

Duration of Breastfeeding and the Risk of Diarrheal Illness in Children Below Age of 2 Years in South Africa, 2016: A Cross-Sectional Study

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Abstract

Background: Childhood diarrheal illness is a threat to public health in relation to child health. The prevalence is high in regions like South Asia and Sub-Saharan regions. These regions contribute to over three-quarters of the diarrheal illness cases in the world. However, there has been evidence on how the duration of breastfeeding reduces the risk of childhood diarrheal illness in infants.

Aim: To explore the impact of the duration of breastfeeding on the occurrence of childhood diarrheal illness in a sample of children below the age of 2 years in South Africa, 2016.

Methods: A cross-sectional study was employed that used secondary data for analysis from the South Africa Demography and Health Surveys, 2016. Six Hundred and Sixty-one participants that were mother-child pairs were used in the final study. Frequency and distribution were used to describe the study population baseline characteristic. Bivariate and multivariate were used to find the relationship between diarrheal illness and other factors (vaccination, rotavirus vaccine etc.). Poisson regression was used to find the predictors of diarrheal illness.

Results: The prevalence of childhood diarrheal illness was 13.2% (n=87) for breastfeeding infants. Multivariate analysis showed that the duration of breastfeeding is associated with childhood diarrheal illness (RR:2.34; 95% CL: 1.11-4.94 p=0.03). Chi-square was employed, and it showed a significant interaction between the duration of breastfeeding and diarrheal illness ($X^2(2) = 8.06, p < .05$) and therefore null hypothesis was rejected. The age of a child and the duration of breastfeeding were the only significant variables in the study, and the rest were not significant.

Conclusion: The longer the duration of breastfeeding, the more the child suffers from a diarrheal illness. Breastfeeding alone does not prevent diarrheal illness among infants, so more exploration in future is required to verify factors that are associated with breastfeeding in the prevention of diarrheal such as the biological nature of the child and the mother's milk content. More emphasis on health education concerning breastfeeding and diarrheal illness with mainly targeting the rural areas.

Introduction

Diarrheal illness in children is the second leading cause of death in children less than five years of age, and it is characterized by a multitude of infectious causes who are ranging from

bacteria, virus to protozoa, that lead to loose watery stools in infants [1]. Diarrheal can be defined as the passage of 2-3 loose or watery stools per day, which can be a frequent passage as compared to normal in a person [2]. Diarrheal illness is responsible for causing high mortality and morbidity in children

with main countries found in low and middle income. Currently, most studies have evidently shown that diarrheal illness in children has accounted for over 2,195 deaths in a day with 1 in 9 children are dying worldwide from a diarrheal illness which has accumulated to 2.5 billion cases of diarrheal disease [3]. In Sub-Saharan regions, diarrheal is responsible for 7.7% of deaths and every child has five episodes of diarrheal illness in a year and over 800,000 children die due diarrheal illness with dehydration mainly responsible for deaths [4]. In Nigeria, diarrheal illness was the second biggest killer in children, with 16% of deaths in a year among children being associated with diarrheal disease [5]. A study conducted by [6] in South Africa stated that there are over 60,000 cases of childhood diarrheal illness per month [6] and also related study showed that diarrheal illness estimated in the country is 14.1/1000 in 2014, with the Free state having the highest burden of 25.8/1000 and Western cape 16.5/1000 [7]. Even though the country is one of the countries in sub-Saharan Africa that has implemented the Rotavirus vaccine in their expanded programme of immunization schedule, the country still reports high diarrheal illness prevalence in children under 5. A lot of studies and prominent international agencies have also recommended breastfeeding for the prevention of diarrheal disease. Breastfeeding comes with many health benefits that can be both short and long term to both a mother and their infants. In children, breastfeeding comes with a variety of benefits. Studies have verified that breastfeeding constitutes a primary form of promoting a child's development and health because it is perfectly adjusted to their nutrition necessities [8]. This has reduced the exposure to contaminated foods and fluids that can suppress the baby's immune system. The identified barriers to the duration of breastfeeding have affected the effective uptake of exclusive breastfeeding among mothers, which has resulted in an increase of diarrheal illness in infants. The connection between breastfeeding and diarrheal illness has been studied and studies show that up to 55% of the infant deaths from diarrheal illness, comes from inappropriate feeding practices with sub-optimum breastfeeding among the practises [9]. Duration of breastfeeding has been more effective in the reducing of diarrheal illness among infants. The more a child is breastfed continuously, the more the reduction in the risk of childhood diarrheal illness in the infant. The recommended duration of breastfeeding in a child is 0-6 months without the introduction of semi-solid foods, which is called exclusive breastfeeding [10]. Numerous studies have shown how exclusive breastfeeding is the easiest and cheapest way of reducing the risk of diarrheal illness among children. For example, on a general platform, it's believed to reduce the prevalence of diarrheal illness by 40% among infants if applied by the mother [10]. In South Africa, this subject of diarrheal illness among children has been a big issue that the country is still having a gradual progress in meeting the SDG 3 especially among infants [11]. Breastfeeding is one of the preventing actions that was identified to in reducing the risk of diarrhoea illness in infants. Specifically exclusive breastfeeding has accounted for 40% reduction which is 7-fold but also babies who are not breastfed or stopped from breastfeeding are reported to be 19.5% with a risk of having a diarrheal illness and 12.3% were reported to have a diarrheal illness [12]. However, some of the studies have created a controversial issue in South Africa were their findings show a neutral image between the breastfeeding and diarrheal illness link. The National Burden of disease in South Africa reported that diarrheal illness accounts for 8.8% of the sum of years of healthy life lost, and the burden is great in the poorest region which are estimated to have the highest population [13].

