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Maternal Education and Diarrhea among Children aged 0-24 Months in Nigeria

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Abstract

Childhood diarrhea remains a problem in countries like Nigeria where access to potable water, good hygiene and sanitation are lacking. Maternal education is an important determinant of health status of under-five children. Very few studies have investigated the relationship between maternal education and diarrhea in children in Nigeria. Therefore, this study was implemented to fill the gap. The study design was cross-sectional and 2013 National Survey was used. Children aged 0-24 months were investigated and the dependent variable was diarrhea status of the index child in the last two weeks prior the survey. The main independent variable was maternal education. Data were analyzed using Chi-square and Logistic regression models (α=0.05). Diarrhea prevalence was 13.7% and higher (15.5%) among children of women who have no formal education, and mothers living in the North East region of Nigeria experienced the highest prevalence (26.4%). Children whose mothers had no formal education were 2.69(CI= 1.800-4.015, p<0.001) more likely to have diarrhea as compared to those who had higher education. Maternal education is an important predictor of diarrhea among children aged 0-24 months in Nigeria. Policies to reduce diarrhea among children in Nigeria should target children of the illiterate, less educated mothers and those living in the North-West. *(Afr J Reprod Health 2017; 21[3]: 27-36).*

Keywords: Maternal Education, Childhood diarrhea, Nigeria

Résumé

La diarrhée infantile demeure un problème dans des pays comme le Nigéria où l'accès à l'eau potable, à la bonne hygiène et à l'assainissement manque. L'éducation maternelle est un déterminant important de l'état de santé des enfants de moins de cinq ans. Très peu d'études ont étudié la relation entre l'éducation maternelle et la diarrhée chez les enfants au Nigeria. Par conséquent, cette étude a été mise en œuvre pour combler l'écart. La conception de l'étude était transversale et l'enquête nationale de 2013 était utilisée. Les enfants âgés de 0 à 24 mois ont été étudiés et la variable dépendante était le statut de diarrhée de l'index chez les deux dernières semaines avant l'enquête. La principale variable indépendante était l'éducation maternelle. Les données ont été analysées à l'aide de modèles de régimes de Chi-carré et de régression logistique (α = 0,05). La prévalence de la diarrhée était de 13,7% et plus élevée (15,5%) chez les enfants des femmes qui n'ont pas reçu l'éducation formelle, et les mères qui habitent dans la région nord-est du Nigeria ont connu la plus forte prévalence (26,4%). Les enfants dont les mères n'ont pas reçu une éducation formelle étaient 2,69 (IC = 1,800-4,015, p <0,001) plus susceptibles d'avoir une diarrhée par rapport à ceux qui avaient fait des études supérieures. L'éducation maternelle est un indice important de la diarrhée chez les enfants âgés de 0 à 24 mois au Nigéria. Les politiques visant à réduire la diarrhée chez les enfants au Nigéria devraient cibler les enfants des analphabètes, des mères moins instruites et des personnes habitant dans le Nord-Ouest. *(Afr J Reprod Health 2017; 21[3]: 27-36).*

Mots clés: Education maternelle, diarrhée infantile, Nigéria

Introduction

Diarrhea is the second disease responsible for under-five mortality worldwide after pneumonia[1]. Each year, 2.5 billion cases of diarrhea, likely to result in death or other health problems, occur among under-five children[2,3], more than half of these cases occur in Africa and South Asia[1]. A global report estimates 111 million cases and 453,000 mortalities in under-five children to

