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Research Article

The Risk Factors of Low Birth Weight in Primary Health Care Centres: A Comparative Study in Selected Rural and Urban Settings in a Southwestern State of Nigeria

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Abstract

The World Health Organization (WHO) defines low birth weight (LBW) as less than 2500g at birth, a critical predictor of infant morbidity and mortality. LBW prevalence is notably higher in developing countries (15%) compared to developed ones (7%), affecting 5–6 million children annually in Nigeria. This study aimed to identify and compare LBW risk factors in rural and urban areas of Ondo State, Nigeria, and to describe the socio-demographic and pregnancy characteristics of affected mothers. Conducted from January 2021 to August 2022, the case-control study analyzed live birth records from selected primary health centers. Factors such as socio-demographics, anthropometrics, nutrition, maternal morbidity, and antenatal care were considered. Logistic regression models, both bivariate and multivariate, were used to analyze the data. The study found a LBW incidence of 10.2%, with 9.7% in rural and 11% in urban areas. BMI, maternal age, occupation, and marital status were not correlated with LBW. In urban areas, lower parity and frequent medication use during pregnancy were linked to lower LBW risk, while ANC visits significantly impacted LBW incidence ($p < 0.05$). Overall, ANC visits, iron supplement use, and parity were significant LBW risk factors, particularly in urban settings, whereas socio-demographic factors showed no substantial association.

Keywords

Low Birth Weight, Risk Factors, Primary Healthcare Center, Rural and Urban Settings

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1. Introduction

The World Health Organization (WHO) defines low birth weight (LBW) as weight less than 2500g at birth, usually measured within the first hour, regardless of gestational age [1]. LBW is a major global public health problem due to its significant role as a predictor of infant morbidity and mortality. This has prompted the global objective of reducing LBW by 30% by 2025 [1]. LBW poses numerous adverse effects both in the short and long term, making it a crucial determinant of neonatal survival and future infant development and growth.

In response to the pressing issue of LBW, the World Health Organization endorsed the "A World Fit for Children" initiative in 2002, which aimed to halve the prevalence of LBW worldwide. This initiative is particularly critical given that approximately 30 million babies are born annually with low birth weight, with about 70% of these births occurring in low-income countries. LBW has far-reaching consequences on health outcomes in adulthood and is a significant predictor of mortality, morbidity, and impairment during infancy and childhood [2].

LBW is intricately linked to various health indicators, significantly affecting the physical, mental, and overall well-being of a child at birth and later in life. LBW children face higher risks of neonatal and post-neonatal death, as well as morbidity. Conditions such as impaired cognitive function, psychological disorders, and coronary heart disease are strongly associated with LBW [2]. Although LBW is multifactorial, many risk factors are preventable before delivery. Premature birth (less than 37 weeks of pregnancy) and fetal growth restriction are the most common causes of LBW, identifiable during routine antenatal visits at healthcare clinics, underscoring the importance of primary healthcare centers.

Despite progress in healthcare, LBW remains a significant health challenge globally, especially in sub-Saharan Africa, where factors such as malaria, extreme poverty, illiteracy, and inadequate access to healthcare are prevalent. In these regions, up to 65% of births occur outside hospitals, with traditional birth attendants (TBAs) handling most deliveries [3]. The prevalence of LBW varies significantly between developed and developing countries, as well as within different regions of the same country. For instance, LBW occurs in 7% of births in developed countries compared to 15% in developing nations [4]. Globally, around 18 million LBW babies are born each year [5].

Maternal factors such as age, socioeconomic status, rural residency, and literacy levels significantly influence LBW incidence. Mothers younger than 17 and older than 35, those deprived socio-economic conditions, and those with unhealthy lifestyles, including smoking, have higher chances of delivering LBW babies. Additionally, maternal health during pregnancy, including anemia, malnutrition, and lack of skilled antenatal care, plays a crucial role [6]. Paternal factors, including education, age, and employment, also contribute to LBW outcomes [5].

Antenatal care (ANC) visits are critical for monitoring maternal and fetal health. The frequency of ANC visits is significantly associated with birth outcomes like birth weight. Pregnant mothers attending fewer than four ANC visits are at double the risk of delivering LBW babies compared to those who visit four or more times [7].

