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Birth Weight and Maternal Socio-Demographic Characteristics in a Rural Tertiary Hospital

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ABSTRACT

Birth weight plays an important role in infant survival, child development, and adult metabolic diseases. Maternal characteristics have been variously shown to impact on the progress and outcome of pregnancy, especially those related to birth weight and perinatal mortality. We carried out this study to ascertain the relationship between maternal socio-demographic characteristics and neonatal birth weight. This was a descriptive cross-sectional study carried out in Irrua Specialist Teaching Hospital, a tertiary health facility in a rural area of Edo state, Nigeria. It was carried out from January 2017 to June 2017. A total of 106 pregnant women were recruited for the study. All the pregnant women who attended the antenatal clinic, and subsequently delivered at the labor ward of the hospital within the study period and their newborn were recruited for the study, with the exception of those who declined. An interviewer-administered questionnaire was used to retrieve information on socio-demographic characteristics from the participants. Data from the questionnaire were coded and entered into an electronic spreadsheet. The analysis was done with the aid of IBM SPSS version 21.0 software. Discrete data were presented as tables, diagrams, and proportions (percentages), while normally distributed continuous variables such as age, and birth weight were expressed as means and standard deviation. The statistical test of association was carried out between maternal socio-demographic characteristics and neonatal birth weight. Fishers, the exact test was used to test for association between the variables. Statistical level of significance was set at $P<0.05$.

All the respondents were in the age range of 20-50 years, with the majority (56.6%) of them between 20-30 years. Mean age was 30.12±5.52. All were married and most (58.5%) had tertiary education. Most of the women (58.5%) were multiparous, and also 80.2% of them booked for antenatal care. Most (61.3%) attended antenatal clinic more than four times before delivery, while about 64.1% delivered their babies at term (37-40 weeks). About 64.2% of the babies had normal birth weight, and 50.9% of the babies were males. Neonatal birth weight was significantly associated with booking status, gestational age at delivery, and neonatal sex. There was no significant association between birth weight and parity, time of antenatal booking, and the number of antenatal visits. Our study has shown that the risk factors for LBW include; high parity, unbooked status, few numbers of antenatal visits, and pre-term delivery.

Key words: *Adult metabolic diseases, Child development, Maternal characteristics.*

1. INTRODUCTION

Birth weight refers to the weight of the new born immediately after delivery by the mother. It is divided into three; low birth weight (underweight), normal birth weight and high birth weight (overweight or Macrosomia). Low birth weight (LBW) has been

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defined by the World Health Organization (WHO) as weight at birth of less than 2,500 grams including 2,499 grams irrespective of gestational age[1,2]. Normal birth weight refers to weights between 2,500 grams (2.5Kg) and 4,000 grams (4.0Kg) at delivery [3], while overweight is any weight above 4.0Kg. Birth weight plays an important role in infant survival, child development, and adult metabolic disease. It has been strongly associated with high mortality risk during the first year of life [4], and it is a powerful predictor of the survival of an individual baby [3]. Infant size, such as birth weight and length, was reported to affect not only infant mortality, but also childhood morbidity [5]. Fetal weight cannot be measured directly *in utero*, but it can be estimated or predicted from fetal and maternal anatomical characteristics. Maternal anthropometric measurements provide a simple, cheap and available means of predicting birth weight with a variable degree of reliability.

The following factors have been found to determine birth weight: maternal height, maternal obesity, maternal pregnancy weight gain, parity, fetal sex, ambient altitude, paternal height, cigarette smoking and glucose intolerance [6]. Other factors that determine fetal birth weight include maternal factors such as race, stature and genetics [7]. Also, gestational age at delivery is a significant determinant of newborn weight [8]. Such maternal factors like genetic endowment, socio-cultural, demographic and maternal conditions (such as hypertension, malaria, urinary tract infections, malnutrition and anaemia) are strongly associated with fetal complications especially low birth weight, prematurity and birth asphyxia all of which act individually or in concert with each other to increase neonatal and infant mortality[9, 10].

