

# Prevalence, Trends and Predictors of Small Size Babies in Nigeria: Analysis of Data from Two Recent Nigeria Demographic and Health Surveys

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**Abstract:** *Background:* Despite low birth weight (LBW) role on child growth, development, and survival in developing countries, it has not been given the desired priority in terms of research, at the national level in Nigeria. Our study aims to estimate the trend in the prevalence of small size babies and to identify its predictors using nationally representative data.

*Methods:* We used the 2013 and 2018 data from the Nigeria Demographic and Health Survey using the statistical methods of descriptive analysis and logistic regression modelling.

*Results:* The proportion of babies reported to have small size at birth in Nigeria declined from 14.9% in 2013 to 13.7% in 2018. Various factors from demographic, socio-economic, and health-seeking behaviour were identified as significant predictors. Women who received iron pills and tetanus toxoids during pregnancy had at most 79% and 80% less risk of having small size babies, respectively, than those who received none of these two. Female children had at least 21% more chance of being small in size than male children. Other key predictors were geopolitical region, maternal age at child birth, maternal literacy level, wealth status, religion, source of water supply, number of ANC visits during pregnancy, and desirousness of pregnancy.

*Conclusion:* In light of the adverse effects of low birth weight on child well-being, we recommend the implementation and prioritization of active, resourceful public health interventions that account for the findings of this study, if Nigeria is to sustain the progress achieved so far in reducing its current high rate.

**Keywords:** Prevalence, Trends, Risks factors, Small size baby, Low birth weight, Nigeria.

## INTRODUCTION

Certain post maternal outcomes have long been identified as major public health problems. One of these is low birth weight (LBW). Birth weight is one of the significant predictors of child development, growth, as well as morbidity and mortality [1-3]. Low birth weight (LBW) is defined as a child weight less than 2500g measured within 24 hours of birth [4]. The proportion of infants with low birth weight mirrors the socio-economic development of any region or country [2]. LBW is a major factor contributing to high infant mortality in developing countries, including Nigeria. Children born with LBW were estimated to have a higher risk of death before age five than children with normal birth weight (birth weight more than 2500g) [5-7]. There are little chances of reaching full growth potential for infants who manage to survive, in terms of

lower intelligent quotient (IQ), difficulties in school and brain retardation, stunting, heart disease, and diabetes in adulthood [8-10]. Globally, LBW contributes to between 40 to 60 percent of neonatal mortality [11].

Over 20.5 million babies were born with low birth weight in 2015, constituting about 14.6% of all births worldwide- Asia accounted for half, while Africa contributed a quarter of all low birth weight babies in the world. East and West African countries had the highest LBW in Africa, implying that over 95% of them were in developing countries [10]. The prevalence of LBW varied across regions and countries. For instance, it ranged from 9% in Latin America, 13% in sub-Saharan Africa, to 28% in South Asia [12]. These disparities also subsisted in the 2015 LBW estimates, from 9.9% in Oceania to 13.7% in Africa and 17.3% in Asia. Because of the high prevalence of LBW across regions and countries, and its recognition as a public health priority, the World Health Assembly (WHA) member states endorsed a global reduction of low birth weight prevalence to 10.5% or less between 2012 and 2025 at their 65th meeting [10].

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Nigeria recorded an LBW prevalence of about 17% between 2010 to 2015, which was considered one of the highest in sub-Saharan Africa [13]. According to the Multiple Indicator Cluster Survey (MICS) 2017 [14], the prevalence of LBW was 14.8%; only about 37.5% were women delivered in a health facility, and skilled health workers assisted 43% of these. These estimates suggested 62.5% of the deliveries took place at home, from which 57% of these assisted by non-health workers, such as traditional birth attendants (TBA). Consequent upon this, it would have been challenging to have recorded babies' weight at-home delivery, as a result of nonexistence of weighing facilities and knowledge of its importance on child health. Hence, the sizes of babies at birth, as perceived by their mothers, were considered as acceptable alternatives to actual birth weights. This is the reality of the data available in national surveys such as the Demographic Health Survey (DHS) and MICS. There is a paucity of research on LBW at the national level in Nigeria, despite its importance as a significant predictor of infant mortality and as a public health problem. This gap may be attributed to the non-availability of appropriate data. This study aims to estimate the trend in the prevalence of small size babies and to identify its predictors using nationally representative data. Small size is used as a proxy of LBW. This is important as it will enable policymakers to design policies that can enhance child survival and increase the change of achieving the 2030 Sustainable Development Goals in Nigeria.

