher (AOR = 2.60; 95% CI = 1.09-6.17, p = 0.031) and 2.3 times higher among working mothers than none working mothers (AOR = 2.31; 95% CI = 1.06-5.02, p = 0.035).

Discussion

With rotavirus infection described as a leading cause of death from childhood diarrhoea and the lack of readily available laboratory techniques for disease confirmation, vaccination remains the most effective strategy for preventing rotavirus diarrhoea. The success of vaccination programs depends on the acceptance and uptake of vaccines, among other factors, especially for vaccines that are newly added to the immunisation schedule. In this study, aproximately18% of the children had experienced diarrhoea in the two weeks preceding the survey. This prevalence is similar to the national average of twenty per cent

reported in the 2018 Nigeria Demographic Health Survey (NDHS) for this age group [14] and that reported from a previous study in northern Nigeria. [15]

Table II: Mothers' awareness of rotavirus diarrhoea and vaccine (n = 309)

Variable	Frequency	Percentage
The index child had diarrhoea two weeks before the survey		
Yes	55	17.8
No	254	82.2
Ever heard about Rotavirus diarrhoea		
Yes	16	5.2
No	293	94.8
Ever heard about the Rotavirus vaccine		
Yes	50	16.2
No	259	83.8
Is the Rotavirus vaccine available free?		
Yes	97	31.5
No	78	25.3
I don't know	134	43.2
Source of information		
Health workers & other mothers	41	82.0
Mass Media (print & internet, radio etc)	9	18.0

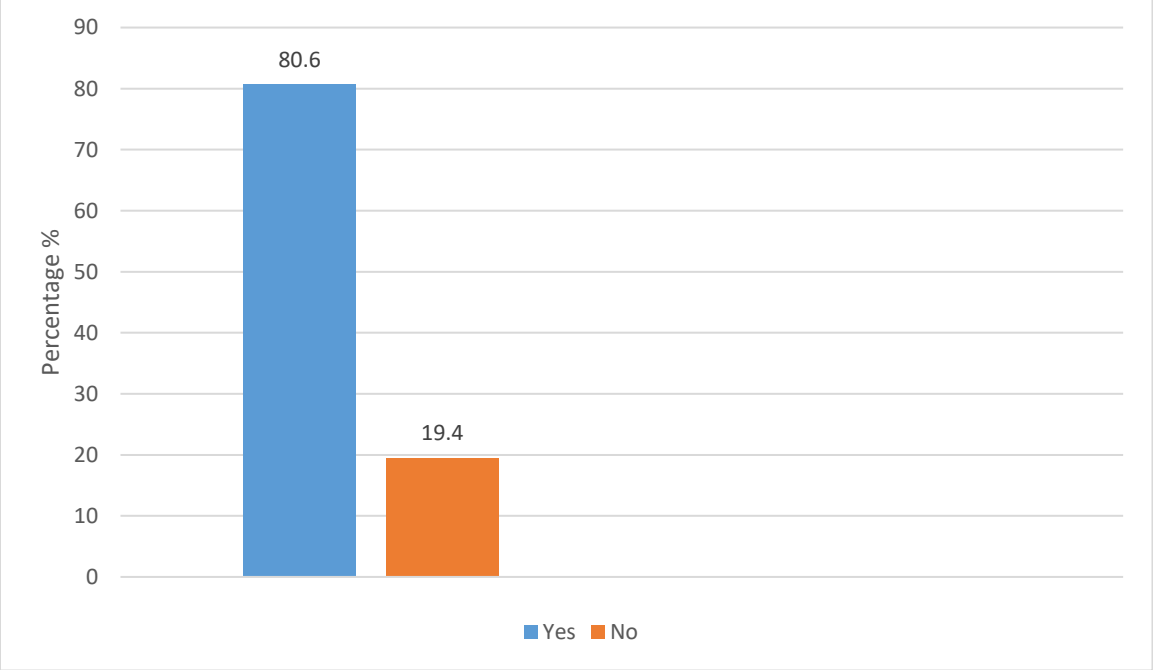

Figure 2: Willingness of mothers to vaccinate their children with the Rotavirus vaccine.

