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Effect of body mass index on pregnancy outcomes in primigravid women delivering singletons babies at Kogi state University teaching hospital (KSUTH), Anyigba north central Nigeria

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Abstract
Introduction: Obesity is an obstetric problem and this has been documented over time. Obesity in the obstetric population is a problem of public health concern that is associated with complications that can arise in the antepartun, intrapartum and postpartum periods of a woman`s obstetric carrier. This study examines the effect of increasing body mass index on the outcome of pregnancy among primigravid women delivering singleton babies in our centre.
Methods: This was a case controlled study based on primigravid women who delivered singleton babies at the Kogi State University Teaching Hospital, Anyigba between September 2012 and August 2018 a six year period. A structured questionnaire was used to collect data on the women who were grouped into five based on their body mass index (BMI). These groups are Underweight (BMI <19.9kg/M^2), Normal (BMI 20 – 24.9KG/m2), Overweight (BMI 25 – 29.9 Kg/m2), Obese (BMI 30 -34.9) and morbid obesity (BMI >35 Kg/M2).
Results: Women in the normal BMI group were compared with women on both sides of the divide with regards to the obstetrics outcomes of their pregnancies and it was found that there is a significant association between increasing body mass index as seen in the obese and preeclampsia, emergency caesarean section, induced labour, post partum haemorrhage and preterm delivery.
Conclusion: Increasing Body mass index is associated with increased incidence of Preeclampsia, postpartum haemorrhage, induction and medicalization of labour, preterm delivery and caesarean delivery.

Keywords: Body mass, pregnancy, primigravid women

Introduction
Obesity that used to be a public health problem in the developed world due to improved quality of life in those climes has also become a health issue in our environment due to improvements in standards of living, socioeconomic status and social class which have bearing on our social and nutritional habits [2, 3, 21, 25]. The rate of obesity has been on the increase as a result of this. In fact, Nigerian and some African women eat in excess to prove to the public the affluence or good care from their spouse. Over weight and obesity are common among pregnant population. In the West the prevalence is 28% while there is paucity of statistical data from our population on this problem of public health importance [2, 3, 11, 21, 34].
In the United states, the incidence of obesity in pregnancy is between 18.5% and 38.3% and 56% in the United Kingdom. The incidence of obesity in the pregnant population in Nigeria is 7.4% - 10.7% according to some studies [34, 35].
Several studies on pregnancy complications in overweight pregnant women have been done in the past as far back as 1945 [3]. Many of these studies have reported clear association between maternal obesity and unfavorable feto-maternal pregnancy outcome [1, 2, 3, 21].
Unlike the clear effect of increasing body mass index on pregnancy outcome, that of maternal underweight is more often unclear.[3,21] While some previous studies have associated maternal underweight with preterm deliveries, low birth weight and unfavorable perinatal outcome, other studies came out with some contradictions or no associations and others some protective effects [3, 25]. Added to this difficulty in conclusion is the variations in the definitions of underweight, overweight and obesity in different reports and from literature to literature. Some reports relate pregnancy weight and height to obstetric outcomes but in recent time and ideally,

the body mass index has been widely used as a better indicator of underweight [2, 3, 31]. Other alternative method to body mass index include the waist – Hip ratio which is not commonly used to study the effects of obesity on pregnancy.
In the Kogi State University teaching hospital, records of patient concerning antepartum, intrapartum and postnatal events are properly documented in the antenatal cards and case files that are usually opened for these clients. At the conclusion of a confinement these records are safely and properly kept in the records department and available for research and references.

Materials and Method

This is a retrospective study using a structured questionnaire to collect data from the records of Primigravid women who booked before 16 weeks and delivering singleton babies after the age of viability (28 weeks). Women who booked after 16 weeks were excluded. Some patient records that were incomplete were excluded.
Information collected from the records using the structured questionnaire incuded sociodemographic variables including the booking weight and height, preexisting conditions that may affect body mass index like diabetes mellitus and lifestyle that may affect variables and outcome like alcohol and tobacco consumption. Other variables obtained include characteristics and outcome of pregnancy. The body mass index was then calculated from the booking weight and height using the formula BMI = Weight (Kg)/Height(m^2) Based on the result, the women were categorized into five groups *viz*:

Underweight : BMI < 19.9 Kg/m^2
Normal : BMI between 20 – 24.9Kg/m^2
Overweight : BMI between 25 – 29.9 kg/m^2
Obese : BMI between 30 – 34.9 Kg/m^2
Morbidly Obese : BMI > 35Kg/m^2

Women within the normal BMI group were used as the reference range to copare the two sides of the divide (underweight and increasing BMI). The main obstetric outcomes that were studied are preeclampsia, postpartum haemorrhage, induction of labour, preterm delivery, nature of delivery, antepartum haemorrhage (due to placenta praevia and abruption-placanta among others.
The perinatal outcome studied include delivery before and after 37 completed weeks, term delivery after 41 weeks and birth weight.
Analysis of data was done using univariate and bivariate analysis of the software, Statistical Package for Social sciences version 20. A p value of less than 0.05 was taken as statistically significant meaning that the null hypothesis that association between the tested obstetric outcome and a particular BMI group is by chance be rejected and the alternate hypothesis that association exists between the obstetric outcome and BMI be accepted.

Results

A total of 346 nulliparous women delivered singleton babies within the period under review. Of these only the records of 292 women were available and complete for the desired analysis. Of these, 9 (3%) were underweight, 78 (27%) had normal body mass index, 98 (33%) were overweight, 78 (27%) were obese and 29 (10%) were morbidly obese. The prevalence of obesity in this obstetric population was 37%.
Table 1 shows the socio demographic characteristics of this population. Women in the underweight group were relatively younger with a mean age of 28 years with a range of 16 to 42 years at the time of delivery.
None of the women had type 1 diabetes mellitus and none either used tobacco in any form nor used alcoholic beverages.
Table 2 indicates the incidence of pregnancy complications, characteristics of labour and delivery in the various BMI groups while table 3 presents the association of increasing body mass index with these complications and characteristics of labour and delivery. These are in comparism with the normal BMI group.
Preeclampsia and induction of labour increase with increase in body mass index occurring more in the groups with higher than normal body mass index compared with those that are within normal body mass index and underweight groups.
This study showed that the lowest incidence of induced labour occurred in the normal BMI population with none in the underweight (p value = 0.03 at CI 99%).
There were more instrumental deliveries in the above normal BMI population compared to the normal and underweight population.
Although caesarean sections were common in the various BMI groups, the frequency of caesarean section was higher in the overweight and obese BMI categories. Caesarean section rate was almost 3 times higher than spontaneous vaginal delivery in the morbidly obese cohorts.
Similarly, there is a significant association of post partum haemorrhage with increasing body mass index. There is a linear increase in blood loss with increasing body mass index. This study recorded nine incidents of post partum haemorhage and they all occurred in the abnormal BMI groups.
This study did not any significant association between body mass index and preterm delivery. The morbidly obese women had more preterm delivery compared to the normal and underweight population (p value = 0.003at CI 99).
There were more post term deliveries among the abnormal BMI group compared to the underweight and normal population.
The incidence of preterm premature rupture of membranes (PPROM) was higher in the population with BMI greater than the normal range. This difference was statistically significant (p value = 0.01 at CI 99)

Table 1: Distribution of the women among the different BMI groups.

BMI group	n	%
Underweight BMI	9	3
Normal BMI	78	27
Over weight BMI	98	33
Obese BMI	78	27
Morbid obesity BMI	29	10
Total	292	100

Discussion

This study like other previous studies, suggests that obesity measured by body mass index is associated with increased adverse pregnancy outcomes and obstetric interventions. It revealed a linear relationship between increasing body mass index and the development of pregnancy complications like preeclampsia, blood loss, post partum haemorrhage, induction of labour and Caesarean section. It stands to reason therefore that low body mass index may be associated with fewer complications as this may be protective.
Previous research has demonstrated a strong association between increasing body mass index and preeclampsia. Indeed, a meta-analysis of the risk of preeclampsia associated with maternal body mass index [19] showed that the risk of preeclampsia doubled with each 5-7kg/m^2 increase in pregnancy body mass

index. In this study the incidence of preeclampsia was higher (2 to 3 times) in the above normal BMI group compared to the normal and underweight population with a P value suggesting strong association [16].

