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ORIGINAL RESEARCH

A Three-Year Review of Birth Weight Pattern Among Term Deliveries in Bowen University Teaching Hospital, Ogbomoso, Nigeria

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Abstract

Background: Birth weight is a commonly used indicator of newborn maturity and health and a reliable predictor of postnatal survival. There is a need to determine the birth weight pattern and maternal factors that influence the birth weight in babies delivered at term.
Objective: To determine the birth weight pattern and maternal factors influencing the birth weight of babies delivered at term.
Methods: In this retrospective, descriptive study, the hospital records of all pregnant women who had childbirth at term in Bowen University Teaching Hospital (BUTH), Ogbomoso, Nigeria, from 01 January 2018 to 31 December 2020, were retrieved. Data on birth weight and maternal obstetric factors were retrieved for analysis.
Results: The mean age of the mothers was 30.52 ± 5.23 years. A total of 1072 deliveries were recorded during the study period. These consisted of 580 (54.1%) males and 492 (45.9%) females, with a male-to-female ratio of 1.18:1. The caesarean section rate was 37.7%. The mean birth weight was 3.15±0.56 kg, and male babies had a higher mean weight (3.186±0.535kg *vs* 3.14±0.493kg). Normal birth weight (NBW) was recorded among 90.3%, while low birth weight (LBW) and high birth weight (HBW) were 6.7% and 3.0%, respectively. Only maternal comorbidities (p = 0.0001) and number of gestation (p = 0.0001) were significantly associated with birth weight.
Conclusion: Maternal and foetal factors influenced the birth weights of the babies. Implementing measures to minimise the risk of delivering babies with abnormal birth weights is essential to improve newborn survival.

Keywords: Birth weight, Gestation, Maturity, Neonates, Nigeria, Term deliveries.

Introduction

Birth weight is the most commonly used indicator of newborn maturity, and it is widely accepted across the globe. [1] According to the World Health Organization (WHO), low birth weight (LBW) is defined as birth weight less than 2500g (or 2.5kg), [2] while birth weight 4000g (or 4.0kg) or more, irrespective of gestational age, is considered foetal

macrosomia or high birth weight. [3] Low birth weight is caused by either a short gestation period (<37 weeks) or restricted intrauterine growth (or a combination of both). [4] Eleven per cent (11%) of all newborns in developing countries are born at term with low birth weight, a prevalence which is six times more than in developed countries.[5] Preterm birth, maternal age (<20 years and > 35 years), stress during pregnancy, maternal undernutrition before pregnancy, and high parity may lead to low birth weight.[6] Other evidence shows that LBW is strongly associated with maternal factors such as low socioeconomic status, residence in a rural area, illiteracy, maternal height, body mass index (BMI), weight, birth interval, multiple gestations, and the lack of focused antenatal care. [7] Foetal macrosomia is related to maternal or foetal conditions pertaining to its development. High pre-pregnancy weight or BMI, excessive weight gain during pregnancy, gestational and pre-gestational diabetes mellitus, post-term pregnancy and male sex are found to be associated with macrosomia.[4] Babies with high birthweight (HBW) have a higher likelihood of perinatal complications, birth trauma and operative deliveries. [8]

An infant's birth weight is highly sensitive in two critical aspects; firstly, it is firmly dependent on the health and nutritional status of the mother. Secondly, the birth weight can determine the chances of survival of a newborn as well as healthy growth and development. [9] It is, therefore, considered a subject of clinical and epidemiological investigation and a target for public health interventions. [1] Other determining factors include gestational age at birth and the prenatal growth rate, measured in relation to the expected gestational age-related weight. Low and high birth weight remains a significant concern in many parts of the world, and it is associated with a range of short-term consequences, such as high infant mortality rate and growth failure among survivors. Also, abnormal birth weight has a long-term risk of adult coronary heart disease and Type 2 Diabetes mellitus. [4,10] This study aimed to determine the birth weight pattern and maternal factors that may influence birth weight in babies delivered at term.

