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Prevalence of Low Birth Weight (LBW) and Associated Maternal Factors in a Tertiary Hospital in Gombe Metropolis, Nigeria

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Aim: This study was aimed at determining the prevalence of Low Birth Weight (LBW) and its association with some maternal factors in the study area.
Materials and Methods: A cross sectional study of 108 consenting and parturient mothers who had their antenatal bookings and singleton baby live deliveries in the State Specialist Hospital Gombe, Nigeria; was conducted in the month of August 2016. The mother-neonate pairs were selected using purposive sampling technique and key variables of interest about the subjects were harvested on structured pro-forma. Simple descriptive statistics were computed, Chi square and two-sided Fisher's Exact Test (FET) were used to test association between Birth Weight (BW) and some maternal factors. Level of significance was set at $P<0.05$.
Results: Majority (85.2%) of the mothers who aged between 15 and 40 years (23.90±6.327) were below the age of 31. Most of them were housewives (77.8%) and 75.0% were Hausa-Fulani by

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tribe. Eighty (74.1%) of them had parity and gravidity of <4 and <5 respectively. Fifty-three of the infants (49.1%) had Low Birth Weight (LBW) and a mean of 2.54±0.641kg. About a quarter of the mothers (25, 23.1%) had a Body Mass Index (BMI) of <18.50 kg/m^{2}while well over a half (65) of them had low Packed Cell Volumes (PCVs) (<33%). When Birth Weight (BW) was cross tabulated against various maternal parameters, significant association could only be found with maternal weight (*P* = 0.000) and BMI (*P*=0.000).

Conclusion: A very high prevalence of LBW (49.1%) related to a compromised maternal nutritional status as indicated by poor BMI and weight indicators is quite worrisome. Although this might require further confirmation by more rigorous large sample-size multicentre follow up studies, this finding calls for the institution of effective intervention measures by all concerned authorities.

Keywords: Low birth weight; neonates; maternal; BMI; Nigeria.

1. INTRODUCTION

The World Health Organization (WHO) defined Low birthweight (LBW) as weight at birth of less than2,500 grams (5.5 pounds), irrespective of gestational age [1]. It has been used as an important indicator of a "multifaceted public health problem that includes long-term maternal malnutrition, ill health, hard work and poor pregnancy health care" [1,2]. Hence, the most important determinant of birth weight is said to be maternal environment whereby factors like maternal under-nutrition, anaemia, malaria, STDs that prevent normal utero-placental circulation; cause shortage of nutrients and oxygen supply to the foetus thereby restricting foetal growth in utero [3]. It is estimated that 95% of LBW cases occur in developing countries. [1]. However, the need for population-specific data on determinants of neonatal birth weight has been stressed in various studies [3-6].This is perhaps due to the fact that Birth weight is an important indicator for assessing child health in terms of early exposure to childhood morbidity and the risks of mortality [4]. Epidemiological observations have shown that infants weighing less than2,500 g are approximately 20 times more likely to die than heavier babies and which tend to contribute to a range of poor health outcomes [1].

LBW is considered to be both an outcome as well as a cause of several short and long term maternal and child health events [1]. In Africa LBW is the strongest determinant of infant morbidity and mortality [7]. Although, the Nigeria Demographic and Health Survey (NDHS) of 2013 reported declining rates of both neonatal and post neonatal mortality in the country, the differential analysis by region has indicated quite disturbing figures for the Northwest (NW) and Northeast (NE) regions where Gombe, the study area is located [8]. The national neonatal mortality (NNM) was put at 37 deaths per 1,000 live births, while those of the NW and NE were put at 44 and 43 deaths per 1,000 live births respectively [8]. Five years after these metrics appeared to have moderately dropped where the NE recorded 37 deaths per 1,000 live births which was slightly lower than the national figure (39 deaths per 1,000 live births) [9]. However, based on the latter, the NNM rate for Gombe state (45 deaths per 1,000 live births) still remains a major source of concern.