LBW is a pressing public health concern globally and remains a leading cause of perinatal deaths. Despite extensive research, the factors affecting LBW in Nigeria, particularly in different residential settings, are under-researched. Identifying and addressing these factors can help reduce childhood morbidity and mortality due to LBW. This study aims to identify the indicators and risk factors of LBW in Ondo State, Nigeria, and compare cases in urban and rural areas, filling a critical gap in the existing literature.

2. Method

2.1. Study Design

This study employed a descriptive survey research design to investigate the knowledge and attitudes of students at the Ondo State College of Health Technology towards the COVID-19 vaccine. The descriptive survey design was chosen to systematically collect data from a representative sample of the population and to provide an accurate portrayal of the students' knowledge and attitudes regarding COVID-19 vaccination. This design is appropriate for identifying patterns, frequencies, and relationships among the variables of interest.

2.2. Sampling Technique

The population for this study comprised all Technician students from the six departments offering Technician programs at the Ondo State College of Health Technology. A sample of 300 students was selected using a random sampling technique. This approach ensured that every student had an equal chance of being included in the sample, thus enhancing the representativeness of the findings. The sample size was determined based on the standard formula for calculating sample sizes in survey research, ensuring sufficient power to detect significant differences and relationships in the data.

2.3. Data Collection

Data was collected using a self-constructed questionnaire titled "Trainee Health Workers Knowledge and Attitude Questionnaire." This instrument was designed to capture comprehensive information on the students' knowledge and attitudes towards the COVID-19 vaccine. The questionnaire included sections on demographic information, knowledge about COVID-19 and the vaccine, attitudes towards vaccination, and personal vaccination status. The questionnaire was pre-tested on a small subset of students to ensure clarity, reliability, and validity. The data collection process involved administering the questionnaire to the selected students during a scheduled class period, ensuring a high response rate. The completed questionnaires were collected and reviewed for completeness before data entry and analysis.

2.4. Ethical Considerations

Ethical approval for the study was obtained from the Institutional Review Board of the Ondo State College of Health Technology. The study was conducted in accordance with the ethical standards of the Helsinki Declaration. Informed consent was obtained from all participants prior to their inclusion in the study. Participants were informed about the purpose of the study, the procedures involved, their right to refuse participation, and the confidentiality of their responses. They were assured that their participation was voluntary and that their academic standing would not be affected by their decision to participate or not. Data confidentiality was maintained by anonymizing the questionnaires and storing data securely. Only the research team had access to the data, which was used solely for the purpose of this study.

3. Result

3.1. Sociodemographic Characteristics

There were 481 overall records retrieved from birth record data from different primary health facilities across the study area during the last 20 months preceding this study. The proportion of low birth weight in this study is 49 (10.2%); 18 (9.7%) in the rural facilities and 31 (11%) in the urban facilities. They were all from documented hospital records of childbirth.

Sociodemographic characteristics of 481 participants are presented in Table 1. On analysis of socio-demographic variables, it was found that a total of 112 (23%) and 85 (18%) babies were born among mothers with the age categories of 16–24 and ≥35 years respectively and among them, numbers of each category's LBW babies were 12 (24%). Among illiterate mothers 3 (6.1%) numbers of LBW babies were seen. Numbers of LBW babies found in rural and urban areas were 18 (37%) and 31 (63%) respectively. Maximum LBW babies belonged to married women that is 47 (96%). Based on the occupation of the mothers, 13 (27%) numbers of LBW babies were found among those without any work while 36 (73%) was seen among the working-class mothers (Table 1).