Due to this case scenario, it arguable for us to explore more on the link between breastfeeding and diarrheal illness in children because there has been a perception that suboptimal breastfeeding including duration has been reported to be associated with high diarrheal illness morbidity and mortality.

Materials and methods

Study setting and design: South Africa will be the setting for the study. It has nine provinces, and it is located in the Southern part of Africa. It shares borders with Namibia, Botswana, Mozambique and Zimbabwe. It is also surrounded by both the Indian ocean and the Atlantic Ocean. Based on the STATS SA in 2018, the population of South Africa has increased to 57.73 million with an overall increase of 1.55% [14]. The study design is based on quantitative research that uses a cross-sectional study design. The study will conduct a secondary data analysis of the South Africa Demographic and Health Survey (SADHS) of 2016.

Study population: The SADHS conducted the primary study in 2016 which used a stratified, two-stage cluster design in the sampling of the 15,000 households that comprised of women and men in relation to Urban, traditional and Farm among the nine provinces. The survey excluded institutional groups like schools, army barracks, clinics and police stations. In the study utilized a portion of SADHS study population that is encompassed of 9,878 women aged 15 - 49 years who were permanent residents of South Africa and stayed in the household the night before the survey. However, out of the 9,878 women, 8,514 completed the interview, which yielded an 86% response rate the focus of the study population being age that lies between 0-24 months which is 1,365 infants being used in the study. Duration of the breastfeeding among women and their reporting of diarrheal illness episodes of their infants was collected for the mothers who signed the consent form [15]. They will be no sampling because all the eligible will be analyzed. The inclusion criteria were Women aged 15-49 years that have a response to the breastfeeding duration question, Infants aged 0-24 months that were breastfed and mothers paired with an infant who met eligibility criteria. Infants outside the age group of 0-24 months and Infants visiting South Africa during the study duration were excluded.

Data analysis: The outcome variable was childhood diarrheal illness which was measured as Yes-diarrheal illness (last 2 weeks) and no. The main explanatory/exposure variable is the duration of breastfeeding, and other exposure variables include Maternal age, education, marital status, region, toilet facility, water source, child age, sex, wealth index, employment status, vaccination vitamin A, rotavirus vaccine, residence. The SDHS data was downloaded in the STATA file format and imported into STATA version 14.0 for analysis (Stata Corp, College Station, Texas, USA). Data Cleaning comprised the use of various descriptive commands to check for missing values and errors in the data set so that they can be eliminated in the analysis. It also includes checking for duplicates, and also the majority of the variables were re-categorized and recoded for a better analysis. Cross tabulation was used for description analysis to determine of sample characteristics. The prevalence of childhood diarrheal illness among infants aged two years was presented in a tabulation with mean and stander deviation used for obtaining normality distribution. The Pearson Chi-square was used to assess the durational of breastfeeding and diarrheal illness. Modified-Poisson regression models examined the link between diarrheal illness and identified confounding variables. The cut of point to screen confounders was 20% (0.2) of the p-value from the un-

adjusted risk ratio in the bivariate analysis. The study outcome variable had a common prevalence which was referred to as $\geq 10\%$ thus the study employed a modified-Poisson regression model to identified predictors of the diarrheal illness instead of the conventional Logistic regression model. A p-value < 0.05 was considered statistically significant.