rotavirus annually (with 232,000 deaths occurring in sub-Saharan Africa)[4]. Statistics have shown that about 20% of child death in sub-Saharan Africa occurs in Nigeria[5-7]. The infant and childhood mortality rates in Nigeria are 69 and 128per 1,000 live births respectively and these are among the highest rates globally[8]. Childhood diseases including diarrhea account for greater proportion of childhood deaths in Nigeria[2, 9]. The incidence of childhood diarrhea is estimated to account for over 160,000 of all deaths in under-five children annually in Nigeria[10]. Diarrheal incidence has been found to be highest in the first two years of life and declines as a child grows older[11]. The occurrence of diarrhea comes with symptoms like vomiting, stooling and can quickly lead to dehydration in young children[1,12]. Signs of dehydration include thirst, irritability, restlessness, lethargy, sunken eye, dry mouth and tongue, dry skins and fewer trips to the bathroom to urinate. Others include lack of interest in playing and extreme sleepiness, fast breathing and rapid heartbeat[12]. Diarrhea incidence remains a tremendous burden on children in low- and middle-income countries due to multiple determinants such as; child malnutrition, low socioeconomic status, maternal education, lack of safe drinking-water, inadequate sanitation and poor hygiene[11]. These determinants of diarrheal disease are strongly linked to poverty and social inequities[11]. Children living in impoverished areas also have higher case-fatality rates compared to children living in high-income countries due to lack of access to quality health care and timely and effective treatment with oral rehydration solution (ORS) and zinc[13,14]. Maternal education is recognized as one of the strongest determinants of infant survival in developing countries[15].

In Nigeria, most of the studies linking maternal education and child nutrition have focused on detecting different ways through which the education of a mother affects the health of her children[16, 3]. Raji and Ibrahim (2011)[16] argued further that the education of the mother plays an important role in determining child survival. The pathways highlighted by his paper include improved mother's health knowledge and greater control over the health choices for her children, among others. Also studies from Caldwell's' paper have shown mixed results about the effect of maternal education on child health status[17]. Gwatkin *et al.*[8] found that prevalence of child health especially diarrhea is lower among children of educated mothers. It is therefore not unlikely that low level of mother's knowledge may militate against the effective performance of diarrhea prevention practices.

However, it is expected that maternal education should improve child health because education has been linked to family socioeconomic situation, which in itself is a determinant of child health[19]. Above and beyond this, maternal education is hypothesized to bring about certain changes in individual behavior that result in better child health[19]. Caldwell and Caldwell[17] suggests two potential paths: education improves child health solely by enhancing the use of modern health services; and education results in a wide range of favorable behaviors-mostly connected with child care-that play a role in improving child health.

Years of formal education are a well-recognized indicator of social position and have been frequently used in international surveys to explore social inequalities[20- 22]. These studies show that people with progressively more advanced levels of education have better health and longer lives than those without. However, going by the benefits of education in the management of disease conditions, one may ponder that maternal education is likely to be linked to diarrhea, since women are primary caregivers of under-five children. Therefore, this study investigated the relationship between maternal education and childhood diarrhea among children aged 0-24 months which in agreement with other studies is a less researched area in Nigeria. The study also seeks to understand the mechanism by which education affects child health as an imperative for policy making.

Methods

Study area

The study was conducted in Nigeria, a country in the western part of Africa and the most populous country in Africa. The Nigerian population

pyramid shows the population is young and children between the ages of 0 and 5 years are more than any other age segment of the population. The country is predominantly rural and a higher proportion of women of reproductive age are still uneducated. Potable water supply is inadequate and many households find their own means of water supply such as wells, bore-holes, rain water, and streams. There are two major seasons in Nigeria, the dry and wet seasons. Nigeria has tropical climate with temperatures staying consistently hot. April to October is the rainy season. Average temperatures at this time range from a low of 23°C / 74°F to a high of 30°C / 86°F.

Data collection and sample selection

The study was cross-sectional in design and used a national representative data that is 2013 Nigeria Demographic and Health Survey. During the survey, cluster sampling approach was used to select the respondents based on allocation of specific numbers of clusters to rural and urban settlements in the country. Different questionnaires were designed to obtain information related to men, women, household, couples and children. However, the current study used children recode data and analysis was based on information supplied on index child by subjects (care givers). Subjects with no information on diarrhea status of the index child were excluded from the study. Thus, 6834 women who provided information on the diarrhea status and other socio-economic characteristics were studied.