The prevalence of LBW was estimated at 14.6% worldwide, 17.3% in Asia, 13.7% in Africa and 7.2 % in the developed countries [10]. Sub-regional estimates include 28% in southern Asia, 13% in sub-Saharan Africa and 9% in Latin America [11]. The Nigeria National Population Commission (NPC) National Demographic and Health Survey (NDHS) of 2008, reported the highest (13%) LBW from Northeastern region of Nigeria [4]. About a decade later the prevalence of LBW in the NE stands at 11.1% implying a merely modest improvement, but a much lower figure (4.4%) was reported for Gombe state [9]. Another estimate by Unicef Multi-cluster Indicator Survey (MICS) of 2011, indicated a national figure of 15%, but again the regional figure for the study area (NE) was higher (16%) [12]. Five years after the report, this figure for the NE appeared not to have changed any much (15.7%) though the (Gombe) state specific figure (12.4%) remains lower [13]. These seeming inconsistencies may not be unconnected with underreporting of LBW decried by UNICEF and WHO [10].

In view of the foregoing, there is germane need for state and locality specific data on LBW so as to assist in the identification of areas that would demand more intensive interventional efforts. An examination of some underlying issues such as maternal risk factors, becomes very crucial.

Some of these maternal factors include age, place of residence, occupation, religion, tribe, gravidity, parity, body mass index (BMI), packed cell volume (PCV), height and weight of mother. Hence this study attempted to determine the prevalence of LBW in the study area and its association with some of these maternal factors.

2. MATERIALS AND METHODS

2.1 Study Setting and Target Population

The Specialist Hospital Gombe is a tertiary health institution that enjoys the status of a premier state-owned health facility located in the heart of the state capital, Gombe. It is the apex hospital of the state with 350 bed capacities and serves as a training centre to the state college of nursing and midwifery, college of health science and technology and various health institutions across the country. The hospital provides outpatient services to about 1, 600 clients daily, with an average monthly delivery of 360 babies and a monthly average inpatient admission of 700 patients.

2.2 Study Design

A cross sectional study design was adopted to assess mother-baby pairs that had skilled birth attendance at the maternity ward of the state specialist hospital Gombe, Nigeria.

2.3 Sample and Sampling Technique

The sample size of this study was determined using the single proportion (Fisher's) formula for cross sectional studies [14, 15, 16].

$$no = \frac{Z^2pq}{d^2}$$

Where,

n_o = Minimum Sample Size
Z = Standard normal deviate, set at 1.96.
P = Expected prevalence based on previous studies (7.5% or 0.075) [9,17]
q = 1 – P (1- 0.075) = 0.925
d = Margin of error or precision/desired degree of accuracy, set at 0.05

$$no = \frac{1.96^2p(1-p)}{d^2}$$

$$no = \frac{1.96^2*0.075(0.925)}{(0.05)^2}$$

$$no = 107$$

Applying the finite population correction formula

$$n = \frac{no}{1+\frac{(no-1)}{N}}$$

Where,
n=adjusted minimum sample size
N= Estimated population size/ number of deliveries per month (360)
Thus,

$$n = \frac{107}{1+\frac{(107-1)}{360}}$$

$$n = 83$$

Adding 30% (25) for nonresponse, adds up to 108
A total of 108 mother-baby pairs were selected using purposive sampling technique.

2.4 Inclusion and Exclusion Criteria

A mother-baby pair was selected if the mother had her booking and antenatal care in the Gombe state specialist hospital within the month of August 2016; a pair was however excluded or not selected if otherwise. Additionally, only mothers who gave their consents were recruited into the study, while those who declined were excluded. Mothers who suffered from severe medical conditions, those having an unknown Last Menstrual Period (LMP), those that had stillbirths, twin or multiple deliveries were also excluded from the study.

2.5 Data Collection and Analysis

A self-constructed data collection template was used to capture relevant information on mother-neonate pairs whose deliveries were taken in the maternity ward of the Gombe state specialist hospital. The data collection assistant who was a student Nurse on posting in the ward during the period of data collection was adequately oriented on how to measure and capture the variables of interest. The main dependent variable was birthweight of the neonates in kg; while independent variables include religion of mother, place of residence (urban or rural), parity, gravidity, packed cell volume (PCV) of mothers, weight of mother in kg, height of mother (cm), length of neonates (cm), occupation and tribe of mother.