Methods

The study was conducted at Bowen University Teaching Hospital (BUTH), Ogbomoso, Nigeria. Ogbomoso is located at coordinates 8.1227° N, 4.2436° E and 95km North-west of the Oyo State capital (Ibadan). Ogbomoso has five local government areas (LGAs) with ten wards each. The LGAs are located in the regions of Ogbomoso North, Ogbomoso South, Surulere, Oriire, and Ogo-Oluwa. The hospital is a referral centre for primary and secondary health facilities in Oyo State. The majority of the resident are of the Yoruba ethnic group.
Inclusion Criteria: All pregnant women who delivered live-term babies at Bowen University Teaching Hospital during the study period.
Exclusion Criteria: All pregnant women with preterm births, stillbirths and neonatal deaths at Bowen University Teaching Hospital during the study period.

Ethical considerations
Ethical approval was obtained from the Ethical Review Committee of BUTH (BUTH/HREC-774) before the commencement of the study. Confidentiality was ensured throughout the study period, and hospital records were identified with code numbers only and not names.

Method of data collection: This was a retrospective, descriptive study. The medical records department retrieved the hospital records of all pregnant women who delivered at term in Bowen University Teaching Hospital (BUTH) from 01 January 2018 to 31 December 2020. Data on birth weight and maternal factors were extracted and tabulated in Microsoft Excel. The data included biodata (age, occupation, marital status), parity, maternal height and weight, mode of delivery, cigarette

smoking, alcohol intake, comorbidities, birthweight, sex, number of fetuses, gestational age at booking and the number of antenatal visits.

Data analysis

The data were analysed using the Statistical Package for Social Science version 22. Frequency distribution tables and charts were generated, and the derived associations were tested for significance using the Chi-Squared test for categorical variables. The level of statistical significance was set at a p-value of <0.05.

Results

There were a total of 1072 deliveries, consisting of 580 (54.1%) males and 492 (45.9%) females with a male-to-female ratio of 1.18:1. The caesarean section rate was 37.7% and spontaneous vaginal delivery (SVD) rate was 62.3%.

Table I shows that the maternal age ranged from 18 to 47 years, with a mean age of 30.52±5.23 years. Most of the mothers (80.2%) belonged to the age group of 20-34 years, while 3% were teenagers. The mean parity was 2±1.1; 59.4% of the women were multiparous, with grand multiparous accounting for 10.1%. Primiparous participants constituted 40.7% of the group. About two-thirds of the mothers were traders (34.0%) or civil servants (35.8%), while artisans accounted for 20.1% and the unemployed accounted for 10.1%. The predominant religion and tribe were Christianity (62.7%) and Yoruba (90.7%), respectively, while only a few (0.6%) practised traditional religions.

Table II shows that the mean EGA at antenatal booking was 18.7±3.2 weeks. Most women (63.8%) registered for antenatal care in the second trimester, and 16% registered in the first trimester. Slightly above one-third (39.6%) of the women in their third trimester were overweight, 21.3% had normal BMI, and 4.5% had BMI in the morbid obesity range. Most of the women were booked (89.9%), had 2 to 6 antenatal clinic visits (60.1%), and 95.1% did not have any comorbidity in pregnancy.

The birth weight of the infants ranged from 1.3 to 4.4kg. Table III shows that the mean birth weight of the babies was 3.15±0.56kg while the birth weight ranged from 1.3 to 4.4kg. Sixty-four (6.7%) babies had low birth weight, while 968 (90.3%) and 9 (3.0%) had normal weight and macrosomia, respectively. Only 8 (0.7%) babies were classified as very low birth weight (less than 1.5kg). The predominant sex was male (54.1%), and most babies (98.5%) were singleton gestation.

Table IV shows the relationship between maternal factors and birth weight among term deliveries.

There was a statistically significant relationship between birth weight and maternal comorbidity factors and number of gestion (p = 0.0001 in each case). However, other maternal factors showed no statistically significant relationship with birth weight. Normal weight newborn babies were more frequent among mothers who had SVD, those with BMI of 25.0 to 29.9kg/m^2, those who booked for antenatal care, those who had 2 to 6 antenatal clinic visits, those with no comorbidity and those aged 25 -29 years. Mothers with parity of 2 to 4, singleton gestation, those who registered for antenatal care in the second trimester, and those who were civil servants also had higher frequencies of normal-weight babies. Babies with low birth weight were commoner among mothers with SVD, BMI of 18.5 - 24.9kg/m^2, those booked for antenatal care and those with 2 to 6 antenatal clinic visits. Absence of comorbidity, age 25-29 years, primiparity, singleton gestation, antenatal clinic booking in the second trimester of pregnancy, and artisanship were other maternal characteristics associated with a higher frequency of babies with low birth weight. Macrosomic

babies were more frequent among women who had SVD, BMI of 30 to 34.9kg/m^2, antenatal clinic booking, 2 to 6 antenatal clinic visits, no comorbidity, aged 30 to 34 years, primiparity, singleton gestation, registered in the second trimester and those who were civil servants.