The finding in this study is in agreement with earlier studies that showed strong association between increasing body mass index and obstetric interventions especially induced labour [10, 13, 20]. Similarly the finding in this study with respect to strong association between increasing body mass index with caesarean section has been documented in earlier reports [1, 8, 10, 14, 23].

Like some previous report, this study showed a strong relationship between postpartum blood loss and increasing body mass index. They are however other reports with conflicting results. Suffice it to say that post partum hemorrhage is blood loss in excess of 500 ml for vaginal delivery and 1000 ml for caesarean delivery. The blood loss in this study showed strong statistical association with abnormal body mass index. Sebire *et al*. [12] reported a 70% increase in post partum heamorrhage while Bianco and colleagues [22] reported that there was no significant difference in mean blood loss among the different BMI categories. Factors that may be responsible for this conflicts and variation include the subjective nature of estimating blood loss at delivery and surgery, increased incidence of induction of labour, operative deliveries and the fact that persons with high body mass index are also expected to bleed more.

Obesity being a problem of public health importance has elicited a lot of research interests and reviews. Most research has been retrospective studies using hospital based data [1, 12, 12, 25, 26].

This study like other observational studies is not devoid of its own limitations:

Although the women included in this study were those below the gestational age of 16 weeks, an ideal time for height and weight measurement for this type of study should be before the women gains any iota of weight no matter how negligible due to gestation. This ideal situation though not readily available due to late registration in our clime should not deter researchers from undertaking studies that strengthen our wealth of knowledge and improve clinical counseling and practice.

This study relied on height and weight recorded in early pregnancy. It is believed that at this point weight gained due to gestation has no significant impact [3]. The limitation here is that these values are approximation and subject to bias especially in our antenatal clinic sessions where more than one individual is involved in measurements.

Exclusion of women who booked at gestation above 16 weeks may as well be a selection bias as this may exclude not only overweight but underweight women as well. However some parameters of the analyzed data set in the sociodemographic characteristics which showed even distribution among the different BMI categories assures of minimized bias.

There is the need to strengthen and encourage preconception counseling, a forum that will be unique for recording pre-pregnancy weight and height.

Since there is a growing body of evidence incriminating obesity as an important complication of pregnancy, clinicians should begin to adapt their practice toward handling this challenge and conducting more enlightenment.

Table 2: Pregnancy, Labour and delivery characteristics of women in the various BMI groups.

Characteristics	BMI group				
	Under weight n = 9	Normal n = 78	Over weight n = 98	Obese n = 78	Morbid obesity, n = 29
Pre-Eclampsia	1	2	4	11	0
Induced labour	0	3	13	10	4
Instrumental delivery	0	2	0	3	3
Caesarean section	4	54	54	47	21
Post partum hemorrhage	0	0	0	0	3
Preterm delivery @ 33 weeks	0	2	0	0	3
Post term delivery @ 41 weeks	0	11	13	12	10
Preterm rupture of membrane	0	0	0	3	3

Table 3: Observed Obstetrics complication correlated with BMI in various BMI group.

Characteristics	BMI groups					Test of Association (ANOVA)		
	Under weight	Normal	Over weight	Obese	Morbid Obesity	P values	Linear Association	Confidence interval
Pre-Eclampsia	1	2	4	11	0	0.01	0.04	99
Induced Labour	0	3	13	10	14	0.03	0.04	99
Instrumental delivery	0	2	0	3	3	0.04	0.04	99
Caesarean Section	4	54	54	47	21	0.05	0.00	99
Post-partum hemorrhage	0	0	0	0	3	0.00	0.01	99
Preterm delivery less than 33 weeks	0	2	0	0	3	0.003	0.01	99
Post term delivery at 41 weeks	0	11	13	12	10	0.04	0.04	99
Preterm rupture of membranes	0	0	0	3	3	0.01	0.01	99
Group SVD: CS ratio	5:4	24:54	44:54	31:47	8:21	P value is less than 0.05.		

Conclusion

There is a strong association of pregnancy complications and outcomes with maternal body mass index. There is increased incidence of preeclampsia, induction of labour, post partum haemorhage, instrumental deliveries and caesarean delivery in the presence of maternal obesity. These problems are less common in the underweight and normal BMI obstetric populations.

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