Variable description

In the original questionnaire used for the survey, a question was asked to ascertain whether a child had diarrhea in the last 2 weeks prior the survey and the response was either yes or no. This variable was used as the dependent variable and demographic variables such as; age of the mother, region, place of residence, marital status, sex of the child and age of the child were used as independent variables. Others include the socio-economic characteristics of women like toilet facility, religion, ethnicity, wealth index, working

status and disposal of youngest child stool. Education was the main independent variable.

Data analysis

Since cluster design approach was used for data collection, the data was weighted before use in order to extrapolate and account for other areas not included in the clusters during the survey. Data were analyzed using descriptive statistics, Chi-square and logistic regression model. Frequency distribution was used to present the data and Chi-square test was conducted to determine factors that are significantly associated with diarrhea status of the children. At multivariate level of analysis, logistic regression was used due to dichotomous nature of the dependent variable to identify the predictors of diarrhea among the children. At this stage of analysis, three models were generated. Three models were used to describe the relationship between maternal education and diarrhea among 0-24 months' old children. In the first model, only maternal education, which was the main independent variable, was introduced into the model while the disposal of youngest baby's stool in the household and education were jointly used in the second model, the third model is the full model where all variables that were found to be statistically significant at bivariate level of analysis were used. The last model was used to identify the predictors of diarrhea among children aged 0-24 months in Nigeria. It also reveals the influence of other variables on the relationship between education and diarrhea among the children. All statistical tests were performed at 5.0% level of significance.

The three models were defined by the mathematical equations as follow:

$$log_e\left(\frac{p}{1-p}\right) = \beta_0 + \beta_1 x_{i1}; i = 1 \tag{1}$$

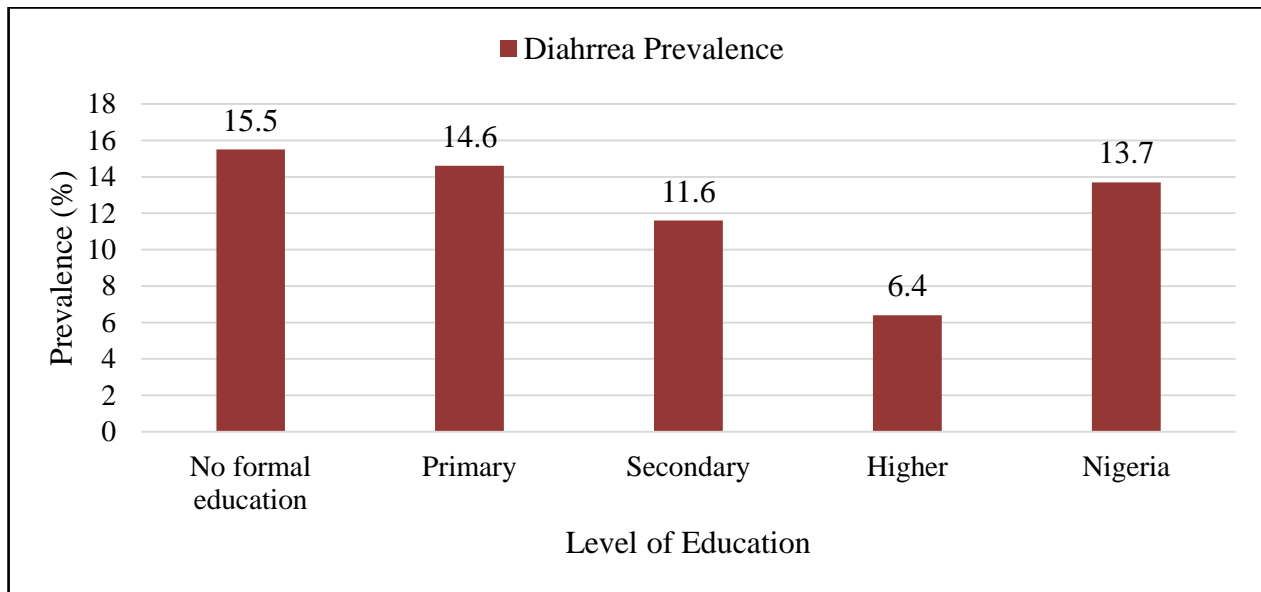$$log_e\left(\frac{p}{1-p}\right) = \beta_0 + \beta_1 x_{i1} + \beta_2 x_{i2}; i = 1,2 \tag{2}$$