Table 1. *Socio-demographic characteristics of mothers who gave birth to LBW babies in the different settlement.*

	<2500G, N = 49	≥2500G, N = 432	Overall, N = 481	CHI-SQ	P-VALUE
MATERNAL AGE					
≤15 years	1 (2.0%)	0 (0%)	1 (0.2%)	2.3908	0.30259
≥35 years	12 (24%)	73 (17%)	85 (18%)		
16–24 years	12 (24%)	100 (23%)	112 (23%)		
25-34 years	24 (49%)	259 (60%)	283 (59%)		
MARITAL STATUS					
Divorced	0 (0%)	1 (0.2%)	1 (0.2%)	0.001	0.97492
Married	47 (96%)	413 (96%)	460 (96%)		
Single	2 (4.1%)	18 (4.2%)	20 (4.2%)		
PLACE OF RESIDENCE					
Rural	18 (37%)	168 (39%)	186 (39%)	0.0861	0.76918
Urban	31 (63%)	264 (61%)	295 (61%)		
MATERNAL LEVEL OF Education					
No formal	3 (6.1%)	38 (8.8%)	41 (8.5%)	0.5813	0.74777
Primary	3 (6.1%)	20 (4.6%)	23 (4.8%)		
Secondary	43 (88%)	374 (87%)	417 (87%)		
MATERNAL OCCUPATION					

	<2500G, N = 49	≥2500G, N = 432	Overall, N = 481	CHI-SQ	P-VALUE
Not working	13 (27%)	70 (16%)	83 (17%)	3.287	0.06983
Working	36 (73%)	362 (84%)	398 (83%)		

3.2. Maternal Characteristics in Urban and Rural Area

The sociodemographic characteristics of 481 participants are presented in Table 2. There were significant differences between urban and rural pregnant women in terms of marital status ($p = 0.00314$) and maternal education level ($p < 0.00001$).

Table 2. *Crosstabulation of Maternal characteristics in urban and rural area (n = 481).*

	Rural, N = 186	Urban, N = 295	Overall, N = 481	CHI-SQ	P-Value
MATERNAL AGE					
≥35 years	38 (20%)	47 (16%)	85 (18%)	2.8751	0.238
16–24 years	47 (25%)	65 (22%)	112 (23%)		
25-34 years	101 (54%)	182 (62%)	283 (59%)		
≤15 years	0 (0%)	1 (0.3%)	1 (0.2%)		
MARITAL STATUS					
Divorced	1 (0.5%)	0 (0%)	1 (0.2%)	8.7191	0.00314
Married	171 (92%)	289 (98%)	460 (96%)		
Single	14 (7.5%)	6 (2.0%)	20 (4.2%)		
MATERNAL LEVEL OF EDUCATION					
No formal education	34 (18%)	7 (2.4%)	41 (8.5%)	37.1901	< 0.00001
Primary	7 (3.8%)	16 (5.4%)	23 (4.8%)		
Secondary	145 (78%)	272 (92%)	417 (87%)		
MATERNAL OCCUPATION					
Not working	31 (17%)	52 (18%)	83 (17%)	0.0737	0.786
Working	155 (83%)	243 (82%)	398 (83%)		

3.3. Pregnancy Characteristics of Mothers Who Gave Birth to LBW Babies

Analysis of pregnancy characteristics [Table 3] revealed that 16 (33%) of LBW babies are born of primipara mothers. There was also a higher LBW percentage among multipara mothers 31 (63%). A high LBW percentage of 16 (33%) was seen when the inter-pregnancy interval was between 24-47 months. LBW percentage was found to be higher among those women who had adequate antenatal care (ANC) visits 33 (67%) and less among those who either had no or less than 4 ANC visits 8 (16%). Among the mothers who had BMI of 18.5 – 24.9 (normal), 12 (24%) had LBW babies and none among mothers who are obese. LBW was significantly associated with the ANC visits of mothers ($P < 0.05$).

Table 3. Crosstabulation of Pregnancy characteristics of mothers who gave birth to LBW babies.