Results

A total of 661 mother-infant paired had participated in the study. The highest percentage of women age that participated lied between 25-34 with a proportion of 46.8% with a mean age of 27.3 years (± 6.7 standard deviation). The highest gender of the infants was female (51.3%), with most of the infants below 6 months (47.4%) and mean of month age is 11.7 months old (Table 1). Majority did not have a diarrheal illness (86.5%, 574) in comparison to those reported to have had a diarrheal illness (13.2%, 87). Table 2 indicated that significant interaction was found ($X^2(2) = 8.06$, $p < .05$) between childhood diarrhoeal disease and duration of breastfeeding (> 6 , 7-12 and 13-24) were infants that lie between 13-24 months are more likely to suffer from diarrheal illness (37.9%) than the rest of the age categories. Table 3 showed that divorced and separated were significantly associated with diarrheal illness as they were reported to have a 14% increase in diarrheal illness in infants as compared to other marital status. Women from richer index had a 74% lower risk of their infants suffering from diarrheal illness (RR: 0.26, CL: 0.10-0.65, $p < 0.05$) so were those from richest (RR: 0.67, CL: 0.29-1.54), middle (RR: 0.76, CL: 0.44-1.30), poorer (RR: 1.13, CL: 0.70-1.82). Children who did not receive the vitamin a vaccine were more prone to suffer from diarrheal illness (RR=2.19 CL: 1.30-3.67, $p < 0.05$) compared to those who received the vitamin a vaccine. There was no significant difference across that other factors associated with a diarrheal illness like women's age, child age employment, receiving rotavirus vaccine, vaccinated, residence, toilet facilities, water source and sex of the child. Although employment was not significant, there was reduced risk of diarrheal of the infant-mother who was not employed (RR: 0.67, CL: 0.38-1.20) and a child who was reported to be female (RR: 0.81, CL: 0.55-1.22). A multivariable analysis was performed in table 5. The duration of breastfeeding (months) and age of a child (months) as the only significant variables in the study with less than $p > 0.05$. However, the variables that are not significant had either increases or decreases between in relationship between diarrheal and population characteristics. Other feeding practise is the only variable that increases the risk of diarrheal illness in infants 1.36 times compared to the children who only breastfed. On the other hand, variables like vaccinations for both Vitamin A and rotavirus for those who vaccinated showed a decrease of diarrheal illness in infants with 1% for vitamin A (RR: 0.99, CL: 0.43-2.26) and 43% for rotavirus (RR: 0.57, CL: 0.21-1.56). Also, mothers that are employed decrease the risk of diarrheal illness in their infants by 56% (RR: 0.44 CL: 0.15-1.30) as compared to those that are not employed and married mothers have shown a decrease of diarrheal illness among their infant by 31% (RR: 0.69 CL; 0.37-1.28) as compared to single parents

Table 1: Baseline characteristics of eligible mother-infant pairs from the 2016 South Africa DHS.

Characteristics	Frequency (Percentage)
1: Demographic	
Women age in years	
15-24	223(37.7)
25-34	277(46.8)
≥ 35	92(15.5)
Education status for mothers	
No education	59(10.0)
Primary	487(82.3)
Secondary	38(6.4)
Higher	
Marital status for mothers	
Single	238(40.2)
Married	
Residence	
Urban	319(53.9)
Rural	
Toilet facility (shared)	
Yes	461(81.0)
No	
Water Source	
Unprotected	59 (10.0)
Protected	
Sex of Child	
Male	286(48.3)
Female	
Age of child (Months)	
<6	199(33.6)
7-12	3(0.5)
13-24	
2: Clinical	
Vaccinated	
Yes	52(75.4)
No	
Received rotavirus vaccine	
Yes	505(85.3)
No	
Received Vitamin A	
Yes	396(66.9)
No	
196(33.1)	
3: Socio-economic	
Wealth index combined	
Poor	292(49.32)
Middle	141(23.82)
Rich	
159(26.86)	
Employment status	
Employed	
111(18.9)	
Unemployed	
481 (81.3)	

Missing values: Clinical status - [Vaccinated 14(12.84%)-don't know, 11(11.59%)] no response-520, 87.84%] & Toilet facility sharing (23, 3.89%).