$$log_e\left(\frac{p}{1-p}\right) = \beta_0 + \beta_1 x_{i1} + \beta_2 x_{i2} + \cdots + \beta_p x_{i1}; i = 1,2,3,\dots,n \tag{3}$$

Chi-square value =35.993, p<0.001

Figure 1: Prevalence of Diarrhea among Children aged 0-24 Months according to Maternal Level of Education

Ethical consideration

Ethical approval was obtained from the National Ethical Review Board of the Federal Ministry of Health before conducting this survey. Informed consent was obtained from the study participants at the point of data collection and all the consented participants were assured of confidentiality and anonymity of the information they supplied.

Results

In figure 1, the data show that there was a significant association between level of education and diarrhea status among children aged 0-24 months in Nigeria. Also, the prevalence of diarrhea falls consistently as the level of maternal education increases. It reduces from 15.5% among children of women who have no formal education to 6.4% among those whose mothers have tertiary education. Diarrhea prevalence among children aged 0-24 months was found to be 13.7% in Nigeria.

Data in Table 1 showed that the prevalence of diarrhea was significantly associated with the: geopolitical region, marital status of the mother and age of the child. Children residing in the North East region of Nigeria had the highest prevalence of diarrhea (26.4%) (p= 0.001). Children with mothers who were formerly in a union and those aged 7-18 months had the highest diarrhea prevalence of (21.6%) (p<0.007), and (18.5%) (<0.001) respectively.

In Table 2, the data showed that experience of diarrhea in the last 2-weeks before the survey was significantly associated with religion, ethnicity, wealth index and the disposal practices of fecal waste of the youngest child in the household. Children of mothers who practiced Islamic religion had higher prevalence of diarrhea (15.5%) compared to their counterparts who are Christians (10.7%). About 15.0% of children of mothers who are from Hausa/Fulani ethnic background had diarrhea, while 13.1% and 8.9% were found among the children of Igbo and Yoruba mothers respectively. The percentage of mothers who reported that their children had diarrhea reduced as the level of wealth index increased; it reduced from 16.4% among children of women in poorest wealth index category to 9.6% among children of mothers in the richest wealth quintile.

The disposal practices of the fecal waste of the youngest child were significantly associated with the prevalence of diarrhea. Children whose mothers reported disposing the fecal waste of their youngest child in the pit toilet/ latrine

Table 1: Percentage Distribution of Children according to Diarrhea Status by Demographic Characteristics