Low birth weight is a sensitive indicator for predicting the chance of infant healthy growth and development and a primary determinant of infant mortality risk [11]. Low birth weight is either the result of preterm birth or due to restricted fetal growth. It is closely associated with fetal and neonatal mortality and morbidity, inhibited growth and cognitive development, and chronic diseases later in life [12]. These chronic diseases may include adult-onset diabetes, coronary heart disease, and high blood pressure, intellectual, physical and sensory disabilities. However, little attention is paid to birth weight improvement as a means of reducing child mortality [13]. Worldwide, about 16% of live births or some 20 million infants per year are born with less than 2500g of weight and 90% of them are born in developing countries [14]. In most developing countries, it was approximated that every ten seconds an infant dies from a disease or infection that can be attributed to low birth weight [14]. The incidence of low birth weight varies depending on the part of the world. In Ethiopia, Gibremariam found an incidence rate of 11.02% [15]. Mothers age, being younger than 20 years and older than 35 years, late antenatal booking were among the risk factors he found for low birth weight. In Bangladesh, Hosan et al, found a low birth weight rate of 24% and mean birth weight of 2961g [16]. Also, Khatun and Rahman in Bangladesh found significant association between the birth weight andmother's age, gestational age at booking, and number of antenatal care visits [17]. In Nigeria, the prevalence of low birth weight range from between 8% - 12%[18].

High birth weight or Fetal Macrosomiaor fetal over weight is described as newborn with excessive birth weight. Fetal macrosomia can be defined as birth weight of 4000 – 4500g or greater than 90% for gestational age after correcting for neonatal sex and ethnicity (90^{th} percentile) [19]. It is encountered in up to 10% of deliveries [19]. Factors associated with high birth weight include: genetics, duration of gestation, presence of gestational diabetes, and diabetes mellitus types I & II, previous delivery of macrosomic baby, excessive weight gain in pregnancy, maternal obesity, multiparity, male fetus and parental stature [20,21].Macrosomic babies are at risk for shoulder dystocia and birth trauma [19].The incidence of fetal macrosomiafound in Benin by Olokor et al was 5.5% [22], while it was found to be 8.1% in Enugu by Ezeugwu et al [23].

There have been very few studies on the relationship between neonatal birth weight and maternal socio-demographic characteristics in our environment. Thus this study was done to look at the relationship between neonatal birth weight and maternal socio-demographics.

2. METHODOLOGY

This is a descriptive cross-sectional study. It was carried out in Irrua Specialist Teaching Hospital, a tertiary health facility in a rural area of Edo state, Nigeria, to assess the relationship between maternal socio-demographic variables and birth weight outcome. The population comprised of women who attended antenatal clinic until delivery in the labor ward, between January 2017 and June 2017. All women who attended antenatal clinic during the period of the study, were followed up to the time of delivery and the relevant information obtained from the mother and baby. Every pregnant woman who attended antenatal clinic within the period of the study, and their new-born were recruited for the study, except those who declined. The study sample size was determined with the use of Cochrane formula [24] thus: $N = Z^2PQ/D^2$ Where N= minimum sample size required for the study (when population is more than 10,000). Z=standard normal deviate. The value of the Z-score of the standard normal deviate to be used for this study is set at 1.96 which corresponds to the 95% confidence level. P = the proportion in the target population estimated to have a particular characteristics. Therefore, using P=53.7% (a Nigerian study to assess maternal characteristics influencing birth weight and infant weight gain in the first six weeks postpartum) [25]= 0.554, Q =1.0-P, and D =tolerable margin of error set at5%. Applying the formula: $1.96^2X0.537X0.463/0.05^2= 382.1$

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Since the estimated population of the study group was less than 10,000; the formula

$$nf = \frac{n}{1+n/N}$$

was applied.[1] where n = 382.1, N = estimated no of women attending antenatal clinic for the period = 500

Therefore, nf= 216.6.To make adjustment for 10% non-response, the formula for non-response adjustment was used: 21.66. Required minimum sample size for the study was = 194.94,
approximately 195.