	<2500G, N = 49	≥2500G, N = 432	Overall, N = 481	CHI-SQ	P-VALUE
MATERNAL BMI					
Nil	27 (55%)	222 (51%)	249 (52%)	4.0167	0.13421
<18.5 (underweight)	3 (6.1%)	17 (3.9%)	20 (4.2%)		
>30 (obese)	0 (0%)	21 (4.9%)	21 (4.4%)		
18.5 – 24.9 (normal)	12 (24%)	115 (27%)	127 (26%)		
25.0 – 29.9 (overweight)	7 (14%)	57 (13%)	64 (13%)		
PARITY					
Nil	0 (0%)	2 (0.5%)	2 (0.4%)	0.7177	0.69846
Grand multipara (≥5)	2 (4.1%)	28 (6.5%)	30 (6.2%)		
multipara (2–4)	31 (63%)	280 (65%)	311 (65%)		
primipara (1)	16 (33%)	122 (28%)	138 (29%)		
PRECEEDING BIRTH iNTERVAL MONTHS					
nil	0 (0%)	12 (2.8%)	12 (2.5%)	1.0991	0.77729
≥48 months	7 (14%)	86 (20%)	93 (19%)		
<24 months	12 (24%)	98 (23%)	110 (23%)		
24–47 months	16 (33%)	128 (30%)	144 (30%)		
First birth	14 (29%)	108 (25%)	122 (25%)		
NUMBER OF ANC VISIts					
Nil	0 (0%)	1 (0.2%)	1 (0.2%)	6.1907	0.045259
adequate (≥4)	33 (67%)	331 (77%)	364 (76%)		
inadequate (1–3)	8 (16%)	72 (17%)	80 (17%)		
No visit (0)	8 (16%)	28 (6.5%)	36 (7.5%)		

3.4. Weight of Mothers with LBW Babies

The mean weight of mothers with LBW babies is almost same for mothers in rural area (62.3) and urban communities (62.5) (figure 1).

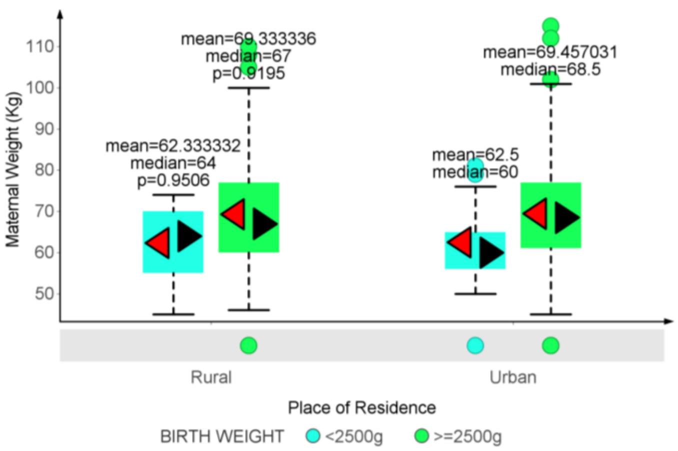

Figure 1. Maternal Weight description for rural and urban residence.

3.5. Maternal and Infant Characteristics Comparing Rural and Urban Residences

Only 232 women completed height assessment at their clinic visit with an eventual calculation of their respective BMI. However, at follow up, all 481 women provided the birth and infant outcomes data. Maternal and infant characteristics for urban and rural pregnant women are shown in Table 4. Urban women were more likely to be overweight or obese than rural women (18% vs 5.9%). There was no significant difference in infant birth weight between women in urban and rural areas. However, there were significant differences in parity (*p = 0.0123*), and number of ANC visits (*p = 0.00229*). More pregnant women in urban areas had infants with low birth weight (11% vs 9.7%) compared to pregnant women in rural areas. Rural pregnant women had greater incidence of high birth weight (90% vs 89%) than urban pregnant women.

Table 4. *Crosstabulation of Maternal and infant characteristics comparing rural and urban residences.*