Demographic Characteristics	Experienced Diarrhea No (%)	Yes (%)	Total	χ^2-value (p-value)
Total	5899(86.3)	935(13.7)	6834	
Age of the mother (in year)				7.385
15-24	1758 (84.8)	315(15.2)	2073	(0.061)
25-29	1698 (86.9)	256 (13.1)	1954	
30-34	1243 (87.8)	172 (12.2)	1415	
35-49	1200(86.2)	192 (13.8)	1392	
Region				273.531***
North Central	868 (89.9)	98 (10.1)	966	(<0.001)
North East	1033 (73.6)	371(26.4)	1404	
North West	2069(88.4)	271(11.6)	2340	
South East	497 (85.5)	84 (14.5)	581	
South South	685 (95.1)	35 (4.9)	720	
South West	747 (90.8)	76 (9.2)	823	
Place of Residence				3.755
Urban	1910 (87.5)	273(12.5)	2183	(0.053)
Rural	3989 (85.8)	662 (14.2)	4651	
Marital Status				7.334
Currently in union	5794 (86.5)	906 (13.5)	6700	(0.007)**
Formerly in union	105 (78.4)	29 (21.6)	134	
Sex of child				0.178
Male	2953 (86.1)	475 (13.9)	3428	(0.673)
Female	2946 (86.5)	460 (13.5)	3406	
Age of the child (in months)				
0-6	1592 (95.7)	71 (4.3)	1663	182.256***
7-18	2333 (81.5)	529 (18.5)	2862	(<0.001)
19-24	1974(85.5)	335(14.5)	2309	

***Significant at 0.1%; **Significant at 1.0%

reported highest prevalence of diarrhea (14.5%) than those who throw it into the garbage (13.6%) or rinse away (8.3%).

In Table 3, the first model showed that diarrhea prevalence decreased consistently with increasing educational level. Children whose mothers had no formal education (OR=2.69; CI= 1.800-4.015, p<0.001) were more likely to have diarrhea compared to those who had higher education. This was also the pattern for those who had primary and those with secondary education.

In the second model, the significant association between mothers' educational level and the prevalence of diarrhea remained with the addition of another predictor- *the disposal practices of the youngest child's stool* into the regression analysis. Mothers who rinsed away the stool of the youngest child in the household were less likely to have an index child with diarrhea (OR= 0.55; CI = .404 - .738, p<.000) compared to those who threw it in the garbage (OR=0.97;

CI=0.824-1.139, p>0.05).

In the third model, it was interesting to note that when other confounding variables were introduced into the regression equation, a significant association still existed between diarrhea prevalence and educational level. Children whose mothers had primary education (OR= 2.13; CI=1.33 – 3.41, p<.000) were more likely to have diarrhea compared to those who had secondary education (OR=1.84; CI =1.186 -2.842) or no education (OR= 1.87; CI= 1.151-3.046, p<.000) although the pattern was no longer consistent. The geopolitical region was a predictor of diarrhea prevalence, children in the North-West geopolitical region of Nigeria were more likely to have diarrhea (OR= 3.20; CI = 2.097-4.892, p<.000) compared to those in the South-South (OR=1.68; CI=0.864-3.253, P>0.05) or South West (OR= 0.45; CI =.271-.738, p=.002) regions. The age of the child was another significant predictor of diarrhea prevalence, children aged 7-18 months were more

Table 2: Percentage Distribution of Children according to Diarrhea Status by Socio-economic/health Related Characteristics

Background Characteristics	Experienced Diarrhea		Total	χ^2-value
	No (%)	Yes (%)		(p-value)
Total	5899(86.3)	935(13.7)	6834	
Toilet facility				1.841
Improved	2856 (85.7)	475 (14.3)	3331	(0.175)
Unimproved	3043 (86.9)	460 (13.1)	3503	
Religion				31.331***
Christianity	2303 (89.3)	276 (10.7)	2579	(<0.001)
Islam	3545 (84.5)	651 (15.5)	4196	
Others	51 (86.4)	8 (13.6)	59	
Ethnicity				18.067***
Hausa/Fulani	2489 (85.2)	434 (14.8)	2923	(<0.001)
Igbo	605 (86.9)	91 (13.1)	696	
Yoruba	668 (91.1)	65 (8.9)	733	
Others	2137 (86.1)	345 (13.9)	2482	
Wealth Index				32.940***
Poorest	1341 (83.6)	263 (16.4)	1604	(<0.001)
Poorer	1377 (84.6)	251 (15.4)	1628	
Middle	1139 (86.7)	175 (13.3)	1314	
Richer	1096 (88.3)	145 (11.7)	1241	
Richest	946 (90.4)	101 (9.6)	1047	
Working Status				0.352
Not-working	2036(86.0)	332(14.0)	2368	(0.553)
Working	3863 (86.5)	603 (13.5)	4466	
Disposal of youngest child stool				17.809***
Toilet/latrine	3112 (85.5)	527(14.5)	3639	(<0.001)
Rinse away	573(91.7)	52 (8.3)	625	
Throw into garbage	1670(86.4)	262 (13.6)	1932	
Others	544(85.3)	94(14.7)	638	