The information so collected on the template were entered on SPSS version 16 and subjected to data cleaning procedures to ensure high data quality. Univariate descriptive analysis was used to compute frequencies and percentages for categorical data, while quantitative data were presented in ranges, means and standard deviation. Associations between the dependent variable (birth weight) and other (independent) variables were tested using chi-square and Fisher's Exact's Test (FET). Alpha levels of significance (*p*-values) were set at 0.05.

3. RESULTS

The 108 mothers of babies recruited for this study were aged 15 to 40 years with a mean age of 23.9±6.33 years (Table 1). Of this number 41.7% were at least 20 years and 43.5% were within the age bracket of 21-30 years, while 14.8% were above 30 years. A Good proportion (46.3%) of the participants affirmed to being semi-urban dwellers, the rest were either urban (42.6%) or rural (11.1%) residents. Among the sampled population, 77.8% of the mothers attested to being just housewives, 16.7% were businesswomen, while a small minority (5.6%) were civil servants. Other demographic data considered revealed that 97.2% identified themselves as practicing Islamic faith adherents; 39.8% were of Hausa ethnic extraction, 35.2% said they were Fulani by tribe and the rest (25.0%) were of other tribal origins. About three-quarters (74.1%) of the mothers have had less than five pregnancies, and less than 4 children.

Table 1. Socio-demographic Characteristics of Mothers (n=108)

SN	Variable	Frequency (n)	Percentage (%)	Min-Max (X±SD)
1	**Age group**			15-40 (23.90±6.327)
	<= 20	45	41.7	
	21 - 30	47	43.5	
	31+	16	14.8	
2	**Place of residence**			
	Rural	12	11.1	
	Urban	46	42.6	
	Semi-Urban	50	46.3	
3	**Occupation**			
	Housewife	84	77.8	
	Businesswoman	18	16.7	
	Civil servant	6	5.6	
4	**Religion**			
	Islam	105	97.2	
	Christianity	3	2.8	
5	**Tribe**			
	Hausa	43	39.8	
	Fulani	38	35.2	
	Tangale Waja/Tera/ Bolewa Others	27	25.0	
6	**Gravidity**			1-12 (3.36**±**2.753)
	<=4	80	74.1	
	5 - 8	20	18.5	
	9+	8	7.4	
7	**Parity**			0-9 (2.25±2.565)
	<=3	80	74.1	
	4 - 6	19	17.6	
	7+	9	8.3	

Min-Max = Minimum – Maximum, X±SD = Mean ± Standard Deviation

Table 2 depicts some vital maternal and newborn parameters that could have some direct bearing on the subject of this article. The body mass index (BMI) of the mothers studied ranged from 12.11 to 47.34 Kg/m2 with a mean of 23.78 ± 7.012. About a quarter (23.1%) of them fell short of the WHO cut off point of 18.50 kg/m^2 and were therefore categorized as underweight. However, some studies suggest using a lower cut off for Nigerian adults [18-20]. Mothers with <33% PCVs were considered as sub-optimal with anaemic tendencies [210]. Majority (62.0%) of the mothers were ≥158 cm in height and had a mean weight of 56.70± 11.89 kg, 49.1% of the babies weighed <2.5 kg (LBW) 63.9% of them measured ≤ 45.0 cm in length. When cross tabulated with some maternal and neonatal parameters, only weight and BMI of mothers had a significant (*P*=0.000) association with BW (Table 4). On the other hand, PCV and weight of the mothers yielded no significant association with BW of the babies.

When birth weight (BW) was cross tabulated with maternal socio-demographics (Table 3) no statistically significant association was established with any of the variables measured. However, 53.3% of babies born by mothers ≤ 20 years, 58.3% born by rural dwellers,62.5% born by Businesswoman/ Civil servants, 57.9% born by Fulani mothers, 53.5% born by Hausa mothers and 51.3% by mothers with the lower categories of parity and gravidity; had LBW.

4. DISCUSSION

The present study revealed that at a mean age of 23.9±6.33 years, 85.3% of the 108 parturient mothers studied were 30 years and below, representing the prime of fecundity based on the context of this study. Other demographic characteristics of the participants with potential for implication on low birth weight (LBW) include 46.3% semi-urban and 42.6% urban residence; 77.8% being housewives, 97.2% Islamic faith adherence; 39.8% Hausa and 35.2% Fulani ethnicity, and 74.1% with less than five pregnancies and less than 4 children as borne out by other studies [17-27].