## METHODS

### Data Source

This study used data from the Nigeria Demographic and Health Survey (NDHS) conducted by the National Population Commission (NPC) and ICF international in 2013 and 2018. The survey is usually conducted every five years- each covering a 5-year period that started in 1990 and involved women and men of reproductive age (i.e., women aged 15-49 and men aged 15-59), selected through a stratified two-stage cluster sampling technique.

### Study Variables

The size of babies at birth, as perceived by the mothers of the babies born within the survey period was considered as the outcome variable, while the explanatory variables included demographic, socio-economic, and healthcare-related behavioural factors.

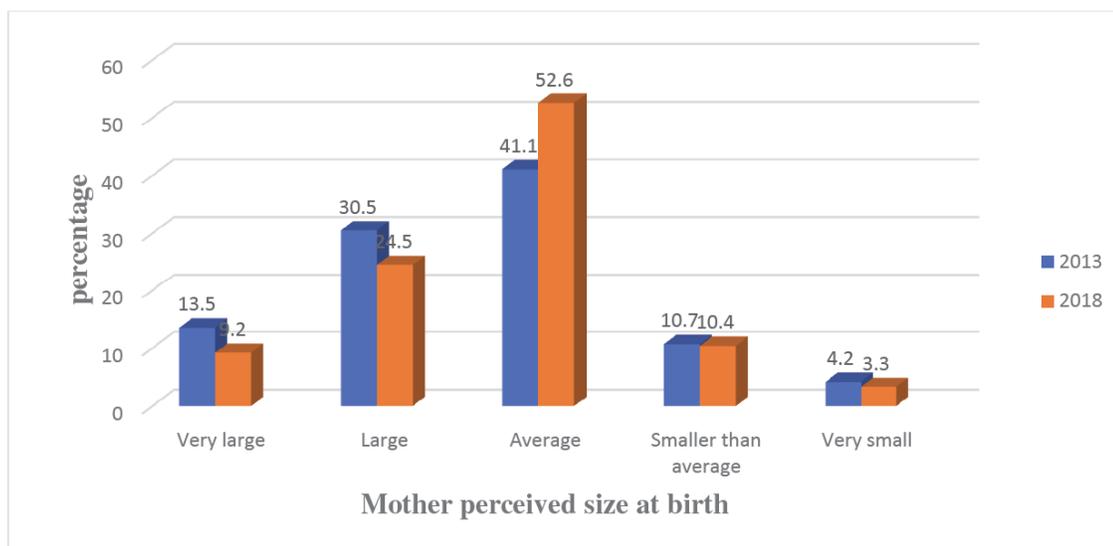
The baby size at birth was obtained by asking the mother: whether the child was born very large, more than average, average, smaller than average, or very small. Demographic factors included sex of a child, region, place of residence, maternal age at child birth, the number of children ever born, and preceding birth interval. Socio-economic variables include maternal education, household wealth index, marital status, type of marriage, religion, and source of water. And the healthcare-related factors include the use of mosquito net, the number of antenatal care (ANC) attended, the use of iron tablets during pregnancy, and tetanus injection status during pregnancy.