Table I: Socio-demographic characteristics of mothers

Characteristics	*Category*	*Frequency*	*Percentage*
Age (Years)	≤19	82	3.0
	20-34	860	80.2
	35-49	180	16.8
Parity	1	436	40.7
	2-4	572	53.3
	>4	64	6.0
Occupation	Civil servant	384	35.8
	Trader	364	34.0
	Artisan	216	20.1
	Unemployed	108	10.1
Religion	Christianity	672	62.7
	Islam	394	36.7
	Traditional	6	0.6
Tribe	Yoruba	972	90.7
	Igbo	71	6.6
	Hausa	25	2.3
	Others	4	0.4

Discussion

The mean birth weight of the babies in this study (3.17kg) was similar to the mean birthweight of term babies in a retrospective study in Ogun State (3.180kg) and Oyo State (3.205kg), both in the southern part of the country. [11, 12] The similarity could be explained by the fact that all the newborn babies in the studies under comparison were delivered at term. However, this pattern differs from another study conducted in Ogun State, in which a smaller mean birth weight (2.64kg) was reported, and this could be attributed to the inclusion of preterm babies in that study. [13]

The slightly higher mean birth weight of male babies in the present study (3.18kg *vs* 3.14kg) is similar to findings in other studies. [11, 12] This can be explained by the effect of androgens secreted by the male foetuses on the development of high lean body mass and lower fat cells than female foetuses. [14] Most babies (90.3%) were classified as normal birth weight (NBW). This is not unusual, considering the maturation of the babies at birth. The same factor may explain this study's low prevalence of low birth weight (LBW). This prevalence is also significantly lower than that of babies born to black mothers in the United States (10.3%) but comparable to Hispanic (5.6%), Asian (6.4%), and American Indian (5.7%) babies. [15] Nevertheless, the recorded LBW rate met the WHO target of an LBW rate below 10% of the total delivery. [4] However, the prevalence of macrosomia (3.0%) is similar to the 3.9% reported in the Ogun State study but lower than the 10.1% reported in Ibadan, Oyo State. [11, 14]

Table II: Obstetric characteristics of mothers

Characteristics	*Category*	*Frequency*	*Percentage*
Gestational age at booking	First trimester	172	16.0
	Second trimester	684	63.8
	Third trimester	216	20.2
Mode of delivery	Spontaneous Vertex Delivery	668	62.3
	Emergency Caesarean Section	264	24.6
	Elective Caesarean Section	140	13.1
BMI (Kg/m^2)	<18.5	0	0.0
	18.5-24.9	228	21.3
	25.0-29.9	424	39.6
	30.0-34.9	256	23.9
	35.0-39.9	116	10.8
	≥40.0	48	4.4
Booking status	Booked	964	89.9
	Unbooked	108	10.1
Number of antenatal visits	1	56	5.2
	2-6	644	60.1
	>6	372	34.7
Comorbidity	None	1020	95.1
	Pre-Eclampsia	16	1.6
	Pregnancy-Induced Hypertension	10	0.9
	Peptic Ulcer Disease	10	0.9
	Sickle Cell Anaemia	8	0.8
	Asthma	4	0.4
	Chronic Hypertension	4	0.4

A study reported the influence of maternal age on birth weight. [16] Several mechanisms have been proffered to explain these associations. In adolescent mothers, it is plausible that the mother and the foetus may compete for the supplied nutrients since the mother is still developing and growing. [17] At older ages, women are more likely to have pre-existing, possibly undiagnosed diseases or poor health, including reduced cardiovascular reserve, which could result in poor placentation and poor foetal growth resulting in LBW. [18 - 21] In the present study, there was no significant increase in birth weight with increasing maternal age.

