

Dietary Diversity and Gestational Weight Gain are Predictors of Birth Outcomes: A Cohort Study in Nigeria

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ABSTRACT

Background: Maternal malnutrition contributes to adverse birth outcomes in low- and middle-income countries, yet evidence from Nigeria remains limited. **Objective:** We tested the directional hypothesis that higher maternal dietary diversity would be associated with greater third-trimester weight gain and improved birth outcomes among pregnant women in Ota, Ogun State, Nigeria. **Materials and Methods:** A longitudinal study of 200 women attending public and private facilities completed three 24-hour dietary recalls; foods were classified into ten groups to compute dietary diversity scores (DDS) categorized as low (≤ 3), moderate (4–5), or high (≥ 6). Last-trimester weight gain (LTWG) was derived from weights at 28, 30, and 32 weeks. Birth weight was classified as low (< 2.5 kg), normal (2.5–3.5 kg), or high (> 3.5 kg). Associations were examined using chi-square tests and binary logistic regression. **Result:** Overall, 32% had low DDS and 3.5% had low LTWG. All low-birth-weight cases (2.5%) occurred among women with low DDS ($p = 0.015$) and low LTWG ($p < 0.01$). Lunch time was the only dietary habit marginally associated with adverse birth outcomes ($p = 0.05$). DDS remained a significant predictor of birth outcome ($\beta = -1.595$, AOR=0.213; 95% CI [0.077, 0.592], $p=0.003$), indicating 78.7% decrease in the odds of adverse birth outcome among women with good DDS. **Conclusion:** Findings support the hypothesis that greater dietary diversity is linked to higher third-trimester weight gain and better birth outcomes in this population. Integrating dietary diversity counseling and weight monitoring into routine antenatal care may help reduce the risk of low birth weight in similar settings.

Keywords: dietary diversity scores; weight gain; birth outcome; pregnancy; maternal nutrition; low birth weight.

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INTRODUCTION

Pregnancy is a physiologically dynamic period that necessitates nutritional adjustments to meet the increased and varying nutrient requirements across trimesters [1-4]. These include energy, protein, vitamins, and minerals sourced from a diverse range of foods [2]. Good maternal nutrition during pregnancy is essential for supporting optimal maternal and foetal health outcomes. It aids in appropriate weight gain, enhances fetal development, and reduces the risk of adverse birth outcomes such as low birth weight [2, 3]. A healthy pregnancy diet has also been associated with improved brain development and favourable birth weight [4].

Maternal malnutrition remains a major public health concern, especially in low- and middle-income countries. In South Asia and Sub-Saharan Africa, high rates of nutritional deficiency among women have been documented [5]. Adolescents and young women are particularly vulnerable due to early marriage, limited dietary knowledge, and socio-economic barriers [6]. Mid-upper arm circumference (MUAC) of less than 23 cm is a reliable indicator of increased risk for low birth weight and other adverse maternal outcomes [7].

Cultural practices, food taboos, and social beliefs often influence dietary patterns during pregnancy, particularly in resource-limited settings [8-10]. Pregnant women frequently consume ultra-processed foods rich in sugar and unhealthy fats but low in fibre, vitamins, and minerals [11]. Other barriers to optimal intake include a lack of nutrition knowledge, fear of difficult labour due to perceived foetal size, and limited access to diverse food groups [10,12-14].

In Nigeria, although some studies have explored dietary diversity among pregnant women, highlighting low consumption of fruits and vegetables and suboptimal dietary diversity scores (DDS) among this population [15], there remains limited research explicitly linking maternal DDS to gestational weight gain and birth outcomes. Nupo et al. [16] evaluated seasonal impacts on dietary

diversity and nutritional status among women in Ogun State, but not within the context of pregnancy. Similarly, Olatona et al. [15] assessed the dietary habits of pregnant women in Lagos without connecting the findings to weight gain or birth weight. Moreover, the potential influence of the type of healthcare facility, public or private, on dietary diversity and pregnancy outcomes remains underexplored. These three levels of healthcare facilities present broader socio-economic spectrum and geographical area as well as antenatal care practices which may influence pregnancy and birth outcome.