A total of 106 pregnant women were recruited into the study.Interviewer-administered questionnaire was used to retrieve information on socio-demographic characteristics from the participants. Data from the questionnaire was coded and entered into an electronic spread sheet. Analysis was done with the aid of IBM SPSSversion21.0 software. Discrete data were presented as tables, diagrams and proportions (percentages), while normally distributed continuous variable such as age and birth weight were expressed as means and standard deviation. Statistical test of association was carried out between maternal socio-demographic characteristics and neonatal birth weight. Where the expected frequency in more than 20% of cells was less than 5, or any cell had an expected cell count less than 1, Fishers' exact test was used to test for association between the variables. Statistical level of significance was set at $p< 0.05$.

2.1 Ethical Approval

Ethical approval to conduct this research was sought and obtained from the Irrua Specialist Teaching Hospital Research Ethics Committee.

2.2 Individual informed consent

All the details of the study were dully explained and communicated to the respondents. They were assured of confidentiality and no respondent was coerced or induced to participate in this study, thus, participation was voluntary.

3.RESULTS

A total of 106 pregnant women were found eligible and were enrolled into the study. All the women were between 20-50years of age, with majority (56.6%) between the range of 20-30 years, and the mean age was 30.12 ± 5.52. All were married. Most (58.5%) had tertiary education while only 3.8% stopped at primary level. About 38.7% of the participants were self employed, with 65.1% residing in the rural area. All the respondents never smoked, with 94.3% of them not taking alcohol. **See table 1**.

Majority of the respondents (58.5%) were multiparous, and also most (80.2%) were booked during pregnancy. About 61.3% attended ante-natal clinic more than four times during pregnancy. Most of the participants (64.1%) delivered their babies at term (37-40weeks), while only 9.4% had preterm deliveries. Majority of the neonates delivered (64.2%) had normal birth weight, with more of the neonates (50.9%) being male. **See table 1**.

Most (73.5%) of the babies who had normal birth weight were delivered by primiparous mothers, while only 20% of them were delivered by grand multiparous mothers. In other words, the incidence of normal birth weight decreases as the parity increases. However, the incidence of low birth weight was found to increase with parity. These finding were however, not statistically significant. P = 0.065. **See table 2.**

From our finding, most of the babies delivered by women who were booked (70.6%) had normal birth weight, while few (11.8%) had low birth weight. Most of the babies delivered by respondents who did not book for antenatal care during pregnancy had low birth weight. This association was found to be statistically significant, P = 0.003. **See table 3.**

In this study, it was found that the incidence of normal birth weight babies was highest in women who booked for ante-natal care in the 1st trimester, and lowest in those who booked in the 3rd trimester. A similar picture was also seen in low birth weight babies. However, this association is not statistically significant. P= 0.302. **See table 4.**

The incidence of normal birth weight babies was found to increase with the number of ante-natal visits of their mothers. However, the picture was different for both low and over-weight babies. And this association was not statistically significant. P=0.421. **See table 5.**

Majority of the normal birth weight babies (78.4%) were delivered at GA of 37-38weeks, whereas none of the over-weight babies were delivered at GA less than 37weeks, while most of the low birth weight babies were delivered pre-term (less than 37weeks). This association was found to be statistically significant. P= 0.001. **See table 6**.

More of the babies with normal birth weight and over-weight were males, while more of the low birth weight neonates were females, and this association was found to be statistically significant. P = 0.001. **See table 7.**

3.1 Discussion

Birth weight is used as an indicator of both individual and population health. It is one of the determinants of perinatal and infant mortality, having strong associations with both child and adult health, and also strongly associated with childhood growth, cognition and disability [26].