However, most of the macrosomic babies (81.3%) were found among the babies of women aged 20 to 34 years, and the highest number of deliveries (80.2%) were recorded within this age range. Restrepo-Mendez *et al*. [18] found that younger age does not influence birth weight; instead, it is the various socioeconomic challenges which young women are exposed to that are responsible for the effects seen and not the biological effect of maternal age. [18] Parity has also been shown to influence foetal weight. [8] However, in the present study, parity had no association with birth weight, even though half of the LBW babies were found among primiparous women.

Table III: Newborn characteristics

Characteristics	*Category*	*Frequency*	*Percentage*
Birth weight (kg)	≥4	32	3.0
	2.5-3.99	968	90.3
	1.0-2.49	72	6.7
Sex	Male	580	54.1
	Female	492	45.9
Number of gestation	Singleton	1056	98.5
	Multiple	16	1.5

This is similar to the findings of earlier studies. [11, 14] Lower birthweights among firstborn infants may directly result from physiological conditions associated with nulliparity. It has been hypothesised that the first pregnancy primes the body, and with each subsequent pregnancy, the body is more efficient in foetal nutrition. [22] Birth weight is generally believed to increase from the first child to the fourth child. [23] The proposed reasons for this include the fact that uteroplacental blood flow improves with subsequent pregnancies and the structural factors that limit uterine capacity decrease with parity leading to an increase in the size of the uterus and the baby. [11]

Socioeconomic status, which is related to occupation, is known to influence birth weight. [22] Higher socioeconomic status tends to be associated with heavier birth weights and vice versa. [11] The findings in the present study showed no association between birth weight and maternal occupation. However, civil servants recorded the highest frequency (75%) of macrosomic babies and the least frequency (12.5%) of low birth weight babies. These observations could be explained based on better nutritional status, higher level of education and better compliance with antenatal care requirements and clinic visits by the civil servants.

Maternal anthropometric parameters such as height, pre-pregnancy body mass index (BMI) and gestational weight gain (GWG) are also essential factors influencing birth weight. [8] The findings in this study are similar to previous reports even though BMI in this study was not recorded during pre-pregnancy but rather at booking. LBW was more frequent among mothers with BMI between 18.5 and 24.9kg/m^2, which decreased with increasing maternal BMI. This finding is similar to the report of other studies. [4, 13] Women with BMI between 30 and 34.9kg/m^2 also had a higher frequency of foetal macrosomia. This is comparable to a prospective Italian study that reported a higher rate of macrosomia/HBW among overweight and obese mothers. [24] Maternal booking BMI reflects the preconception nutritional status of the mother preconception. [8] Intra-uterine foetal growth is dependent on maternal nutrients supplied to the uteroplacental bed. Thus, malnutrition in the mothers will directly affect foetal growth, which would be reflected in the birth weights of the babies at birth. [14] There was no association between birth weight and mode of delivery in the present study; however, 43.8% of macrosomic babies were delivered via emergency lower segment caesarean section (EMLCS), which was about twice the rate (22.8%) for normal-weight babies born via the same route. This observation correlates with a previous study. [25] This increase in emergency lower segment caesarean section rate could be explained by the increased risk of prolonged labour, shoulder dystocia, cephalopelvic disproportion and obstructed labour among mothers in labour with macrosomic foetuses.