Despite national nutrition programmes, most interventions have targeted infants and young children, with comparatively less focus on maternal nutrition. Yet, adequate dietary practices during pregnancy are crucial not only for the immediate health of the mother and child but also for long-term population health and national development goals [17,18].

Therefore, this study hypothesizes that pregnant women with higher dietary diversity scores (DDS) will have significantly greater third-trimester weight gain and better birth outcomes, including higher birth weight and reduced risk of adverse outcomes, compared with those with lower DDS. To test this hypothesis, the study examined the associations between dietary practices and diversity, third-trimester weight gain, and birth outcomes among pregnant women attending public and private health facilities in Ota, Ogun State, Nigeria.

MATERIALS AND METHODS

Study Design, Setting, and Period

This study utilized a cross-sectional longitudinal design. The setting is Ota, the capital of Ado-Odo/Ota Local Government Area of Ogun State, the second-largest local government area in Ogun State. The area is an industrial hub bordering Lagos State and located at coordinates 6°41'00"N, 3°41'00"E. The study was conducted over three months, from May to July 2022.

Sampling procedure

A total sample size of 200 pregnant women was determined based on the events per variable (EPV) rule for logistic regression in observational studies. The calculation followed the formula $n = 100 + xi$, where $x = 50$ and i represents the number of independent variables in the final model (Bujang et al., 2018). This sample size was considered adequate to achieve 80% statistical power at a 5% significance level ($\alpha = 0.05$) to detect a moderate effect size in the relationship between dietary diversity score, third-trimester weight gain, and birth outcomes.

One private and two public healthcare facilities in the study area were randomly selected from a comprehensive list of hospitals stratified by ownership type (private and public). Pregnant women in the final week of their second trimester (27th-28th week) were identified through clinic registers and screened for eligibility. Random sampling was performed using these registers in both secondary and primary health centres, where most eligible participants were located. At each facility, data were collected biweekly, and participants were enrolled on two consecutive weekly clinic days. The target recruitment goal was approximately 70 consenting participants per facility, ensuring representativeness across healthcare levels and socio-economic groups.

Eligibility criteria

Pregnant women with multiple gestations or known medical conditions such as diabetes mellitus, hypertension, or peptic ulcer disease were excluded. All consenting pregnant women who met the inclusion criteria within the study period were enrolled.

Data Collection Method

A well-structured, validated, and pre-tested questionnaire was used to collect specific information from each respondent. The questionnaire comprised four main sections: (1) socio-demographic characteristics, (2) dietary habits, (3) dietary diversity, and (4) anthropometric measurements.

Socio-demographic data

This section comprised questions designed to collect background information on the participants, including age, religion, marital status, ethnicity, parity, and occupation. These variables were considered important for understanding potential socio-cultural and economic influences on dietary practices and pregnancy outcomes.

Dietary assessment

Dietary habits were assessed using semi-structured questions. Information was gathered on meal frequency, timing, mid-meal snacks, pica practices, and desired foods. Desired foods referred to items particularly craved or preferred during pregnancy. Daily and weekly food consumption was assessed using a frequency table listing food groups and consumption frequencies.

Dietary diversity was evaluated using an adapted version of the Food and Agriculture Organization (FAO) Minimum Dietary Diversity for Women (MDD-W) guidelines (Food and Agricultural Organization, 2010). Locally available foods identified in the frequency table were classified into ten food groups. Three 24-hour dietary recalls were collected during clinic visits, and respondents recalled all foods and beverages consumed the previous day. The day representing the most typical dietary pattern was used for analysis.

Dietary diversity scores (DDS) were calculated as the count of food groups consumed out of the ten possible groups, following FAO recommendations. Based on observed dietary patterns and international guidelines, scores of ≤ 3 were classified as low DDS, 4–5 as moderate DDS, and ≥ 6 as high DDS. These DDS categories were used as predictor variables in subsequent analyses.