This study examined the relationship between birth weight and maternal socio-demographic characteristics such as maternal age, parity, booking status, number of ante-natal visits, gestational age at delivery and time of ante-natal booking among pregnant women attending the antenatal clinic of Irrua Specialist Teaching Hospital, in Edo State. The study population was made up of predominantly young married women with mean age 30.12± 5.52. This is similar to the finding by Nnaji et al [27] where the mean age was 27.86±5.39.It was found that maternal age influences the birth weight of infants [28]. The findings in this study indicated that the number of LBW babies delivered by older mothers was lower than that by younger mothers, and this agrees with the findings in a similar study byAmosu et al [28]. In our study, mothers with high educational level gave birth to most of the babies with normal weight and over-weight. This is in agreement with what was found by Karim et al [29] in their study, which showed that birth weight increases with higher maternal education. Also in another study [30] low educational status was found to have a relationship with low birth weight. However, this is in contrast to the finding by Nnaji et al [27] who observed no association between birth weight and maternal education.

The incidence of low birth weight was found to increase with parity in this study. This is in agreement with the finding in a similar study [10]. In Sudan, Elshibly and Schmalisch [31] showed that as the birth order increases beyond the third pregnancy, the birth weight tends to drop especially if the spacing is poor.Also in similar studies [32,33], significant association was found between parity and low birth weight.

A significant association was found between the booking status of the mothers and the birth weight of the babies delivered. Most of the normal weight babies were delivered by the booked mothers, while most of the babies with low birth weight were delivered by the un-booked ones. This is not surprising as the booked mothers were monitored during pregnancy till delivery, and any abnormality detected were treated accordingly.

This study showed that mothers who booked for antenatal care early in the first trimester had improved neonatal weight. This agrees with the Gebremariam [15] in his study. Also, it was observed most of the mothers booked for ante-natal during the 2nd trimester. A similar situation was found by Nnaji et al [27] in their study. This situation appears to be common in most African communities, as the women are usually secretive about a new pregnancy, until it has reached an advanced stage, when they can no longer hide it [34]. The implication of these findings (reduced number of antenatal visits and late booking), is that the pregnant women did not derive optimum benefit from antenatal care interventions, like micro nutrient supplementation, etc.

It was observed in this study, that most of the respondents had ≥4 ante-natal visits. This meets the recommended WHO's minimum number of visits (a schedule of at least 4 ante-natal visits for every pregnant woman) [35]. It is well known that antenatal care is essential for early identification of pregnancy induced complications and subsequent management, before problems that could lead to preterm and abnormal weight babies emerges. It was indicated that the number of antenatal care follow-up had a positive impact on birth weight, as similar studies reported [14, 33].

We found a significant association between birth weight and maternal gestational age at delivery. At GA less than 37weeks, most of the babies born had LBW. This in not unexpected as fetuses that are carried to term, mature fully, and develop fully with improved weight. This is unlike babies who are born prematurely (before 37weeks) who do not have enough time to develop fully, to mature fully and to gain adequate weight.

A significant association was found between birth weight and neonatal sex. The males had more weight than the females. This is in agreement with the findings in similar studies [11, 15, 27]. The reason for this is not very clear, but may be probably due to the different hormonal changes taking place in the male fetus in-utero prior to delivery. This finding requires more research to find out an explanation for this.

4. CONCLUSION

From this study, the risk factors for LBW include; high parity, unbooked status, few antenatal visits, and gestational age at delivery less than37 weeks (pre-term). Normal birth weight was found to be common in the following; low parity, booked status, frequent antenatal visits, and term deliveries.

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Table 1: Socio-demographic characteristics of respondents

Variables	Frequency,n= 106	Percent
Maternal age (Years)		
20-30	60	56.6
31-40	43	40.6
41-50 Mean±SD=30.123±5.524	3	2.8
Marital status		
Married	106	100.0
Educational status		
Primary	4	3.8
Secondary	40	37.7
Tertiary	62	58.5
Occupation		
Civil servant	40	37.7
Self employed	41	38.7
Unemployed	25	23.6
Residence		
Rural	69	65.1
Urban	37	34.9
Smoking habit		
Never smoked	106	100.0
Alcohol intake		
Never	100	94.3
Occasional	6	5.7
Parity		
Grandmultip	10	9.4
Multipara	62	58.5
Primipara	34	32.1
Booking status		
Booked	85	80.2
Unbooked	21	19.8
GA at birth(weeks)		
Less than 37	10	9.4