## Data Analysis

To create a binary outcome variable out of the data on baby size, we defined the combined categories of smaller than average and very small as small size, which we considered as a proxy to low birth weight (LBW). Thus, the prevalence of low birth weight was estimated based on the values: LBW=1 for small sized babies and LBW=0 for greater than or equal to average-sized babies. As the first stage, the Chi-square test ( $\chi^2$ ) was performed to explore a possible relationship between low birth weight and each of the explanatory variables. Those with significant results were subsequently included in a multiple logistic regression analysis to assess the independent effect of each of these (i.e., having controlled for the impact of the other factors) [15]. For a variable to be considered as having an association with LBW, the 95% confidence interval for the corresponding odds ratio (OR) must not include the value of 1, which also meant a p-value < 0.05. We used the STATA statistical package (version 15) for all analyses.

## RESULTS

Figure 1 presents the distribution of babies by size at birth as perceived by their mothers from the 2013 and 2018 NDHS surveys that covered the 5-year periods 2009-2013 and 2014-2018, respectively. It shows a slight decline from 2009 to 2018 in the smaller than average size (10.7% vs. 10.4%) and the very small sizes (4.2% vs. 3.3%). But there was substantial decline in the other sizes- very large sizes (13.5% vs 9.2%), large sizes (30.5% vs 24.5%) and average sizes (41.1% vs 52.6%). Therefore, the prevalence of low birth weight (i.e. babies with smaller than average sizes and those with very small sizes) was 14.9% (i.e. 10.7% + 4.2%) as at 2013 and 13.7% (i.e. 10.4% + 3.3%) as at 2018.



**Figure 1:** Trends in percentage distribution of mother perceived Infant Size at Birth, 2009-2018.

Table 1 presents the trends in the prevalence of small size babies and its prevalence across the study variables. The highest prevalence was observed in those residing in the rural areas compared with those in urban residence as at 2013 (32.7% vs. 5.7%), and the difference was statistically significant, whereas there was no difference between those residing in rural and urban areas (14.2% vs. 12.1%). We also observed a high prevalence of small size babies in the women that made between 1-3 ANC visits over the two survey periods: 21.4% for the 2009-2013 period and 15.6% for the 2014-2018 period; while women who did not attend ANC had 19.4% in the first survey period and 16.3% in the second. There was no difference in prevalence between male and female babies in either the survey period.

As for the geopolitical region, we observed a high prevalence of small sized babies in the North compared with the South. In the two survey periods from 2009-2014 and 2015-2018, the North-East had the highest prevalence (19.3% and 16.4% respectively), while the South-West had the lowest prevalence (9.1% and 9.8% respectively). The North-West and North-Central both had a slight increase between the two periods from 16.8% - 14.9% and 11.0% - 12.3% respectively; both the South-East (12.3% and 11.1%) and South-South (12.4% and 11.4%) regions had slight reductions between the two periods.

The results did not indicate a clear pattern on the prevalence of small size babies over the two periods, in terms of mothers' educational attainment and wealth status, with rates barely changing, except for those with

no education who experienced a reduction. We observed a higher proportion of small sized babies born in polygamous homes compared with monogamous homes in both surveys, 15.7% vs. 14.0% in 2009-2013, and 15.5% vs. 12.4% in 2015-2018. We observed a higher prevalence among women who did not receive tetanus injection compared with those that received tetanus injection: 19.1% vs. 13.1% and 16.6% vs. 12.7% in the corresponding periods.

In the bivariate analysis shown in Table 1, all the variables are statistically significant, except marital status and Iron intake during pregnancy in the 2009-2013 period. Also, in the 2015-2018 period, all the variables are statistically significant except those of the number of children ever born, source of water supply and use of mosquito net. As previously described, all the variables without indication of association with the small baby size (i.e., with the non-significant association) were subsequently excluded in the multiple logistic regression model.