Weight measurements

Body weight was measured using a calibrated digital weighing scale (EP 1440, Laica, Italy) before 8:00 a.m. Participants were instructed not to eat before measurement. Each participant was weighed twice by the same investigator, and the average value was recorded to ensure consistency.

Weight measurements were taken during the 28th–29th, 30th–31st, and 32nd–33rd weeks of gestation. For participants who missed a measurement, adjusted data were derived from subsequent visits. Weight gain was computed as the difference between the initial and final weights over the four-week interval, referred to as last trimester weight gain (LTWG), which served as a secondary explanatory variable.

The United States Centers for Disease Control and Prevention (2024) recommended ranges for weight gain during pregnancy are shown in Table 1.

Table 1: Recommended Weight Gain During Pregnancy According to Prepregnancy Body Mass Index Categories*

Pre-pregnancy Weight Category	Recommended range of total weight	Recommended rates of weight gain in the second and third trimesters (lb) (Mean Range [lb/wk] (Mean kg)
Underweight	28-40 lbs (13-18 kg)	1 (1-1.3) (0.45kg)
Normal weight	25-35 lbs (11-16 kg)	1 (0.8-1) (0.45kg)
Overweight	15-25 lbs (7-11 kg)	0.6 (0.5-0.7) (0.27kg)
Obese	11-20 lbs (5-9 kg)	0.5 (0.4-0.6) (0.23kg)

*Source: Centers for Disease Control and Prevention (2024).

Birth Weight Measurement

Birth weights, the primary outcome variable, were extracted from hospital delivery registers. They were categorized according to World Health Organization (WHO) guidelines [30] as follows:

- Low birth weight (LBW): <2.5 kg
- Normal birth weight: 2.5–3.5 kg
- High birth weight: >3.5 kg

Statistical analysis

All completed questionnaires were reviewed, coded, and entered into SPSS version 26 for analysis. Normality of data was assessed using skewness, kurtosis and visual inspection methods (histogram, Q-Q plot). The data for the continuous variables (weight, weight change, birth weight) were found to be normally distributed (skewness 0.22-0.43, kurtosis -1.07-0.46). Q-Q Plot and histogram also confirmed normality of the continuous variables.

Descriptive statistics, including frequency tables, means, and percentages, were generated to summarize participants' characteristics and dietary patterns.

The chi-square test was used to assess associations between socio-demographic variables, type of health facility, dietary practices, weight gain, and birth outcomes. DDS and LTWG were treated as independent variables, while birth weight status (BWS) was the main outcome variable.

Binary logistic regression was used to estimate odd ratios to determine the extent to which DDS and gestational weight gain predicted birth outcomes. For this analysis, the main variables (BWS, DDS, and LTWG) were dichotomized into binary codes: 0 for favorable and 1 for poor outcomes. For example, DDS was regrouped for statistical significance with scores ≥ 4 and ≤ 3 recorded as good and low DDS, respectively. Low birth weight was regarded as poor/adverse birth outcomes (<2.5) while normal and high birth weight were grouped as good birth outcome (≥ 2.5 kg). LTWG < 1.2 kg/4 weeks and > 1.2 kg/4 weeks were depicted as poor and good LTWG, respectively. Model fit was evaluated using the Omnibus Test of Model Coefficients ($p < 0.05$) and the Hosmer–Lemeshow Goodness-of-Fit Test ($p > 0.05$). Statistical significance was set at $p < 0.05$.

Ethical Consideration

Ethical approval for this study was granted by the Ogun State Hospital Management Board (HMB), Abeokuta, Nigeria. Informed verbal consent was obtained from all participants before data collection. Questionnaires were completed anonymously, with coded identifiers used to facilitate follow-up and linkage with delivery register records.