	Rural, N = 186	Urban, N = 295	Overall, N = 481	Chi-sq	p-Value
MATERNAL BMI					
Nil	162 (87%)	87 (29%)	249 (52%)	7.8031	0.0502
<18.5 (underweight)	1 (0.5%)	19 (6.4%)	20 (4.2%)		
>30 (obese)	4 (2.2%)	17 (5.8%)	21 (4.4%)		
18.5 – 24.9 (normal)	8 (4.3%)	119 (40%)	127 (26%)		
25.0 – 29.9 (overweight)	11 (5.9%)	53 (18%)	64 (13%)		
PARITY					
Nil	1 (0.5%)	1 (0.3%)	2 (0.4%)	8.7826	0.0123
grand multipara (≥5)	13 (7.0%)	17 (5.8%)	30 (6.2%)		
multipara (2–4)	133 (72%)	178 (60%)	311 (65%)		
primipara (1)	39 (21%)	99 (34%)	138 (29%)		
PRECEEDING BIRTH INTERVAL (MONTHS)					
Nil	9 (4.8%)	3 (1.0%)	12 (2.5%)		
≥48 months	41 (22%)	52 (18%)	93 (19%)	3.4132	0.3322
<24 months	43 (23%)	67 (23%)	110 (23%)		
24–47 months	54 (29%)	90 (31%)	144 (30%)		
first birth	39 (21%)	83 (28%)	122 (25%)		
NUMBER OF ANC VISITS					
Nil	0 (0%)	1 (0.3%)	1 (0.2%)	12.1587	0.00229
adequate (≥4)	154 (83%)	210 (71%)	364 (76%)		
inadequate (1–3)	27 (15%)	53 (18%)	80 (17%)		
no visit (0)	5 (2.7%)	31 (11%)	36 (7.5%)		
BIRTH WEIGHT					
≥2500g	168 (90%)	264 (89%)	432 (90%)		
<2500g	18 (9.7%)	31 (11%)	49 (10%)	0.0861	0.769
SEX OF CHILD					
Nil	6 (3.2%)	0 (0%)	6 (1.2%)		
Female	93 (50%)	154 (52%)	247 (51%)	0.0129	0.910

	Rural, N = 186	Urban, N = 295	Overall, N = 481	Chi-sq	p-Value
Male	87 (47%)	141 (48%)	228 (47%)		
MORBIDITY					
Nil	4 (2.2%)	1 (0.3%)	5 (1.0%)	-	-
Absent	182 (98%)	293 (99%)	475 (99%)		
Present	0 (0%)	1 (0.3%)	1 (0.2%)		

3.6. Factors Associated with Infant Low Birth Weight

Logistic regression included factors found to significantly influence birth weight in univariate analysis (Pearson correlation *p < 0.05*). BMI, maternal age, maternal occupation and maternal marital status were not correlated with birth weight and therefore were excluded from the logistic regression models. In Urban pregnant women, lower parity (OR = 0.527, 95% Cl 0.342 to 0.813) and frequent use of medication during pregnancy (OR = 1.513, 95% Cl = 1.02 to 2.245) were associated with lower risk of birth to lower birth weight in infants (Table 5).

***Table 5.** Crosstabulation of Factors associated with infant low birth weight.*

Variables	Urban			Rural		
	OR	95% C.I.	p-Value	OR	95% C.I.	p-Value
Parity	0.527	(0.342-0.813)	0.003355	1	-	-
History of medication	1.513	(1.02- 2.245)	0.0407	1	-	-

4. Discussion

Low birth weight (LBW) is a significant contributor to neonatal mortality and is influenced by various socio-economic, maternal, and environmental factors. Understanding the birth weight of infants and maternal characteristics is crucial for preventing complications related to LBW. This study analyzed 481 birth weights from primary health center records in Ondo State between January 2021 and September 2022. The number of births recorded in primary health centers was lower compared to secondary and tertiary facilities due to the referral of complicated cases and births occurring in non-institutional settings like mission houses, traditional birth homes, and home deliveries.

The prevalence of LBW in this study was 10%, with 9.7% in rural areas and 11% in urban areas. This rate is lower than the global prevalence rate of 17% in developing countries [8]. A study in India reported a higher prevalence of 26.8%, likely due to the study being conducted in tertiary care settings where high-risk patients are treated [9]. Several pre- and during-pregnancy factors, including environmental influences on access and quality of care, affect LBW. This study identified parity, history of medication use, and antenatal care (ANC) visits as predictors of LBW, aligning with previous research emphasizing the importance of identifying risk factors for improving maternal health and pregnancy outcomes [10].