Table 2 shows the results for both the univariate and multivariate logistics regression analyses. We found the sex and gender of the baby as having significant association with the risk of small size baby: Female babies had a higher chance than male babies: Adjusted Odds Ratio (AOR) = 1.21; 95% CI= 1.14-1.29 in the 2009-2013 period and 1.34; 95% CI= 1.22-1.48 in the 2015-2018 period. The multivariate results also indicated female babies, irrespective of their geopolitical region of residence, had a higher risk of being born as small size than male babies. Those residing in the North-East (AOR=1.56, 95% CI=1.39-1.77), North-West (AOR=1.27, 95% CI=1.12-1.43),

**Table 1: Trends in Factors Associated with Small Size Babies in Nigeria, 2009 – 2018**

Factors	2013				2018			
	Total births N	(%)	% of Small size births	P-value	Total births N	(%)	% of Small size births	P-value
Total	31482	100	14.9		33924	100	13.7	
<b>Sex of child</b>				0.000				0.000
Male	15965	50.7	13.4		17257	50.9	12.3	
Female	15517	49.3	15.8		16667	49.1	14.6	
<b>Region</b>				0.000				0.000
North-Central	4614	14.7	11.0		5875	17.3	12.3	
North-East	6517	20.7	19.3		7211	21.3	16.4	
North-West	9906	31.5	16.8		10305	30.4	14.9	
South-East	2816	8.9	12.3		3798	11.2	11.1	
South-South	3747	11.9	12.4		3202	9.4	11.4	
South-West	3882	12.3	9.1		3533	10.4	9.8	
<b>Place of residence</b>				0.000				0.000
Urban	21131	67.1	5.7		11699	34.5	12.1	
Rural	10351	32.9	32.7		22225	65.5	14.2	
<b>Maternal age at child birth</b>				0.000				0.003
<20 years	4524	15.4	17.4		4573	14.5	15.2	
20-29years	14917	50.9	14.2		16281	51.4	13.3	
30-35	5803	19.8	13.3		6596	20.8	12.8	
36+	4063	13.9	15.4		4207	13.3	13.5	
<b>Number of children ever born</b>				0.001				0.054
≤2	9002	28.6	14.6		9824	29.0	13.3	
3-4	9588	30.5	13.6		10648	31.4	12.9	
5+	12892	41.0	15.4		13452	39.6	14.0	
<b>Preceding birth interval</b>				0.026				0.002
<24 months	5817	18.5	17.6		6706	24.5	14.6	
≥24 months	19484	61.8	18.3		20676	75.5	13.0	
<b>Maternal educational level</b>				0.000				0.000
No education	14762	46.9	17.8		15391	45.4	15.6	
Primary	6432	20.4	13.4		5274	15.5	12.9	
Secondary	8365	26.6	11.3		10623	31.3	11.7	
Higher	1923	6.1	8.1		2636	7.8	9.3	
<b>Wealth index</b>				0.000				0.000
Poor	14462	45.9	18.3		15809	46.6	15.3	
Middle	6272	19.9	13.2		7171	21.1	13.5	
Rich	10748	34.1	10.5		10944	32.3	10.8	

(Table 1). Continued.

Factors	2013				2018			
	Total births N	(%)	% of Small size births	P-value	Total births N	(%)	% of Small size births	P-value
<b>Marital status</b>				0.640				0.046
Never married	1492	4.7	14.2		1698	5.0	15.0	
Married	29990	95.3	14.6		32226	95.0	13.4	
<b>Type of marriage</b>				0.000				0.000
Monogamous	20037	63.6	14.0		22461	66.2	12.4	
Polygamous	11445	36.4	15.7		11463	33.8	15.5	
<b>Religion</b>				0.000				0.000
Christianity	12654	40.2	11.6		13239	39.0	11.2	
Islam	18354	58.3	16.6		20412	60.2	14.9	
Others	474	1.5	17.3		273	0.8	13.5	
<b>Source of water supply</b>				0.000				0.955
Unimproved	14232	45.7	16.9		15198	44.8	13.5	
Improved	16905	54.3	12.6		18726	55.2	13.5	
<b>Slept under Mosquito net</b>				0.039				0.327
No	24666	78.3	14.8		14685	43.3	13.2	
Yes	6816	37.6	13.8		19239	56.7	13.7	
<b>Attended antenatal care</b>				0.000				0.000
No visit	6662	33.6	19.4		5365	25.0	16.3	
1-3	2107	10.6	21.4		3793	17.7	15.6	
4+	11047	55.7	10.2		12307	57.3	11.8	
<b>Took Iron during pregnancy</b>				0.618				0.000
No	26704	94.3	14.1		25358	83.0	13.5	
Yes	1623	5.7	13.7		5190	17.0	9.9	
<b>Pregnancy was wanted</b>				0.000				0.001
Wanted	28370	91.1	14.6		30355	89.5	13.3	
Unintended	2236	7.2	15.7		2662	7.8	14.8	
Unwanted	549	1.8	14.2		907	2.7	16.5	
<b>Received tetanus toxoid injection</b>				0.001				0.000
No	7811	24.9	19.1		6695	19.7	16.6	
Yes	23558	75.1	13.1		27229	80.3	12.7	