RESULTS

A total of 200 questionnaires were completed with the assistance of a trained research assistant, and no participants were lost to follow-up. The socio-demographic characteristics of the participants is displayed in Table 2. Age distribution of respondents revealed that 5% were under 18 years, while the

majority (74%) were between 19 and 34 years. Most respondents (64.5%) had attained tertiary education, followed by 31% who completed secondary education. Regarding monthly income, 42% earned

between \$50 and \$125, while 20% reported no regular income. Only 8% of respondents earned above \$250.

Table 2. Socio-demographic characteristics of the pregnant women

Variables	Frequency (n)	Percentage (%)
Age		
<18	1	0.5
19-34 years	148	74.0
35-45 years	51	25.5
>45 years	0	0.0
Ethnicity		
Igbo	18	9.0
Yoruba	147	73.5
Hausa	0	0.0
Others	35	17.5
Religion	151	75.5
Christianity	49	24.5
Islam	0	0.0
Others		
Monthly Earnings		
< \$50	28	14.1
\$50-\$125	84	42.0
\$127.5-\$250	32	16.0
>\$250	16	8.0
No salary	40	20.0
Level of Education		
Primary	5	2.5
Secondary	62	31.0
Tertiary	129	64.5
No formal	4	2.0
Occupation		
Civil servant	29	14.5
Self-employed/ skill	68	34.0
Business/ trading	87	43.5
Housewife	16	8.0
TOTAL	200	100

As presented in Table 3, just over half of the respondents reported consuming food three or more times daily, and more than 40% experienced an increase in food intake during pregnancy. Fruit and vegetable consumption patterns were generally positive, with 62% and 79%, respectively, reporting increased intake during pregnancy. Most women consumed sugary beverages occasionally (58%) while very few avoided them entirely. There were no significant relationships between BWS of the new borns and their mothers dietary habits, sugary beverage ($p=0.33$), supper ($p=0.57$) and vegetable ($p=0.67$) while lunch time showed marginally relationship ($p=0.05$).

The Minimum Dietary Diversity for Women (MDD-W) classification, as illustrated in Figure 1, showed that approximately one-third (32%) of the women had low dietary diversity scores ($DDS \leq 3$), while 67% fell within the moderate range ($DDS 4-5$).

Table 3: Relationship between dietary habits and birth weight outcome (N = 200)

Variable	BIRTH WEIGHT STATUS				p-Value
	Low BW	Moderate BW	High BW	Total	
Sugary Beverages					0.33
≤ 3 Times A Week					
>3 Times A Week	3 (1.5)	40 (20.0)	3 (1.5)	46 (23.0)	
Occasionally	0 (0.0)	20 (10.0)	1 (0.5)	21 (10.5)	
Never	2 (1.0)	98 (49.0)	16 (8.0)	116 (58.0)	
	0 (0.0)	15 (7.5)	2 (1.0)	17 (8.5)	
Breakfast					0.65
7am-9am	5 (2.5)	128 (60.5)	15 (7.5)	141 (70.5)	
10am-12pm	0 (0.0)	2 (1.0)	0 (0.0)	2 (1.0)	
9am-11am	0 (0.0)	50 (25.0)	7 (3.5)	57 (28.5)	
Lunch					0.05
12pm-2pm	4 (2.0)	60 (30.0)	5 (2.5)	69 (34.5)	
2:30pm-4p	1 (0.5)	113 (56.5)	17 (8.5)	131 (65.5)	
Supper					0.52
6pm-8pm	4 (3.2)	110 (87.3)	12 (9.52)	126 (100)	
8:30pm-10pm	1 (0.0)	63 (85.1)	10 (13.5)	74 (100)	
Vegetable Intake					0.67
Increased					
Decreased	5 (2.5)	134 (67.0)	17 (9.5)	158 (79.0)	
Did Not Change	0 (0.0)	10 (5.0)	1 (0.5)	11 (5.5)	
Fluctuates	0 (0.0)	29 (14.5)	2 (1.0)	31 (15.5)	
	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	
Fruit Intake					0.47
Increased	5 (2.5)	105 (52.5)	14 (11.3)	124 (62.2)	
Decreased	0 (0.0)	8 (4.0)	0 (0.0)	8 (4.0)	
Did Not Change	0 (0.0)	42 (21.0)	4 (2.0)	46 (23.0)	
Fluctuates	0 (0.0)	18 (9.0)	4 (2.0)	22 (11.0)	
Food Intake					0.92
Increased	3 (1.5)	77 (38.5)	9 (4.5)	89 (44.5)	
Decreased	1 (0.5)	16 (8.0)	2 (1.0)	19 (9.5)	
Did Not Change	1 (0.5)	51 (25.5)	7 (3.5)	59 (29.5)	
Fluctuates	0 (0.0)	29 (14.5)	4 (2.0)	33 (16.5)	