Table 2: Occurrence of childhood diarrheal illness by the duration of breastfeeding.

Duration of breastfeeding (months)	Diarrheal, n(%)		
	No	Yes	Total
<6	249 (48.7)	25 (30.9)	274 (46.3)
	107 (20.9)	26 (32.1)	
12-Jul			133 (22.5)
13-24	155 (30.3)	30 (37.0)	185 (31.3)

p-value=0.008.

Table 4: Multivariate analysis of the adjusted relative risk for the association between diarrheal illness and the associated factors of the study population in South Africa, 2016.

Characteristics	Adjusted Risk ratio	95% CL	P- value
Duration of breastfeeding (months)			
<6	1	Ref	-
7-12	2.5	1.28-3.56	0.00*
13-24	3	1.08-2.92	0.00*
Other Feeding Practises			
No	1	Ref.	-
Yes	1.36	0.61-3.05	0.45
Education			
Lower	1	Ref	-
Higher	1.24	0.65-2.38	0.51
Wealth index			
Poor	1	Ref.	-
Middle	0.86	0.44-1.71	0.68
Rich	0.57	0.23-1.40	0.22
Marital status for mothers			
Single	1	Ref	-
Married	0.69	0.37-1.28	0.24
Residence			
Urban	1	Ref.	-
Rural	0.84	0.44-1.71	0.08
Received vitamin A			
No	1	Ref	-
Yes	0.99	0.43-2.26	0.75
Received Rotavirus			
No	1	Ref	-
Yes	0.57	0.21-1.56	0.27
Employment			
No	1	Ref.	-
Yes	0.44	0.15-1.30	0.14
Age of child (Months)			
<6	1	Ref.	-
7-12	0	0.00-0.00	0.00*
13-24	0	0.00-0.00	0.00*

Table 3: Bivariate analysis of the unadjusted relative risk for the association between diarrheal illness and the associated factors of the study population in South Africa, 2016.

Characteristics	Unadjusted Risk ratio	95% CL	P-value
Duration of breastfeeding (months)			
<6	1	Ref	-
7-12	2.14	1.28-3.56	0.00*
13-24	1.78	1.08-2.92	0.02*
Other Feeding Practises			
Yes	1	Ref.	-
No	0.97	0.55-1.72	0.92
Women age in years			
15-24	1	Ref.	-
25-34	1.24	0.80-1.92	0.33
≥35	1.05	0.57-1.95	0.87
Marital status for mothers			
Single	1	Ref	-
Married	0.97	0.64-1.47	0.89
Residence			
Urban	1.43	0.97-2.13	0.08
Rural			
Toilet facilities (shared)			
Yes	1.09	0.65-1.80	0.75
No			
Water source			
Unprotected	1.27	0.69-2.33	0.44
Protected			
Sex of Child			
Male	0.81	0.55-1.20	0.29
Female			
Age of child (Months)			
<6	1.73	0.82-3.69	0.15
7-12	7.85	0.92-3.71	0.08
13-24			
2: Clinical			
Vaccinated			
Yes	1	Ref.	-
No	1.18	0.16-8.51	0.87
Received rotavirus vaccine			
Yes	1	Ref.	-
No	1.47	0.79-2.74	0.23
Received Vitamin A			
Yes	1	Ref	-
No	2.19	1.30-3.67	0.00*
3: Socio-economic			
Wealth index combined			
Poor	1	Ref	-
Middle	0.72	0.44-1.18	0.19
Rich	0.39	0.21-0.72	0.03*
Employment status			
Employed	1	Ref.	-
Unemployed	0.67	0.38-1.20	0.18