***Significant at 0.1%

likely to have diarrhea (OR=5.67; CI= 4.369 - 7.368, p<.000) compared to those aged 19-24 months (OR =4.15; CI= 3.172- 5.435, p<.000).

The predictors of diarrhea prevalence were mother's level of education, disposal practices of the youngest child's stool, the geopolitical region where the child is domiciled and the age of the child.

Discussion

Studies in developed and developing countries have investigated factors contributing to the prevalence of diarrhea among children in diverse settings[23, 24]. A number of studies conducted in Nigeria focused on diarrhea morbidity, risk factors, care and management[24, 16, 3]. There are however few documented national studies that used maternal education as a major factor for diarrhea occurrence. This study has therefore revealed how maternal educational attainment influences

childhood diarrhea in Nigeria. In this study, the factors found to be associated with diarrhea among children aged 0-24 months were; maternal education, religion, ethnicity, wealth index and the disposal practices of fecal waste of the youngest child, while the identified predictors were maternal education, the geopolitical region where the child resides and child's age.

Substantial consideration has been given to the relationship between maternal education, and child health in the literature. Among all the social determinants of health that explain health inequalities in any population, education has been consistently identified as a main factor and this has been extensively established in wider literature[25]. Education is critical to population health and its health benefits accrue at the individual, community and socio-cultural context[26]. More educated women may have tendency to navigate the health care system, have better personal health behaviors, and better able to possess a comprehension of the

Table 3: Binary Logistic Regression of Relationship between Diarrhea among Children according to Background Characteristics

Background characteristics	Model 1 UOR(95% C.I)	Model 2 AOR(95% C.I)	Model 3 AOR(95% C.I)
Highest educational level			
No education	2.69(1.800-4.015)***	2.68(1.794-4.014)***	1.87(1.151-3.046)*
Primary	2.52(1.657-3.832)***	2.62(1.720-3.985)***	2.13(1.331-3.411)**
Secondary	1.92(1.268-2.908)**	1.97(1.301-2.988)**	1.84(1.186-2.842)**
Higher	1	1	1
Region			
North Central			1
North East			0.94(0.627-1.414)
North West			3.20(2.097-4.892)***
South East			1.01(0.646-1.588)
South South			1.68(0.864-3.253)
South West			0.45(0.271-0.738)**
Age of the child (in months)			
0-6			1
7-18			5.67(4.369-7.368)***
19-24			4.15(3.172-5.435)***
Disposal of youngest child stool			
Toilet/latrine		1	1
Rinse away		0.55(0.404-0.738)***	0.93(0.671-1.295)
Throw into garbage		0.97(0.824-1.139)	1.12(0.921-1.349)
Others		0.96(0.760-1.224)	1.18(0.911-1.531)
Religion			
Christianity			1
Islam			1.03(0.796-1.331)
Others			1.10(0.494-2.407)
Ethnicity			
Hausa/Fulani			1
Igbo			0.79(0.417-1.494)
Yoruba			0.83(0.529-1.307)
Others			0.88(0.701-1.115)
Wealth Index			
Poorest			0.97(0.688-1.362)
Poorer			0.99(0.719-1.376)
Middle			1.01(0.742-1.379)
Richer			0.99(0.740-1.332)
Richest			1
-2 Log likelihood	*5415.372*	*5397.362*	*4935.869*
Cox & Snell R Square	*0.006*	*0.008*	*0.073*
Nagelkerke R Square	*0.011*	*0.015*	*0.133*

