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Impacts of Obesity on Maternal and Fetal Outcomes in Women with Singleton Pregnancy at a Nigerian Clinical Setting

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Authors' contributions

This work was carried out in collaboration between all authors. Author ASA conceived and designed the study, analysed the data, and wrote the first draft of the manuscript. Authors OGI, OAE and OK managed the literature review and critical analyses of the study. All authors read and approved the final version of the manuscript.

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ABSTRACT

Background: Obesity, an emerging public health concern in maternity care with increasing prevalence even in developing countries is associated with maternal and perinatal complications. This study sought to evaluate the impact of maternal obesity on pregnancy outcomes in a cohort of Nigerian women.
Study Design: A prospective cohort study.
Place and Duration of Study: Department of Obstetrics and Gynaecology, Bingham University Teaching Hospital Jos, between January 2013 and September 2014.
Methodology: A study of matched 324 obese [Body mass index (BMI) ≥ 30 Kg/m^2] and 324 non-

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obese women (BMI 18.5 – 24.9 Kg/m^2) with singleton pregnancies recruited at the antenatal clinic during their first trimester. They were followed-up to the postpartum period to ascertain development of antenatal, intra-partum, postpartum and fetal complications. Chi square or Fisher's Exact test and student t-test were done to ascertain any relationship between obesity and the outcome variables using SPSS version 16 (SPSS Inc., Chicago, IL, USA) and P value < 0.05 was considered statistically significant.

Results: In comparison with pregnant women with normal BMI, obese women faced higher risk of developing antenatal complications (*P* = 0.001, Odds Ratio (OR) 5.32, 95% Confidence Interval (CI) 1.90 – 14.94) especially gestational hypertension and pre-eclampsia (*P* = 0.002, OR 4.66, 95% CI 1.65 – 13.19), having caesarean section (*P* = 0.043, OR 0.48, 95% CI 0.23 – 0.99) and macrosomic baby (P = 0.005, OR 3.40, 95% CI 1.41 – 8.19). However, no statistical difference with respect to risk of spontaneous miscarriage (*P* = 0.313, OR 3.08, 95% CI 0.31 – 30.22), preterm delivery (*P* = 0.167, OR 3.16, 95% CI 0.62 – 16.15), genital tract injury (*P* = 0.407, OR 0.76, 95% CI 0.40 – 1.46), postpartum haemorrhage (*P* = 0.199, OR 1.75, 95% CI 0.74 – 4.13), low birth weight babies (*P* = 0.732, OR 1.27, 95% CI 0.33 – 4.90) and stillbirth (*P* = 0.080, OR 0.96, 95% CI 0.92 – 1.01).

Conclusion: Maternal obesity is associated with elevated risk of hypertensive disorders, caesarean delivery and fetal macrosomia. It is imperative to implement a policy of identifying these women as high risk group at this clinical setting so as to institute appropriate materno-fetal surveillance and management strategies aim at enhancing their pregnancy outcomes.

Keywords: Obesity; pregnancy; maternal and fetal outcomes; Nigeria.

1. INTRODUCTION

Maternal obesity which is an emerging worldwide public health concern is associated with spectrum of adverse pregnancy outcomes [1,2,3]. This nutritional disorder predisposes to poor maternal and fetal outcomes. Increasing evidences indicate that maternal obesity is associated with increased risk of first trimester spontaneous miscarriages [2,4]. Late pregnancy complications of obesity include increased risk of hypertensive disorders including pre-eclampsia, gestational diabetes, thromboembolism and induced preterm delivery as a result of these pregnancy complications [5-8]. Also associated with maternal obesity is higher risk of operative deliveries including caesarean section as well as its post-operative morbidities [6,9].

Fetal adverse outcomes associated with maternal obesity in pregnancy have also been well documented. Reported fetal complications which usually lead to increased rate of early pregnancy losses and perinatal morbidity and mortality [6] include congenital malformations especially neural tube defects [10] as well as fetal macrosomia [6,7,11]. Also, antepartum stillbirth is associated with maternal obesity during pregnancy [12]. In addition, macrosomic babies of obese mothers are predisposed to development of childhood obesity and metabolic syndrome in adult life [13].