As shown in Table 4, only 3.5% (n = 7) of respondents experienced low weight gain during the third trimester, while the majority, 59.0% (n = 118), recorded high weight gain. The mean third-trimester weight gain among respondents was 3.13 ± 1.16 kg. Most respondents with low weight gain (71.4%) were receiving antenatal care at the private hospital.

Table 4: Distribution of Third-Trimester Weight Gain by Type of Health Facility Among Pregnant Women in Ota, Ogun State, Nigeria (N = 200)

Weight Gain	Local Government n (%)	State Hospital n (%)	Private Hospital n (%)	Total n (%)
Low WG	1 (14.3)	1 (14.3)	5 (71.4)	7 (100.0)
Recommended WG	23 (30.7)	30 (40.0)	22 (29.3)	75 (100.0)
High WG	42 (35.6)	38 (32.2)	38 (32.2)	118 (100.0)
Total	66 (33.0)	69 (34.5)	65 (32.5)	200 (100.0)

There was no statistically significant association between type of health facility attended and third-trimester weight gain among respondents ($\chi^2 = 6.273$, $p = 0.180$).

As shown in Table 5, all respondents with high DDS (1.0%, $n = 2$) recorded high weight gain, with no cases of low weight gain in this group. Among those with moderate DDS, 35.8% ($n = 45$) achieved the recommended weight gain, while 64.2% ($n = 86$) had high weight gain. Low weight gain (10.0%) was observed only among respondents with low DDS. As presented in Table 6, 2.5% of the women gave birth to low-birth-weight infants (< 2.5 kg), while 11.0% had babies with high birth weight (> 3.5 kg).

A statistically significant relationship was found between DDS and birth outcome ($p = 0.015$). According to Table 7, all respondents with high DDS (1.0%) had babies within the normal birth weight range. Among those with moderate DDS, 90.3% had babies of normal birth weight, and 9.7% had babies with high birth weight. Low birth weight was reported only among women with low DDS. However, there were no significant relationships between DDS of the women and their ethnicity ($p=0.59$), education ($p=0.63$) and income ($p=0.31$).

Table 5: Relationship Between Dietary Diversity Scores and Third-Trimester Weight Gain Among Pregnant Women in Ota, Ogun State, Nigeria (N = 200)

Dietary Diversity Score	Low Weight Gain n (%)	Recommended Weight Gain n (%)	High Weight Gain n (%)	Total n (%)
Low	7 (11.0)	27 (42.2)	30 (46.9)	64 (100.0)
Moderate	0 (0.0)	48 (35.8)	86 (64.2)	134 (100.0)
High	0 (0.0)	0 (0.0)	2 (100.0)	2 (100.0)
Total	7 (3.5)	75 (37.5)	118 (59.0)	200 (100.0)

P-value < 0.01: There was a statistically significant association between dietary diversity score and third-trimester weight gain.