Parity was significantly associated with birth weight. Mothers in urban areas with lower parity were less likely to deliver LBW infants, consistent with findings from India, where multiparity increased the risk of medical and obstetric complications, including LBW [10]. Grand multiparity is associated with higher risks for both mother and infant, including LBW [11]. Similar associations were reported in a study from Kano, Nigeria, where higher parity was linked to a higher risk of LBW infants [12].

A significant association was found between ANC visits and LBW. Adequate ANC visits (>4) were linked to a higher risk of LBW babies, contrasting with a study from Sub-Saharan Africa, where more than 8 ANC visits reduced the likelihood of LBW [13]. In this study, 67% of LBW infants were born to mothers with adequate ANC visits, while only 16% were born to those with fewer than 4 visits. The high percentage of mothers attending more than 4 ANC visits in both rural and urban areas could be due to the proximity of primary health centers, facilitating better access to care. However, this also resulted in a higher proportion of LBW infants among those attending ANC clinics.

Frequent iron supplementation was significantly associated with a lower risk of LBW infants in urban areas. This correlation was not significant in rural areas. Previous studies by Haider et al. and Imdad et al. showed that iron supplementation significantly reduces the risk of LBW [14, 15]. Other factors like infection, diet, and socio-economic status also influence LBW incidence [16]. Maternal age, marital status, education level, and occupational status were not significant risk factors for LBW in this study. Some facilities lacked records of maternal height, preventing the calculation of BMI and its assessment as a risk factor. Morbidity could not be assessed as most complications were referred to higher-level facilities.

Increased maternal age is associated with decreased fetal growth due to aging maternal systems or accumulated disease effects. Conversely, younger mothers, particularly those under 15, also face high risks for poor birth outcomes [17]. Mothers aged 20-35 had the lowest risk of LBW infants in other studies, but in this study, 49% of LBW infants were born to mothers aged 25-34. Other research also shows increased LBW risk with maternal age [18].

Marital status did not significantly affect birth weight outcomes, as 96% of mothers in this study were married. Previous studies suggest that unmarried mothers are more likely to have LBW infants due to the absence of partner support [19]. Maternal education and occupation were examined as potential risk factors. Despite 88% of mothers with LBW infants having at least secondary education, maternal education is generally a strong determinant of birth weight, improving access to information, healthcare, and nutrition [20]. This finding contrasts with studies showing that less educated mothers are more vulnerable and have limited healthcare access [21]. Another study found that maternal education had minimal effect on birth weight compared to other factors [22].

Working mothers were linked to higher LBW risk, with unfavorable working conditions increasing the likelihood of LBW fivefold [23]. This study also found that 73% of mothers with LBW infants were employed. Birth interval extremes are associated with poor outcomes, including LBW. Short intervals may lead to nutrient deficiencies, while long intervals may be linked to hypertensive disorders, which can cause preterm births and fetal growth restrictions [24]. This study found no significant differences in LBW incidence across different birth intervals, with the highest percentage (33%) occurring at intervals of 24-47 months.

5. Conclusion

The study highlights significant associations between antenatal care visits, iron supplementation, and parity with low birth weight (LBW) in urban areas of Ondo State. Advocacy efforts are needed to ensure expectant mothers attending antenatal care put into practice knowledge gained during visits, and screening for fetal growth restriction is crucial for early intervention. Close monitoring of pregnant women with multiparity is recommended to detect signs of poor birth outcomes. Iron supplementation guidelines should be provided, particularly to anemic or iron-deficient pregnant women, to improve birth outcomes, especially birth weight. However, socio-demographic characteristics showed no significant associations with LBW, possibly due to data limitations. Further studies should explore socio-demographic factors with more accurate participant information.

6. Recommendations

It is recommended to conduct further studies on the quality of antenatal care visits and their association with LBW. Prospective studies exploring all available risk factors throughout pregnancy till birth are needed for a comprehensive understanding. Additionally, efforts should focus on enhancing the quality of antenatal care and ensuring adherence to iron supplementation guidelines to improve birth outcomes in Ondo State.

Abbreviations

ANC	Antenatal Care
BMI	Body Mass Index
LBW	Low Birth Weight
TBA	Traditional Birth Attendant
WHO	World Health Organization

Conflicts of Interest

The authors declare no conflicts of interest.

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