Obesity in pregnancy has been a problem of developed countries but there are evidences of increasing prevalence of this disorder in developing countries including Nigeria [14,15]. Most of the researches reporting effects of maternal obesity on pregnancy outcomes are mainly from developed nations. This study was therefore conceived to ascertain the impacts of maternal obesity on pregnancy outcomes in an obstetric population in Jos, North-central Nigeria where to the best of our knowledge, no study has been undertaken in this regard. The findings will document the type of burden(s) this disorder have in pregnancy at this clinical setting. It will also raise awareness about the disorder among health workers and enhance their patient counseling, anticipation of pregnancy complications and institution of appropriate interventions so as to improve maternal and perinatal outcomes in this group of pregnant women.

2. MATERIALS AND METHODS

The institutional Human Research and Ethics Committee (HREC) of the hospital reviewed and granted approval for the study. This was a prospective cohort study of obese (Body mass index ≥ 30 kg/m^2) and non-obese women with singleton pregnancies and delivered at Bingham University Teaching Hospital, Jos, from January 2013 to September 2014. Informed consent was obtained from each woman before recruitment

for the study. Obese women were recruited consecutively at booking during the first trimester at the antenatal clinic. The next consecutive woman with normal body mass index (18.5 – 24.9 Kg/m^2) after a recruited obese woman served as control and they constituted the comparison group. Dating of pregnancy was done using the last menstrual period and confirmed by obstetric ultrasound. Both groups were matched for age and parity. Inclusion criteria included women who booked in the first trimester and had singleton pregnancy. Women who booked in the second trimester or beyond, those with pre-existing diabetes mellitus, chronic hypertension, sickle cell anaemia or any chronic medical condition were excluded from the study.

A minimum sample size of 294 each for obese and control groups (total of 588) was calculated using the formula n = $2Z^2Pq/d^2$and a prevalence rate of 10.7% reported by Chigbu CO et al. [16] was used. With an assumption of about 15% attrition rate, an additional 88 participants were added to give a total sample size of 676 participants (338 for each group). Their antenatal cards were coded for easy identification when they present at the gynaecological or obstetric unit for medical care. At the end of the pregnancy (miscarriage or successful delivery), the requisite data of each woman is entered into a proforma and these were used at the end of the study for analysis. Maternal obstetric outcomes assessed included occurrence of spontaneous miscarriage, hypertensive disorders in pregnancy (gestational hypertension and pre-eclampsia), gestational diabetes, preterm or term delivery, mode of delivery, genital injury/ episiotomy and occurrence of postpartum haemorrhage. Fetal outcome measures included low birth weight (< 2.5 Kg), fetal macrosomia (> 4.0 Kg), birth asphyxia (Apgar score less than 7 at fifth minute), and stillbirth.

Statistical analysis was conducted using SPSS version 16 for windows (SPSS Inc., Chicago, IL, USA). Chi square test or Fisher's exact test as appropriate (whenever expected count < 5) was done for categorical variables while student t-test was performed for numerical variables. A P-value less than 0.05 was considered statistically significant at 95% confidence intervals.

3. RESULTS

A total of 648 (95.9%) out of 676 women participated in the study (324 each for Obese and control groups) and the rest were lost to follow-up or had incomplete information on their proforma. The mean age of the women was 30±4.7 years with a range of 19 – 43 years while the average parity was 1.5±1.4 and a range of 0 – 7. The average weight gain in pregnancy compared to the weight at booking was 9.4±3.8 Kg and 8.3±4.2 Kg for obese and non-obese women respectively (P = 0.154). The average weight at delivery for obese women was 91.4±14.7 Kg while that of the control group was 72.6±8.6 Kg (P< 0.001). The mean gestational age at delivery were 38.9±1.6 and 39.1±1.5 weeks for obese and non-obese groups respectively (P = 0.683). Table 1 shows the age and parity distribution of the women as well as the weight gain and delivery weights among the women.