The prevalence of diarrhoea in this study is thus similar to that within the country. An effective strategy is required to reduce the associated mortality, particularly from a leading cause of childhood diarrhoea, such as the rotavirus. [4]

In the present study, only 5.2% of mothers had ever heard of rotavirus diarrhoea. This contrasts with Pratiwi *et al.*'s study in Indonesia, where more than fifty per cent of the respondents were aware of rotavirus diarrhoea.[11] This high disparity in awareness may be because the rotavirus vaccine has been part of Indonesia's immunisation schedule for a long time. This could have given mothers more opportunities to learn about rotavirus diarrhoea during health education and vaccination sessions for the children. Furthermore, policy and contextual differences between the two countries may also be a possible contributing factor to the finding.

Table III: Determinants of acceptability of rotavirus vaccine among mothers of children 0-23 months

Variable	*Willingness to accept rotavirus vaccine*		*AOR (95% CI)*	*p-value*
	Yes	*No*		
Index child had diarrhoea before the survey				
Yes *(Ref)*	51 (92.7%)	4 (7.3%)	1	
No	198 (78.0)	56 (22.0)	0.21 (0.07-0.63)	0.006
Maternal age				
15-24*(Ref)*	51 (76.1)	16 (23.9)	1	
25-34	145 (85.3)	25 (14.7)	1.07 (0.47-2.43)	0.373
≥ 35	53 (76.6)	19 (24.6)	0.42 (0.20-1.87)	0.108
Marital status				
Unmarried *(Ref)*	16 (61.5)	10 (38.5)	1	
Married	233 (82.3)	50 (17.7)	3.16 (1.79–4.85)	0.019
Maternal Education				
NFE and primary *(Ref)*	26 (66.7)	13 (33.3)	1	
Secondary and higher	223 (82.6)	47 (17.4)	2.60 (1.09-6.17)	0.031
Maternal employment status				
Not formally employed *(Ref)*	33 (67.3)	16 (32.7)	1	
Formally employed	216 (83.1)	44 (16.9)	2.31 (1.06–5.02)	0.035
Religion				
Christianity *(Ref)*	229 (82.1)	50 (17.9)	1	
Islam	20 (66.7)	10 (33.3)	1.83 (0.71-4.71)	1.210
Sex of the child				
Male *(Ref)*	136 (82.9)	28 (17.1)	1	
Female	113 (77.9)	32 (22.1)	1.39 (0.76-2.54)	0.285

NFE - No formal education; AOR - Adjusted Odds ratio; CI - Confidence interval

This finding suggests the need to educate mothers on rotavirus diarrhoea so that they recognise the need for and importance of preventive measures such as the rotavirus vaccine recently included in the national immunisation schedule.

In addition, only 16.2% of mothers in this study were aware of the rotavirus vaccine, similar to the findings from a study conducted in Ekiti, southwest Nigeria, [4] and Pakistan. [16] The Ekiti. Nigeria study was conducted before the government added the rotavirus vaccine to the national immunisation schedule as a free vaccine. The present study and that of Ekiti, Nigeria, are from the same region, suggesting that there is still a lack of awareness regarding the vaccine even after becoming freely available. The low awareness about the vaccine among mothers in this study contrasts with the findings of studies from other countries, which reported a high level of understanding. [11, 17] A possible explanation is that the vaccine was only recently added to the national immunisation schedule in Nigeria at no fee, and it might take a while for awareness to increase among mothers. This finding emphasises the importance of continuous

education and information about the vaccine during immunisation sessions and related clinics such as the antenatal clinic. The acceptance of the rotavirus vaccine was high in the present study, with eight in every ten mothers willing to allow their children to receive it. This study's high acceptance level is consistent with a previous study conducted within the country [4] and another in Italy.[17] These studies reported higher rates of acceptance of the rotavirus vaccine compared to what the present study observed. The high acceptance observed in the present study could be attributed to the general awareness of the benefits of childhood vaccination among mothers and the high-level campaigns around childhood immunisation.