Significant at P-value&lt;0.05.

South-East (AOR=1.40, 95% CI=1.19-1.64), and South-South (AOR=1.32, 95% CI=1.14-1.53) were significantly more likely to have a small birth size in the 2009-2013 period, compared to those in the North-Central region. By contrast, only those who resided in the North-East (AOR=1.26, 95% CI=1.07-1.48) had a

significantly higher risk compared with those in the North-Central region. Whereas the unadjusted results for both periods suggested women who resided in the rural areas had a significantly higher chance of delivering small size babies than those who lived in the urban areas, the adjusted risks were not significantly

**Table 2: Logistic Regression Analysis of Factors Associated with Small Size Babies in Nigeria, 2009-2018**

Factors	2013				2018			
	SOR	95% CI	AOR	95% CI	SOR	95% CI	AOR	95% CI
<b>Sex of child</b>								
Male	1.00		1.00		1.00		1.00	
Female	1.21	1.13-1.29	1.21*	1.14-1.29	1.22*	1.15-1.30	1.34*	1.22-1.48
<b>Region</b>								
North-Central	1.00		1.00		1.00		1.00	
North-East	1.93*	1.72-2.15	1.56*	1.39-1.77	1.36*	1.23-1.50	1.26*	1.07-1.48
North-West	1.64*	1.48-1.83	1.27*	1.12-1.43	1.22*	1.11-1.34	1.08	0.92-1.26
South-East	1.14	0.99-1.32	1.40*	1.19-1.64	0.90	0.79-1.02	1.13	0.91-1.42
South-South	1.14	0.99-1.30	1.32*	1.14-1.53	0.91	0.80-1.04	1.04	0.83-1.31
South-West	0.80*	0.69-0.92	0.96	0.82-1.12	0.78*	0.68-0.90	0.91	0.73-1.12
<b>Place of residence</b>								
Urban	1.00		1.00		1.00		1.00	
Rural	1.45*	1.35-1.55	0.96	0.89-1.07	1.21*	1.13-1.29	0.97	0.86-1.10
<b>Maternal age at child birth</b>								
<20 years	1.00		1.00		1.00		1.00	
20-29years	0.76*	0.70-0.83	0.89*	0.80-0.98	0.86*	0.78-0.94	1.02	0.83-1.25
30-35	0.84*	0.75-0.93	0.95	0.82-1.09	0.82*	0.74-0.92	0.98	0.79-1.22
36+	0.86*	0.78-0.95	0.96	0.74-1.21	0.88*	0.77-0.99	0.98	0.78-1.23
<b>Number of children ever born</b>								
≤2	1.00		1.00		1.00		NA	
3-4	0.92	0.85-1.01	0.92	0.84-1.01	0.97	0.90-1.06		
5+	1.07	0.99-1.15	0.93	0.84-1.03	1.06	0.99-1.15		
<b>Preceding birth interval</b>								
≥24 months	1.00		1.00		1.00		1.00	
<24 months	1.09*	0.16-0.18	1.07*	0.19-0.26	1.14*	1.05-1.23	1.13*	1.01-1.27
<b>Maternal educational level</b>								
No education	1.00		1.00		1.00		1.00	
Primary	0.71*	0.65-0.77	0.93	0.85-1.03	0.81*	0.74-0.89	0.91	0.78-1.06
Secondary	0.55*	0.51-0.59	0.87*	0.78-0.98	0.73*	0.68-0.79	0.82	0.78-1.08
Higher	0.53*	0.46-0.62	0.59*	0.47-0.79	0.55*	0.48-0.64	0.62*	0.47-0.81
<b>Wealth index</b>								
Poor	1.00		1.00		1.00		1.00	
Middle	0.68*	0.62-0.74	0.85*	0.77-0.93	0.86*	0.79-0.93	0.90*	0.81-0.98
Rich	0.52*	0.48-0.56	0.75*	0.67-0.85	0.68*	0.63-0.72	0.78*	0.75-0.94
<b>Marital status</b>								
Married	1.00		NA		1.00		1.00	
Never married	1.12	1.02-1.29			1.15*	1.00-1.32	1.07	0.84-1.37
<b>Type of marriage</b>								
Monogamous	1.00		1.00		1.00		1.00	
Polygamous	1.15	1.08-1.22	0.99	0.92-1.06	1.29*	1.21-1.37	1.09	0.98-1.21