Table 6: Birth Weight Distribution of Infants Born to Pregnant Women in Ota, Ogun State, Nigeria (N = 200)

Birth Weight Category	Frequency (n)	Percentage (%)
Low Birth Weight (< 2.5 kg)	5	2.5
Recommended Birth Weight (2.5–3.5 kg)	173	86.5
High Birth Weight (> 3.5 kg)	22	11
Total	200	100

Mean $\pm$ SD: 3.17 ± 0.37 kg

Table 7: Relationship Between Maternal Dietary Diversity Scores and Infant Birth Weight Status Among Pregnant Women in Ota, Ogun State, Nigeria (N = 200)

Dietary Diversity Score	Low Birth Weight n (%)	Recommended Birth Weight n (%)	High Birth Weight n (%)	Total n (%)
Low	5 (7.8)	50 (78.1)	9 (14.1)	64 (100.0)
Moderate	0 (0.0)	121 (90.3)	13 (9.7)	134 (100.0)
High	0 (0.0)	2 (100.0)	0 (0.0)	2 (100.0)
Total	5 (2.5)	173 (86.5)	22 (11.0)	200 (100.0)

P-value = 0.015: A statistically significant relationship was found between dietary diversity score and birth weight status of the infants.

A statistically significant relationship was observed between weight change and birth outcome ($p < 0.01$). As shown in Table 8, most low-birth-weight babies (71.4%) were born to respondents who experienced low weight gain during the third trimester. In contrast, no low-birth-weight cases were recorded among women who had recommended or high weight gain.

Table 8: Association Between Third-Trimester Gestational Weight Gain and Birth Weight Status Among Pregnant Women in Ota, Ogun State, Nigeria (N = 200)

Gestational Weight Gain	Low Birth Weight n (%)	Recommended Birth Weight n (%)	High Birth Weight n (%)	Total n (%)
Low Weight Gain	5 (71.4)	2 (28.6)	0 (0.0)	7 (100.0)
Recommended Weight Gain	0 (0.0)	75 (100.0)	0 (0.0)	75 (100.0)
High Weight Gain	0 (0.0)	96 (81.4)	22 (18.6)	118 (100.0)
Total	5 (2.5)	173 (86.5)	22 (11.0)	200 (100.0)

A statistically significant association was found between gestational weight gain and birth weight status ($p < 0.01$).

There was no statistically significant relationship between birth weight and the intake of sugary beverages, overall food intake, fruit and vegetable consumption, or meal timing for breakfast, lunch and supper at $p > 0.05$.

The association between poor birth outcome, DDS, and last-trimester weight gain (LTWG) was initially explored using Chi-square (cross-tabulation) analysis. Significant associations were found between birth weight and DDS ($p = 0.015$), LTWG ($p < 0.01$) supertime ($p < 0.01$). Notably, all participants with poor weight change (either low or high weight gain) delivered babies with poor birth weight status. To further assess the predictive strength of these independent variables, a binary logistic regression analysis was conducted. The Omnibus Test of Model Coefficients was statistically significant ($\chi^2(10) = 42.896$, $p < 0.01$), indicating a good model fit. The Hosmer-Lemeshow Test was non-significant, ($\chi^2(8) = 3.879$, $p = 0.868$). The model explained approximately 35.3% (Nagelkerke R^2) of the variance in birth weight status and correctly classified 86.5% of cases, demonstrating high sensitivity and acceptable model performance.

As shown in Table 9, DDS emerged as a significant predictor of poor birth weight status, $\beta = -1.974$, OR=0.377; 95% CI [0.166, 0.860], $p = 0.02$. indicating a 62.3 % decrease in the odds of having poor birth outcome among women with good DDS compared with women with low DDS. Adjusting for weight gain in last trimester, hospital type, age, level of education, religion and lunch time, DDS remained a significant predictor of birth outcome among these women ($\beta = -1.595$, OR=0.213; 95% CI [0.077, 0.592], $p = 0.003$), indicating 78.7% decrease in the odds of adverse birth outcome among women with good DDS.