Discussion

This study investigated the impact of the breastfeeding duration on the occurrence of childhood diarrheal illness in a sample of children below the age of 2 years. Overall, results showed that the duration of breastfeeding impacts on the prevalence of diarrheal in children. The first objective was achieved as it looked at determining the prevalence of childhood diarrheal illness and the prevalence of childhood diarrheal illness in this cross-sectional was 13.2% for infants that suffer from diarrheal illness and 82.8% for infants that are not suffering from diarrheal illness. Research done about the prevalence of diarrheal illness in South Africa has reported the prevalence to lie between 10.13%-58.73% [16]. For example, a study done by Bamford et al found out that there are 12% diarrheal cases in infants of South Africa [16]. Also, the continuous form, duration of breastfeeding across the 24 months increased the risk of childhood diarrheal illness 2.33 times and in the categorized way with comparison to less than 6 months, 7-12 months' duration of breastfeeding were 2.5 times more likely to suffer from diarrheal illness and 13-24 years were 3 times more likely to suffer from diarrheal illness. The findings contradicted with the current research hypothesis as it predicted that the more you breastfeed the less likely for the child to get the diarrheal illness. Mothers that stay in rural areas, their infants are 1.43 times more likely to suffer from diarrheal illness as compared to infants that are raised in urban areas. Mother's that were employed reduced the risk of childhood diarrheal illness by 56% as related to those that are unemployed. Moreover, Infants that came from a rich family had a reduced risk of diarrheal illness by 43%, middle class by 14% as compared to those that come from a poor family. These findings can be linked with the duration of breastfeeding as mothers that are employed are exposed to vital skills and information on breastfeeding that they practice on their infants especially the prolonged breastfeeding that is good for the baby. Numerous studies show that the longer the duration of breastfeeding the less likely for the child to acquire diarrheal. This has arisen to the questioning of breastfeeding as a preventive method to diarrheal illness as claimed by most of the literature in South Africa. Likely, the women in this country may not effectively have initiated early breastfeeding as soon as possible and also most studies show that mothers that carry any respiratory disease while breastfeeding can result into causing the diarrheal illness which hinders breastfeeding to work effectively. More explanation to ineffective breastfeeding prevention to diarrheal illness was displayed in some study which found out that breast milk protection is not universally conferred by the passive transfer of humoral immunity [17].

Study implications and recommendation: There was an association between the duration of breastfeeding and diarrheal illness, but the predictions were suppressed with the findings. Prevalence was high in infants as mothers breastfed more. This can arise to the question of exclusive breastfeeding as prevention means to respiratory diseases as most research assumed. Also, it opens up a more discussion it what could prevent breast milk to effectively reduce these respiratory diseases like diarrheal illness. Our findings can act as the base for future research on the ineffective of exclusive breastfeeding as found out that the more the mother breast feed the more occurrence of diarrheal illness. It is recommended that studies should look at the underlying factors of a mother's biological and child nature in relation to diarrheal outcome.

Study limitations: The data used was secondary data, thus

some crucial variables were not captured that may have affected our exposure and the outcome of the study. For example, ethnicity, cultural beliefs, religious norms and beliefs. In the analysis, we did not consider other underlying causes of diarrheal illness like measles, and information bias was suspected when participants did not know if it's child diarrheal or not with relation to the prevalence of diarrheal question. Lastly, the duration and severity of the outcome variable (childhood diarrheal illness) were not obtained in the survey.

Conclusion

Overall, the study showed a less prevalence of childhood diarrheal illness but slightly high (5.7%) in relation to 2013, and as the duration of breastfeeding lasted longer, the more the infant was susceptible to diarrheal illness. It is not the only duration of breastfeeding linked to diarrheal illness, but a much bigger picture was observed when we looked at the demographic and socioeconomic factors that affected the length of breastfeeding resulting in high prevalence of diarrheal illness. Findings from this study show that women should invest more in their educational life, and health promoters should conduct masses of health promotion in rural areas. Future studies should explore more in relation to the nature of exclusive breastfeeding and the biological factors that lead to diarrheal illness even when all the confounders have been controlled in the study.

Ethical consideration: Approval to use the secondary data was obtained from the primary data collector who, is the SADHS gatekeepers 2016. Written informed consent from the respondents was obtained at the time of primary data collection. The privacy and confidentiality of the respondents were upheld as there was no attempt in identifying the subjects in the secondary data. Secondary data obtained from SADHS was stored on a well-protected device with a password to prevent access of users that are not authorized. Ethical approval to conduct the study was obtained from the Monash University Human Research Ethics Committee.

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