(Table 2). Continued.

Factors	2013				2018			
	SOR	95% CI	AOR	95% CI	SOR	95% CI	AOR	95% CI
<b>Religion</b>								
Christianity	1.00		1.00		1.00		1.00	
Islam	1.53*	1.43-1.63	1.17*	1.05-1.31	1.36*	1.27-1.45	1.11	0.95-1.30
Others	1.62*	1.27-2.07	1.26	0.97-1.62	1.23	0.86-1.74	1.05	0.61-1.80
<b>Source of water supply</b>								
Unimproved	1.00		1.00		1.00		NA	
Improved	0.71*	0.66-0.75	0.82*	0.77-0.88	0.99	0.94-1.06		
<b>Slept under Mosquito net</b>								
No	1.00		1.00		1.00		NA	
Yes	0.92*	0.85-0.99	0.99	0.92-1.07	1.03	0.97-1.10		
<b>Attended antenatal care</b>								
No visit					1.00		1.00	
1-3	0.87	0.76-1.07			0.93	0.83-1.04	1.16	0.96-1.40
4+	0.65*	0.61-0.76	0.81*	0.77-0.87	0.68*	0.62-0.74	1.03	0.86-1.24
<b>Took Iron during pregnancy</b>								
No	1.00		NA		1.00		1.00	
Yes	0.88	0.75-1.08			0.70*	0.64-0.78	0.79*	0.68-0.92
<b>Pregnancy was wanted</b>								
Wanted	1.00		1.00		1.00		1.00	
Unintended	1.12*	1.02-1.26	1.21*	1.04-1.50	1.13*	1.01-1.27	1.23*	1.03-1.48
Unwanted	1.33*	1.13-1.60	1.32*	1.15-1.86	1.32*	1.11-1.58	1.42*	1.12-1.80
<b>Received tetanus toxoid injection</b>								
No	1.00		1.00		1.00		1.00	
Yes	0.69*	0.65-0.76	0.78*	0.77-0.98	0.72*	0.67-0.78	0.80*	0.68-0.94

\*Significant at P-value<0.05. NA Not available. SOR=Specific Odd Ratio. AOR=Adjusted Odd Ratio.

different in either period. After adjusting for the effects of other factors, we found that mothers aged 20-29 years at child birth were considerably less likely to give birth to small size babies than mothers aged <20 years, but only in the 2009-2013 period (AOR = 0.89, 95% CI=0.80-0.98). The adjusted results also suggested the risk of having small size babies was significantly higher for children delivered at preceding birth interval of fewer than 24 months compared with those delivered at a birth interval of 24 months or more in both the 2009-2013 (AOR=1.07, 95% CI = 0.19-0.26) and 2015-2018 (AOR=1.13, 95% CI = 1.01-1.27) periods.