With respect to outcomes during the antenatal period, obese women had no significant increased risk of spontaneous abortion (P = 0.313) and preterm delivery (P = 0.167) compared to the non-obese controls. Obese pregnant women however had 5-fold increased risk of developing a medical complication during the antenatal period comprising hypertensive disorders in pregnancy (gestational hypertension and pre-eclampsia) and gestational diabetes (P = 0.001, OR 5.32, 95% CI 1.90 – 14.94). However when analyzed individually, they were at increased risk of developing only hypertensive disorders in pregnancy (P = 0.002). Table 2 shows the details of the antenatal outcomes among the study populations.

Compared to the non-obese women, obese women were not at increased risk of perineal tear or episiotomy (P = 0.407), instrumental vaginal delivery (P = 0.560) and postpartum haemorrhage (P = 0.199) but had higher risk of having a caesarean delivery (P = 0.043). There was no maternal death among the study groups. Table 3 shows the outcomes of labour among the women. Table 4 shows the fetal outcomes among the study populations. Obese women were about three times more likely to give birth to a macrosomic baby (P = 0.005, OR 3.40, 95% CI 1.41 – 8.19) but had no statistically increased risk of delivery to low birth weight babies (P = 0.732).

4. DISCUSSION

This study demonstrated significant association between maternal obesity and some adverse pregnancy outcomes in this Nigerian obstetric population. This study demonstrated that pregnant obese women are at higher risk of

developing antenatal medical complications especially hypertensive disorders (gestational hypertension and pre-eclampsia). This is corroborated by previous published reports by researchers in other regions of Nigeria [17,18] as well as different clinical settings in the world [1,3,5,7,8,19]. However, obesity is not significantly associated with gestational diabetes as also noted elsewhere [18] but contrary to findings by other published literatures [5,7,20].

Table 1. Age, parity and anthropometric profile of the study groups

Feature	Frequency		Percentage	
Age (years)				
≤ 20	8		1.2	
21 – 25	100		15.4	
26 – 30	276		42.6	
31 – 35	176		27.2	
36 – 40	76		11.7	
> 40	12		1.9	
Total	**648**		**100.0**	
Parity				
0*	188		29.0	
1 – 4	428		66.1	
≥ 5	32		4.9	
Total	**648**		**100.0**	
Weight gain in pregnancy (Kg)	**Obese**	**Non-obese**	**Obese**	**Non-obese**
1 – 5	108	80	33.3	24.7
6 – 10	164	160	50.6	49.4
> 10	52	84	16.1	25.9
Total	**324**	**324**	**100.0**	**100.0**
Weight at delivery (Kg)	**Obese**	**Non-obese**	**Obese**	**Non-obese**
50 – 70	16	152	4.9	46.9
71 – 90	152	164	46.9	50.6
91 – 110	132	8	40.7	2.5
> 110	24	0	7.4	0.0
Total	**324**	**324**	**100.0**	**100.0**

0 refers to nulliparity during the period of recruitment for the study*

Table 2. Antenatal outcomes among the study groups

Variable	Obese N =324	Non-obese N =324	OR	95% CI	*P*-values
Spontaneous abortion	12	4	3.08	0.31 – 30.22	0.313
Pre-term delivery	24	8	3.16	0.62 – 16.15	0.167 ǂ
Antenatal complications	84	20	5.32	1.90 – 14.94	0.001
Hypertensive disorders *	76	19	4.66	1.65 – 13.19	0.002
Gestational diabetes	8	1	0.098	0.94 – 1.01	0.155 ǂ