Table 9: Binary Logistic Regression Analysis of the Association Between Dietary Diversity Score and Risk of Poor Birth Outcome Among Pregnant Women in Ota, Ogun State, Nigeria (N = 200)

Dietary Diversity Score	n (%)	Odds Ratio (95% CI)	p-value
Good DDS (≥ 4)	136 (48.1%)	1.00 (Reference)	—
Poor DDS (≤ 3)	64 (51.9%)	0.377 (0.166– 0.860)	0.02
Adjusting for other variables		AOR=0.213, CI .077-.592	0.003

Note: Good DDS includes both Moderate (4–5) and High (≥ 6) dietary diversity categories.

A statistically significant association was found between poor dietary diversity and poor birth outcome, with women in the good DDS group having 0.213 times lower odds of delivering a low-birth-weight baby compared to those with poor DDS.

DISCUSSION

This study contributes to the growing body of evidence linking maternal dietary practices with birth outcomes. It establishes that poor birth outcomes are more prevalent among pregnant women who consume a limited variety of foods and gain lower than recommended last trimester weight.

Evidence from various countries underscores the link between maternal dietary diversity and birth outcomes as found in this study. In a study among 6,805 Chinese women, Teng et al. [19] found that higher maternal DDS was associated with 9% and

27% lower risks of LBW. Similarly, Cano-Ibáñez et al. [20] found that a more diversified maternal diet reduced the likelihood of delivering small-for-gestational-age babies among Spanish women. The finding of this study also supports the findings of Saaka [21], who reported a link between low DDS and LBW. Likewise, Madzorera et al. [22] reported that women with higher DDS had a reduced risk of having small-for-gestational-age infants, LBW, and preterm births. Among Ethiopian women, DDS above four food groups was associated with reduced risks of LBW and preterm birth [23]. In addition, studies from Bangladesh, Ethiopia, and Ghana reported that consuming less than five food groups daily predisposed pregnant women to having babies with intrauterine growth restriction (IUGR) and growth-restricted newborn (GRN) [24, 25].

Inadequate gestational weight gain is also a known predictor of adverse maternal and child health outcomes [26]. Studies have shown that pregnant women who follow a healthy dietary pattern rich in nutrient-dense foods are less likely to be underweight and are at lower risk of delivering LBW babies [27]. In Brazil, da Mota Santana et al. [13] reported a similar relationship between third-trimester weight gain and birth outcome, noting that inadequate weight gain was strongly associated with LBW. In this study, approximately half of the respondents neither increased their meal portions nor consumed mid-meal snacks, factors that may have contributed to poor gestational weight gain. Xiao et al. [28] also noted that underweight mothers had a higher incidence of LBW babies, while those who gained weight within the recommended range delivered infants within the normal weight range.

It is noteworthy that some women with low DDS but high gestational weight gain still delivered infants within the recommended birth weight range (2.5–3.5 kg or 5.5–7.7 lbs), suggesting that both diet quality and weight gain independently contribute to birth outcomes.

Although there were no strong relationships statistically between birth outcome and dietary habits, the finding highlights that majority of the mothers ate supper between 6 and 8 pm. Furthermore, other good dietary habits were

observed among these pregnant women, such as consuming three meals per day, increased fruit and vegetable and reduced sugary beverage intake. These positive behaviours might be attributed to increased awareness due to high educational status of the study population and probably urban status. Durrani and Rani [14] identified strong associations between birth weight and the intake of energy, protein, iron, and fat during pregnancy in India.

Previous research has highlighted several potential determinants of poor dietary patterns among pregnant women, including high food costs, parity, seasonal variation, time constraints, and lack of access to healthy foods at home [29,30]. Financial limitations, particularly among women with low income, may hinder access to nutritionally adequate meals. However, in this study, socio-demographic characteristics were not strongly related to birth outcome.