37-38	37	34.9
39-40	31	29.2
41-42	17	16.0
Birth weight		
Low birth weight	18	17.0
Normal weight	68	64.2
Overweight	19	17.9
Neonatal sex		
Female	52	49.1
Male	53	50.9
Number of visits		
1	5	4.7
2-3	15	14.2
≥4	65	61.3

Table 2: Birth weight and parity of respondents

Birth weight	**Parity**			
	Grandmultip	**Multipara**	**primipara**	**Total**
Low birth weight	4(40.0%)	12(19.4%%)	3(8.8%)	19(17.9%)
Normal weight	2(20.0%)	41(66.1%)	25(73.5%)	68(64.2%)
Over weight	4(40.0%)	9(14.5%)	61(17.6%)	19(17.9%)
Total	10(100.0%)	62(100.0%)	34(100.0%)	106(100.0%)
P = 0.065, chi-square = 11.848				

Table 3: Birth weight and booking status of respondents

Birth weight	**Booking status**		
	Booked	**Un-booked**	**Total**
Low birth weight	10(11.8%)	9(42.9%%)	19(17.9%)
Normal weight	60(70.6%)	8(38.1%)	68(64.2%)
Over weight	15(17.6%)	4(19.0%)	19(17.9%)
Total	85(100.0%)	21(100.0%)	106(100.0%)
Chi-square = 13.713, P = 0.003			

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Table 4: Birth weight and gestational age (GA) at booking of respondents

Birth weight	**GA at booking**			
	1st trimester	**2nd trimester**	**3rd trimester**	**Total**
Low birth weight	3(20.0%)	5(10.9%%)	2(8.3%)	10(11.9%)
Normal weight	12(80.0%)	32(69.6%)	16(66.7%)	60(70.6%)
Over weight	0(40.0%)	9(19.6%)	6(25.0%)	15(17.6%)
Total	15(100.0%)	46(100.0%)	24(100.0%)	85(100.0%)
P = 0.302, fisher's exact = 4.862				

Table 5: Birth weight and number of ante-natal visits of respondents

Birth weight	**No of visits**			
	1	2-3	4 and more	Total
Low birth weight	1(20.0%)	3(20.0%)	6(9.2%)	10(11.8%)
Normal weight	2(40.0%)	10(66.7%)	48(73.8%)	60(70.6%)
Over weight	2(40.0%)	2(13.3%)	11(16.9%)	15(17.6%)
Total	5(100.0%)	15(100.0%)	65(100.0%)	85(100.0%)
P = 0.421, fisher's exact = 3.894				

Table 6: Birth weight and GA at birth of respondents

Birth weight	**GA at birth**				
	Less than 37	37-38	39-40	41-42	Total
Low birth weight	13(61.9%)	2(50.4%)	2(6.5%)	2(11.8%)	19(17.9%)
Normal weight	8(38.1%)	29(78.4%)	20(64.5%)	11(64.7%)	68(64.2%)
Over weight	0(0.0%)	6(16.2%)	9(29.0%)	4(23.5%)	19(17.9%)
Total	21(100.0%)	37(100.0%)	31(100.0%)	17(100.0%)	106(100.0%)

Table 7 Birth weight and neonatal sex of respondents

Birth weight	**Neonatal sex**		
	Female	Male	Total
Low birth weight	14(26.4%)	5(9.4%)	19(17.9%)
Normal weight	32(60.4%)	36(67.9%)	68(64.2%)
Over weight	7(13.2%)	12(22.6%)	19(17.9%)
Total	53(100.0%)	53(100.0%)	106(100.0%)
	Chi-square= 111.146	P = 0.001	

P = 0.0001, fisher's exact = 43.550: birth weight

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