In terms of mother's educational level, we found evidence of a reduction in the risk of delivering small size babies with increased educational attainment in the 2009-2013 period: the risks were less for mothers

with secondary and higher education (AOR =0.87, 95% CI = 0.78-0.98) and (AOR = 0.59, 95% CI = 0.47-0.79) respectively compared to those with no formal education. However, the risk was significantly less only for mothers with higher educational levels in the 2015-2018 period (AOR =0.62, 95% CI = 0.47-0.81). We also found that the better the household wealth index, the lower the risk of delivering small size babies in both periods. Mothers from middle and rich status households were significantly less likely to have small size babies at birth (AOR = 0.85, 95% CI = 0.77-0.93) and (AOR = 0.75, 95% CI = 0.67-0.85) respectively compared with women from a poor household in the 2009-2013 period. Similar results were found for the 2015-2018 period: mothers from middle and rich status households: AOR = 0.90, 95% CI = 0.81-0.98 and AOR

= 0.78, 95% CI = 0.75-0.94 respectively. The adjusted results also showed that the risk of low size birth did not vary significantly between women in polygamous and monogamous relationships. However, Islamic women were significantly more likely to have small size babies at birth than Christian mothers (AOR = 1.17, 95% CI=1.05-1.13) in 2009-2013, although the risk was not significantly different in 2015-2018. Furthermore, women who had access to an improved water supply source were significantly less likely to give birth to small sized babes compared to women in households with no access to improved water supply (AOR = 0.82, 95% CI=0.77-0.88), but only in the 2009-2013 period.

For health-seeking behavior-related factors, we found that the frequency of antenatal care attendance during pregnancy has a significant associated with the risk of small size baby, but only in the 2009-2013 period. Women who attended a minimum of four ANC visits during the 2009-2013 period were significantly less likely to have small size babies at birth (AOR=0.81, 95% CI= 0.77-0.87) compared with women who did not attend antenatal care during the pregnancy period. We found no evidence of an association between the use of mosquito nets and the risk of small sized babies at birth. Hence, that variable was dropped. Information on Iron intake during pregnancy was only available in the 2018 survey. It was found to be significantly related to the risk of delivering small size babies: women who took iron pills during pregnancy were found to have a lower risk compared to those who did not receive iron pills. The results also indicated higher risk for unintended and unwanted pregnancies compared to wanted pregnancies, in both survey periods: AOR = 1.21 (95% CI=1.04-1.50) and AOR = 1.23 (95% CI=1.03-1.48) for unintended pregnancies and AOR = 1.32 (95% CI=1.15-1.86) and AOR = 1.42 (95% CI=1.12-1.80) for unwanted pregnancies, in the periods 2009-2013 and 2015-2018 respectively. Receiving tetanus toxoid injection was found to be significantly associated with a lower risk of giving birth to a small size baby compared to those who did not receive one: AOR = 0.78 (95% CI=0.77-0.98) and AOR = 0.80 (95% CI=0.68-0.94) for periods 2009-2013 and 2015-2018 respectively.

## DISCUSSION

We used the mother's perception of the small size of the baby as a proxy for our definition of low birth weight in this study. Our results indicated a slight but declining trend in the prevalence of small size babies in Nigeria from 14.9 % as of 2013 to 13.7% in 2018.

These results are similar to those described in the Multiple Indicator Cluster Survey report on low birth weight infants [14]. When considered over the two NDHS survey periods, 2009-2018, we can see that the prevalence in Nigeria was lower than those for Bangladesh (17.2%) [16] and Ethiopia (29.1%) [17], but slightly higher than the prevalence in Pakistan (10.6%) [18].