The study further found that mothers whose children had diarrhoea before the survey were more willing to vaccinate their children with the rotavirus vaccine, unlike mothers whose children had no previous episode of diarrhoea before the study. This result is not unexpected because mothers' awareness of health services for their children's illnesses may motivate them to use such services to prevent repeat episodes and care for their sick child. Similarly, the study observed an association between mothers' marital status and acceptance of the rotavirus vaccine. This finding may not be surprising because married women may receive spousal support to strengthen their resolve to adhere to all childhood immunisations and other essential child health practices due to their partner's encouragement and motivation. Partner support has been reported to improve maternal and child health outcomes. [18,19] The present study found that mothers with secondary and higher education were more likely to accept the rotavirus vaccine for their children. This finding is consistent with previous studies that have suggested that education plays a role in increasing awareness about child health practices [20-22] and may have contributed to the findings in this study. Literacy impacts people's views about events in life, and it is not unlikely that it does the same even in child healthcare.

Another finding of this study is that formally employed mothers were more willing to accept the rotavirus vaccine than those who were not. A possible explanation may be that formally employed mothers may have better access to relevant child health information during work or other sources they interact with daily. In addition, mothers who work in formal employment often have a higher level of education. This educational background could positively aid in their perception of the benefits of immunisation, thus influencing acceptance of the rotavirus vaccine. The association between marital status, maternal employment status, maternal education status, and the acceptance of the rotavirus vaccine contrasts with a previous study in Nigeria [4], which did not find any relationship between these demographic characteristics and acceptance of the rotavirus vaccine. The variance in the findings could be due to differences in the study population in both studies. The present study focused on mothers with children aged 0-23 months, which aligns with the national recommendation on vaccination completion. In contrast, the previous study involved mothers of children under five years of age in general. [4, 23] However, other previous studies have demonstrated that socioeconomic status impacts health-seeking behaviour in child health care; this may also apply to the findings of this study. [21,24]

Considering the findings presented above, healthcare providers should prioritise raising awareness about the availability of rotavirus vaccine and other vaccines included in the national schedule. This will significantly improve vaccine uptake by leveraging the readiness and willingness to accept vaccines, as demonstrated by mothers in this study. Additionally, it is crucial to include sufficient childhood vaccination education and information in health education sessions for mothers and caregivers to strengthen mothers'

awareness of vaccination. By doing so, mothers can become a source of awareness for other mothers.

This study has its strengths and limitations. The study's strength is that it provides valuable insight into the acceptability of the recently introduced rotavirus vaccine among mothers of children under two years. However, it is essential to note the limitations of this study. First, the cross-sectional nature of the data limits inferring causal relationships. Second, there is the possibility of recall bias and the inability to verify the data due to the nature of the study design. Lastly, the recruitment of respondents from the child welfare clinic may have contributed to the high acceptability of the rotavirus vaccine among respondents in this study, as caregivers may be exposed to vaccination information from immunisation clinics, often around Child Welfare Clinics. These limitations have implications for future research on the acceptability of the rotavirus vaccine. Future community-based studies are recommended to explore and identify factors other than those reported in this facility-based study.

Conclusions

The study reveals a high willingness to vaccinate children with the rotavirus vaccine despite a low awareness of rotavirus diarrhoea and the vaccine. This finding underscores the importance of raising awareness about rotavirus diarrhoea and the availability of the vaccine.

Authors' Contributions: OAO conceived the study. All the authors designed the study, did a literature review and collected the data. OAO and OT analysed the data. OAO, FFO and OT interpreted the data. OAO, FFO and BOE drafted the manuscript. All the authors revised the manuscript for sound intellectual content and approved the final version of the manuscript.

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