ǂ *Fisher's exact test*

**Hypertensive disorders = gestational hypertension and pre-eclampsia*

Table 3. Outcomes of labour among the study groups

Variable	Obese N = 324	Non-obese N = 324	OR	95% CI	*P*- values
Caesarean delivery	104	60	0.48	0.23 – 0.99	0.043
Episiotomy/perineal tear	100	120	0.76	0.40 – 1.46	0.407
Instrumental delivery	8	4	2.03	0.18 – 22.79	0.560 ǂ
Postpartum haemorrhage	32	20	1.75	0.74 – 4.13	0.199

ǂ *Fisher's exact test*

Table 4. Fetal outcomes among the study populations

Variable	Obese N =324	Non-obese N =324	OR	95% CI	*P*-values
Low birth weight	20	16	1.27	0.33 – 4.90	0.732 ǂ
Fetal macrosomia	88	32	3.40	1.41 – 8.19	0.005
Birth asphyxia	52	40	1.36	0.56 – 3.30	0.501
Stillbirths	12	0	0.96	0.92 – 1.01	0.080 ǂ

ǂ *Fisher's exact test*

Medical disorders are said to be commoner among obese women because of associated hyper-insulinaemia which can predispose to the development of hypertension, hyperlipidaemia and diabetes [21]. Due to increased risk of these disorders, pregnant obese women tend to have higher rates of hospital admissions often due to close materno-fetal surveillance and treatment they require. This is aimed at reducing morbidity and maternal mortality associated with medical disorders especially hypertensive complications associated with maternal obesity [18].

The risk of spontaneous abortion and preterm delivery was not noted to increase among obese women. This same findings was also reported in another obstetric population in southern Nigeria and in an European setting [7,18] but contrary to findings elsewhere [8,22]. Obesity is however linked to increased risk of induced preterm delivery as a result of the higher risk of medical complications associated with it during pregnancy [23].

With respect to intra-partum outcomes, there is a significant association between maternal obesity and caesarean delivery and this finding is corroborated by other studies as well [7,12,17,18,20]. However, there was no increased risk of episiotomy/perineal tear, instrumental vaginal delivery and postpartum haemorrhage among obese pregnant women in this study. This is contrary to positive correlations in other research reports [7,12,24]. Increased medical complications associated with obesity in pregnancy and predicted fetal macrosomia are likely to enhance greater use of interventional deliveries especially caesarean section among these women in order to reduce adverse outcomes. This increased risk of caesarean delivery may also be explained by labour dystocia often associated with large for gestational age fetuses (fetal macrosomia) which was commoner among obese women in this study.

Maternal obesity has also been associated with adverse fetal outcomes. This was noted in this study as it is associated with risk of fetal macrosomia. This is in agreement with findings from different obstetric populations [7,19,24,25]. Obesity is associated with maternal insulin resistance and fetal hyperinsulinaemia and the high fetal insulin levels may explain the increased fetal macrosomia among pregnant obese women. Hence, complications related to fetal macrosomia including genital tract injuries and shoulder dystocia are more likely to be commoner in obese patients [12] but this was not demonstrated in our study. Other complications comprising stillbirth, low birth weight and birth asphyxia were not significantly increased among this obstetric population as also noted elsewhere [18]. These were however noted to be increased in other studies [7,12,20,26]. It is expected that these fetal complications will increased as a result of higher risks of medical disorders and difficult vaginal or caesarean delivery due to labour dystocia among obese women.

Limitations of this study included the fact that this is an urban obstetric population and these findings may not be a reflection of what is obtainable among rural pregnant Nigerian women. This is especially so as social class was not assessed in this study as it is related to obesity. However, the findings thrown some insights into complications related to obesity in this environment whose prevalence had been perceived in the past to be low in developing countries.

5. CONCLUSION

Maternal obesity is associated with increased risk of antenatal medical complications especially hypertensive disorders, caesarean delivery and fetal macrosomia in this obstetric population. The need to institute screening for obesity at booking aimed at implementing close materno – fetal surveillance in these women is imperative so as to reduce adverse pregnancy outcomes.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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