Table 2. Distribution of Some Maternal and Newborn Parameters (n=108)

SN	Variable	Frequency (n)	Percentage (%)	Min-Max (X±SD)
1	Weight of baby (Kg)			1.0-4.3 (2.54±0.641)
	< 2.50 (Low Birth Weight)	53	49.1	
	2.50 +	55	50.9	
2	Body Mass Index of Mothers (Kg/M^2)			12.11 - 47.34 (23.78 ± 7.012)
	<18.50	25	23.1	
	18.50 – 24.99	44	40.7	
	25.00	39	36.1	
2	Packed Cell Volume of Mothers (%)			8.0-41.0 (30.18±6.521)
	<33	65	60.2	
	33 +	43	39.8	
3	Height of Mothers (cm)			130.0-190.0 (156.85±15.63)
	≤157.00	41	38.0	
	158.00 +	57	62.0	
4	Weight of mother (kg)			35.0-100.0 (56.70± 11.89)
	<= 55.00	58	53.7	
	56.00+	50	46.3	
5	Length of baby (cm)			38.0-50.0 (44.69±3.260)
	≤ 45.0	69	63.9	
	46.0 +	39	36.1	

Min-Max = Minimum – Maximum, X±SD = Mean ± Standard Deviation

Table 3. Baby's birth weight Vs Maternal Socio-demographic characteristics (n= 108)

SN	Variable	Baby's Birth Weight (Kg)		X^2	Df	P-Value/ (FET*)
		< 2.5 n (%)	2.5 + n (%)			
1	Maternal Age group			0.605	2	0.739
	≤ 20	24(53.3%)	21(46.7%)			
	21 - 30	22(46.8%)	25(53.2%)			
	31+	7(43.8%)	9(56.3%)			
2	Religion					0.243*
	Islam	53 (50.5)	52 (49.5)			
	Christianity	0 (0.0)	3 (100.0)			
3	Residence			0.644	2	0.725
	Urban	21 (45.7)	25 (54.3)			
	Semi-urban	25 (50.0)	23(50.0)			
	Rural	7 (58.3)	5 (41.7)			
4	Parity			0.585	1	0.445
	≤3	41 (51.3)	39 (48.8)			
	4+	12 (42.9)	16 (57.1)			
5	Gravidity			0.585	1	0.445
	≤4	41 (51.3)	39 (48.8)			
	5+	12 (42.9)	16 (57.1)			
6	Occupation			2.226	1	0.136
	Housewife	38 (45.2)	46 (54.8)			
	Businesswoman/Civil servant	15 (62.5)	9 (37.5)			
7	Tribe			5.603	2	0.061
	Hausa	23 (53.5)	20 (46.5)			
	Fulani	22 (57.9)	16 (42.1)			
	Tangale Waja and Others	8 (29.6)	19 (70.4)			

FET = Fisher's Exact's Test

Table 4. Baby's birth weight Vs Some Maternal characteristics (n= 108)

SN	Variable	Neonates' Birth Weight (Kg)		X^2	Df	P-Value/ (FET*)
		< 2.5 n (%)	2.5 + n (%)			
1	PCV (%)			0.557	1	0.455
	< 33	30 (46.2)	35 (53.8)			
	33 +	23 (53.5)	20 (46.5)			
2	Weight (Kg)			35.973	1	**0.000**
	≤ 55	44 (75.9)	14 (24.1)			
	56 +	9 (18.0)	41 (82.0)			
3	Height (cm)			0.002	1	0.962
	≤157	20 (48.8)	21 (51.2)			
	158 +	33 (49.3)	34 (50.7)			
4	Body Mass Index (kg/m^2)			17.662	2	**0.000**
	<18.50	21 (84.0)	4 (16.0)			
	18.50 – 24.99	20 (45.5)	24 (54.5)			
	25.00 +	12 (30.8)	27 (69.2)			
5	Length of Baby (cm)			2.751	1	0.097
	≤ 45.00	38(55.1%)	31(44.9%)			
	46.00+	15(38.5%)	24(61.5%)			