Table IV: Comparison of birth weight groups in relation to maternal factors

Maternal factors	*Category*	*Birth weight groups (kg)*			*Total*	*Chi-Squared*	*p-value*
		1.0-2.49	2.5-3.99	≥4			
Maternal Age (Years)	<20	4 (12.5)	28 (87.5)	0 (0.0)	32	7.318	0.292
	20-34	58 (6.8)	776 (90.2)	26 (3.0)	860		
	35-49	10 (5.6)	164 (91.1)	6 (3.3)	180		
Parity	1	36 (8.2)	380 (87.2)	20 (4.6)	436	5.370	0.497
	2.4	24 (4.2)	536 (93.7)	12 (2.1)	572		
	>4	12 (18.8)	52 (81.2)	0 (0.0)	64		
Number of gestation	Singleton	64 (6.1)	960 (90.9)	32 (3.0)	1056	69.928	0.0001
	Multiple	8 (50.0)	8 (50.0)	0 (0.0)	16		
Booking Status	Booked	64 (6.6)	868 (90.0)	32 (3.3)	964	1.402	0.705
	Unbooked	8 (7.4)	100 (92.6)	0 (0.0)	108		
Number of ANC visits	1	3 (5.4)	53 (94.6)	0 (0.0)	56	1.029	0.984
	2-6	53 (8.2)	571 (88.7)	20 (3.1)	644		
	>6	16 (4.3)	344 (92.5)	12 (3.2)	372		
GA at Booking	First trimester	0 (0.0)	172 (100.0)	0 (0.0)	172	5.306	0.505
	Second trimester	44 (6.4)	608 (88.9)	32 (4.7)	684		
	Third trimester	28 (13.0)	188 (87.0)	0 (0.0)	216		
Mode of delivery	SVD	37 (5.5)	613 (91.8)	18 (2.7)	668	7.318	0.292
	Emergency CS	29 (11.0)	221 (83.7)	14 (5.3)	264		
	Elective CS	6 (4.3)	134 (95.7)	0 (0.0)	140		
Occupation	Trader	20 (5.5)	340 (93.4)	4 (1.1)	364	33.254	0.600
	Artisan	24 (11.1)	192 (88.9)	0 (0.0)	216		
	Unemployed	16 (14.8)	88 (81.5)	4 (3.7)	108		
	Civil servant	12 (3.1)	348 (90.6)	24 (6.3)	384		
Comorbidity	None	48 (4.7)	940 (92.2)	32 (3.1)	1020	91.809	0.0001
	Pre-Eclampsia	10 (62.5)	6 (37.5)	0 (0.0)	16		
	Pregnancy-Induced Hypertension	6 (60.0)	4 (40.0)	0 (0.0)	10		
	PUD	0 (0.0)	10 (100.0)	0 (0.0)	10		
	Sickle Cell Anaemia	4 (50.0)	4 (50.0)	0 (0.0)	8		
	Asthma	0 (0.0)	4 (100.0)	0 (0.0)	4		
	Chronic Hypertension	4 (100.0)	0 (0.0)	0 (0.0)	4		

SVD – Spontaneous Vertex Delivery; CS – Caesarean Section; PUD – Peptic Ulcer Disease; GA – Gestational Age; ANC – Antenatal Clinic

There was an association between the number of gestation and birth weight. None of the multiple gestation babies was macrosomic. LBW babies were more prevalent among mothers with multiple pregnancies than those with singletons. This observation is similar to the findings in a study done in Ilorin which revealed that multiple births were associated with prematurity and low birth weight. [26] The increased LBW rate in multiple gestations can be partly explained by the increased risk of intrauterine growth restrictions and partly by the higher risk of preterm birth among mothers with multiple gestations. Maternal comorbidities also showed an association with birth weight in the present study. Comorbidities such as sickle cell anaemia, chronic hypertension, pre-eclampsia and pregnancy-induced hypertension were associated with low birth weight. This could be explained by the negative effect of these comorbidities on uteroplacental blood flow and, thus, insufficient nutrient supply to the foetus. This is similar to another study where

mothers with comorbidities (such as chronic hypertension, anaemia and diabetes mellitus) had poor birth weight outcomes. [14] The present study suggests that the presence of comorbidities and the number of gestations have far-reaching adverse effects on birth weight and, therefore, the need for specialist care and close monitoring of women with these characteristics during antenatal visits to reduce the morbidity and mortality associated with babies born with low birth weight.

Limitation of the study: The study is retrospective and descriptive in design, with the risk of incomplete retrieval of data, possibly due to missing records, poor entries and incomplete data. The effect of BMI on birthweight could have been more helpful if it had been obtained before pregnancy or during the first trimester. Also, the birth interval was not considered as a possible factor impacting birth weight and regression analysis was not performed on potential associations to minimise the effects of possible confounders.

Conclusion

The study elucidated the influence of maternal factors on birth weight and reported associations between the number of gestation as well as maternal comorbidities and birth weight. Therefore, women with multiple gestations and those with comorbidities should be treated as high-risk pregnancies and accorded specialist care during antenatal clinic visits for appropriate and focused care and intervention. In addition, those with pre-existing comorbidities should receive preconception care for health optimisation.

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Authors' Contributions: All the authors conceived the study. BTY, OAO and BT designed the study and did a literature review. BTY and OAO collected, analysed, interpreted the data and drafted the manuscript. BTY, OAO and OIP revised the manuscript for sound intellectual content. All the authors read and approved the final version of the manuscript.
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