We identified certain demographic, socio-economic, and healthcare utilization factors on which we found evidence of association with the risk of low birth weight in Nigeria. These are the sex of the child, geopolitical region, maternal age, maternal education, wealth index, religion, source of water supply, number of antenatal clinics (ANC) visits, iron intake during pregnancy, desirousness of pregnancy and intake of tetanus toxoid injection. Female children are more likely to be of the small size at birth; this finding was consistent with two previous studies, one in Nigeria [19] and another in Bangladesh [16]. Under-utilization of health care service and low nutritional intake during pregnancy have been reported elsewhere as possible responsible [20]. The mother's age at child birth was also identified to have a statistically significant association with the risk. Women aged 20-29 years were less likely to deliver small size babies than the other age groups, which is consistent with previous studies in Nigeria [20] and abroad [17].

We also found that the mother's educational level and household wealth index were significantly associated with small sized babies at birth. Mothers who have higher educational attainment and better household wealth status have lower risk- results, which are consistent with the findings in some other studies [16-17, 19, 20]. In particular, women with secondary or higher education levels are significantly less likely to give birth to small sized babies. One explanation is that better educated and privileged women are likely to have increased knowledge and awareness of healthy living and are more likely to be able to afford better health care services [16]. Other findings include higher risk among Islamic women when compared with Christian women which could be attributed to the high proportion of teenage pregnancy and motherhood in the northern part of Nigeria, where over half of the population are Muslims [21]. Antenatal care (ANC) attendance in reducing the risk of low birth weight, which has previously been reported as a part of the general risk of adverse pregnancy outcomes and the importance of frequent ANC attendance for women's health during pregnancy [16, 22, 23]. The reasons

presented including ANC visits are enhancing the dietary practices of mothers, promoting proper monitoring of both mothers and fetuses during the period of pregnancy, and enabling health care providers to discover any clinical and obstetric complications to initiate early interventions and treatment, which would improve the outcomes [16,23]. As previously reported by other studies, women with access to improved water supply were found to have a lower risk of small size babies than those with poor or unimproved sources [24, 25]. One explanation is that poor or unimproved water sources are often contaminated with biological and chemical hazards such as macro-organism, benzene, and trichloroethylene (TCE), which can cause defects and diseases to mothers and unborn children [26, 27].

Our study also added to the growing evidence of a significant relationship between unintended and unwanted pregnancies and the risk of small size babies [16, 28, 29]. Some have suggested women who have unintended and unwanted pregnancies may be reluctant or less likely to receive the right antenatal care and are more likely to indulge in smoking or alcohol consumption than those with wanted pregnancies [28, 29]. We found an association between receiving iron pills during pregnancy and lower risk of small size babies at birth- a finding previously reported by other studies in Nigeria [19] and Ethiopia [30]. The importance of iron intake during pregnancy in reducing the LBW risk has also been emphasized [31, 32]. Another finding is the association between tetanus toxoid injection and lower risk of small sized babies, which is consistent with the finding from a study in Rural North India that reported a reduced risk of neonatal deaths with at least one dose of tetanus toxoid [33]. Of course, other studies have already reported a small size at birth as a risk factor for childhood mortality [5-7, 34].

## CONCLUSION

This study presents the national prevalence of reported small size babies at birth, which we considered as a proxy for low birth weight, using data from 2013 NDHS and 2018 NDHS in Nigeria. Our results indicate a slight but declining trend in the prevalence of low birth weight in Nigeria throughout the two surveys, namely between 2009-2018. However, despite the slight decline, prevalence rates are still very high in Nigeria. We found evidence of an association between the risk of low birth weight and the sex of the child, geopolitical region, maternal age at the birth of

the child, maternal education, wealth index, religion, source of water supply, number of antenatal visits, iron intake during pregnancy, desirousness of pregnancy and intake of tetanus toxoid injection. In light of the adverse effects of low birth weight on child growth, development and survival, we recommend the implementation and prioritization of active, and resourceful public health interventions, if Nigeria is to sustain the little progress achieved so far in reducing the current high rate.

## ETHICAL ISSUES

Ethical approval was not needed since NDHS does not require direct or primary source data collection. However, permission to use the data was obtained from ORC Macro International via the DHS website.

## CONFLICTS OF INTEREST

None to declare.

## FUNDING SOURCE

None to declare.

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