This study reinforces the critical role of maternal nutrition, particularly dietary diversity and appropriate weight gain, in shaping birth outcomes. The findings call for integrated strategies that address both the quality and timing of maternal diets, especially in the third trimester. From a policy perspective, there is a pressing need to embed dietary diversity education into national antenatal care protocols. Comprehensive nutrition programmes should be prioritised, with an emphasis on food-based approaches that reflect local dietary patterns and cultural practices.

Nutrition education and counselling should be strengthened across all levels of antenatal care. Healthcare providers must be equipped to inform pregnant women about the specific risks associated with both inadequate and excessive gestational weight gain. Regular monitoring and individualised counselling can help mitigate poor birth outcomes. Women must understand not only the immediate implications of their diet on their health and that of their unborn child, but also the long-term developmental consequences for their babies.

To support this, community-based nutrition interventions should be scaled up. For instance, providing nutritious meals twice weekly to pregnant women with low income can help bridge nutritional

gaps. Where food support is not feasible, the distribution of multi-micronutrient supplements, along with education on their use and benefits, should be prioritised. These initiatives should be community-driven and sensitive to local needs, ensuring they are both accessible and culturally acceptable.

The findings reinforce the association between low dietary diversity scores (DDS), inadequate gestational weight gain, and adverse birth outcomes such as low birth weight. Importantly, we demonstrate predictive value of DDS for poor birth weight status in this setting, offering a simple screening tool for antenatal clinics. Additionally, this study offers a novel insight by identifying late-night meal consumption as a potential risk factor for poor birth outcomes, a relatively underexplored area in maternal nutrition research. These findings provide important context-specific evidence from Nigeria and underscore the need for more nuanced dietary guidance during pregnancy, particularly regarding meal timing and food diversity.

Future studies should explore the role of meal timing in greater detail, using longitudinal or experimental designs to assess its causal relationship with birth outcomes. Investigating the influence of nutritional knowledge, cultural beliefs, and food taboos on dietary diversity could also provide a more holistic understanding of maternal dietary behaviour. Additionally, expanding research to include all three trimesters of pregnancy and incorporating pre-pregnancy weight, paternal factors, and biochemical nutritional assessments would help strengthen the evidence base. Intervention trials that pair DDS-focused counseling with guidance on earlier supper timing and reduced late-night intake could clarify combined effects on foetal growth. Comparative studies across different geographical and socio-economic settings in Nigeria could further inform targeted interventions and national nutrition policies.

CONCLUSION

The findings of this study indicate that the majority of pregnant women demonstrated relatively good dietary practices, with increased intake of food, fruits, and vegetables during pregnancy. Most respondents achieved good dietary diversity scores (DDS) and optimal gestational weight gain. However, low birth weight was more prevalent among women with poor DDS and inadequate weight gain compared to those with adequate dietary diversity and appropriate weight gain. These results support our directional hypothesis that higher DDS is associated with greater third-trimester weight gain and improved birth outcomes.

Overall, DDS emerged as a valuable indicator of maternal nutritional status during pregnancy. These findings underscore the importance of maternal diet, particularly in the third trimester, as a significant determinant of birth outcomes. Integrating DDS screening and targeted counseling into routine antenatal care may offer a pragmatic pathway to reduce LBW risk.

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Author Contributions

Conceptualization: DA, HA, AT; Study Design: JOA, DA; Data Collection: AT, HA; Data Curation: JOA, AT, HA, KC; Data Analysis: DA, JOA; Interpretation of Results: DA, JOA, ANM, KC, HNE; Writing – Original Draft: JOA, ANM, DA; Writing – Review & Editing: All authors. All authors have read and approved the final version of the manuscript and agree to be accountable for all aspects of the work.

Data availability:

The datasets generated and analyzed during this study will be made available upon reasonable request to the corresponding author. Anonymized data, including anthropometric measurements, will be shared only with participant consent and ethics board approval under a formal Data Sharing Agreement.

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Conflicts of Interests:

The authors declare no competing interests.

Ethical approval

Ethical approval for this study was granted by the Ogun State Hospital Management Board (HMB), Abeokuta, Nigeria.

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