FET = Fisher's Exact's Test

The high (49.1%) prevalence of LBW in the study area is in sharp contrast to the finding of the most recent Nigeria national demographic and health survey which reported very low rate of 7.5% [9,17]. This obvious variation may not be unconnected with the fact that the non-probability sampling technique used in this study may have introduced some biasness in the sample selection and hence a tendency for an inflated rate. This notwithstanding figures of high LBWs in upwards of 20% have been reported in Ethiopia and South Asia [10,22]. It is also important to point out that the association of LBW with maternal weight and BMI further buttresses the importance of improvement in maternal nutrition in addressing the problem of LBW [17,20,21,22,25,26,27]. With a body mass index (BMI) range of 12.11 to 47.34 Kg/m^2 and a mean of 23.78 ± 7.012 Kg/m^2, about a quarter (23.1%) of the mothers studied fell short of the WHO cut off point of 18.50 kg/m^2 and were therefore declared to be underweight [28,29]. However, this has to be taken with some caution as some of the studies equally suggest using a lower cut off for Nigerian adults [28,29,30]. Mothers with <33% PCVs were considered as having sub-optimal haemoglobin levels with anaemic tendencies [31]. Majority (62.0%) of the mothers were ≥158 cm in height and had a mean weight of 56.70± 11.89 kg, and 63.9% of the babies measured ≤ 45.0 cm in length. Low maternal height and weight are known to be possible predictors of LBW [25].

The lack of any statistically significant association between LBW and most of the maternal socio-demographic variables (Table 3) is in conflict with other findings in Nigeria and elsewhere [17-26]. However, wholly or in part, it corroborates other findings from some parts of Nigeria [17,27]. And, that 53.3% of the babies born by mothers ≤ 20 years, 58.3% born by rural dwellers, 62.5% born by Businesswoman/ Civil servants, 57.9% born by Fulani mothers, 53.5% born by Hausa mothers and 51.3% by mothers with the lower categories of parity and gravidity; had LBW, albeit not statistically significant, points to the relevance of these factors in any discourse on LBW. This tends to agree with the findings of other studies which reported that LBW is strongly associated with maternal factors such as younger and older age, low socio-economic status, residence in the rural area, and illiteracy [20-26]. This picture is in tandem with the fact that almost all health indicators in the northern part of the country where the area of this study is located are generally poor compared to the southern part [9, 17].

When cross tabulated with some maternal and neonatal parameters, only weight and BMI of mothers had a significant (P=0.000) association with BW (Table 4). On the other hand, PCV, height of the mothers and length of baby yielded no significant association with BW of the babies. Although not statistically significant it is noteworthy that a good proportion (46.2%) of the LBW children were born to women with sub-optimal PCV (<33%). This and maternal height or stature have been shown in some studies to be important predictors of LBW [21,31].

5. CONCLUSION

This study reports an unusually high burden of LBW (49.1%) which appears to be one of the highest in recent times. Despite some note of caution that has been sounded by the authors regarding the limitations of the study, the findings are not to be downplayed. There is need for further interrogation into the problem of LBW in the study area so as to come up with definite benchmarks for LBW and other forms of abnormal birth weight (ABW) rates in the study area. The corresponding high prevalence (60.2%) of low PCV (<33%) rates as well as the significant (*P*=0.000) association between LBW and maternal weight cum BMI equally raises serious concern regarding compromised nutritional status of parturient mothers. Hence, all relevant stakeholders are called upon to upscale their efforts towards the improvement of nutritional status of pregnant women so as to curtail the problem of LBW, morbidity and mortality among newborns. In addition, the need for policy alignment toward the delivery of primary health care service especially in semi urban and rural region in the state will help mothers attend regular antenatal appointment and early intervention deployed.

6. LIMITATIONS OF THE STUDY

Ab initio, the design of the study being cross sectional and the adoption of a nonprobability(purposive) sampling technique may have introduced some possibility of bias in the data collection. The small sample size is an obvious limitation of this study. Hence, the need for the exercise of some caution in generalizations using findings from this study.

CONSENT AND ETHICAL APPROVAL

Approval and consent of the hospital management was obtained before embarking this study. Additionally, the study group gave an assurance of anonymity for all subjects that participated in this study. More so, participants were at liberty to drop out at any point without giving any reason. The research committee of the College of Nursing and Midwifery Gombe vetted and approved the study protocol.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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