***Significant at 0.1%; **Significant at 1.0%; UOR: Un-adjusted Odds Ratio; AOR: Adjusted Odds Ratio

basic consequences of unhealthy living than the less educated. World-wide, previous studies have identified maternal education as a major predictor of child health outcomes[27]. In this study, maternal education has been identified as an important predictor of childhood diarrhea. This finding is an indication that children of mothers with lower educational attainment have a higher risk of experiencing childhood diarrhea than those whose mothers are better educated. This is in line with community-based studies conducted in Asia and sub-Saharan Africa[28, 29, 21, 22]. The possible reasons for this finding in Nigeria, is that better educated mothers are involved in practices that are of benefit to the health of their children.

Chronic diarrhea can affect children of any age but its occurrence varies across childhood period. In this study, children aged between 7 and 18 months were found to experience higher occurrence of diarrhea than those below 7 months and those above 18 months. This pattern could be explained that this age range is the period in which

most children are exposed to contaminants through their surroundings by crawling. This period is also associated with the weaning period of the children and its associated challenges. A study by Sinmegn et al[30], corroborates this assertion.

Wealth index was found to be related to the occurrence of diarrhea and more prevalent among children of women from poorer homes. This finding is corroborated by the study of Boardi and Keutunen[31]. However, according to Siziya, et al [32], no relationship was established between wealth index and childhood diarrhea. In Nigeria, potable water as one of the key social responsibilities of the Government is either not available or not within the reach of the generality of the population. While the rich circumvent this situation by sinking boreholes in their houses, the poor still get their domestic water sources from unprotected wells, brooks and streams. Ability to make provisions for some factors that could limit diarrhea disease transmission by wealthier families can be explained from these findings.

Nigeria is a large country in terms of population and geographical distribution. The access to good health varies widely across the regions in Nigeria. The literacy level varies considerably across the regions in Nigeria. For instance, higher proportion of women of reproductive age has at least secondary education in the southern part of the country compared to their counterparts in the North. Even within the regions in the North, there are disparities in literacy level. Further, important finding from this study is that, diarrhea was mostly prevalent among children of women living in the Northwestern part of Nigeria. This result conforms to Raji and Ibrahim[16] study outcome where prevalence of diarrhea was found to be highest among children of women in the Northwest Nigeria. A research report by Raji et al[33], has also confirmed instances of disease outbreak in this region of Nigeria due primarily to water contamination. The same study showed that drinking water sampled from Sokoto, a major town in this region was found to contain a very high load of microbes which were far beyond the allowable limits by WHO[2]. A study carried out in Sudan by Siziya et al[32], also supports variation in diarrhea prevalence by geographic distribution.

The often consistent outcome in Nigeria could be due to the intensity of grazing which exposes most of the farmlands to contamination by cow dung and some of these animals drink from the same water sources as humans.

Limitations of the Study

The data used for this study was cross-sectional survey based on reported information on diarrhea status by the mother or caregiver of the index child in two weeks preceding the survey. As such, their responses could be subjected to recall bias and misreporting of other diseases for diarrhea. Although, the data originator ensured that such errors were minimized at the time of the study. Also, diarrhea reported for the children was not based on their clinical examination especially since reporting of illnesses differs among sociocultural groups, this could be a source of variability and thus generalization should be done with caution.

Conclusion

Maternal education is an important predictor of diarrhea among children aged 0-24 months in Nigeria. Other important factors are age of the child and region of residence. While care should be provided for all children, strategies to reduce diarrhea disease among children in Nigeria should focus more on the children of the uneducated, less educated mothers and those living in the Northwest. This study has provided a baseline for future intervention studies which could inform policy formulation and review in Nigeria towards diarrhea prevention and its control.

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