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Maternal Anthropometric Status as A Correlate of Neonatal Outcomes Among Pregnant Women in Selected Secondary Health Facilities in Ibadan Metropolis, Oyo State

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ABSTRACT: *Maternal anthropometric measurements provide a simple, cheap and available means of predicting neonatal outcomes. Pregnant women anthropometric indices reveal their nutritional statuses and determine to great extent the health of the neonate after they have been born. Hence, this study investigated maternal anthropometric status as a correlates of neonatal outcomes among pregnant women in selected secondary health facilities in Ibadan Metropolis, Oyo State, Nigeria. This retrospective study adopted descriptive research design. Purposive sampling technique was used to select those who met the inclusion criteria. Total enumeration was used for the study. A self-structured checklist was used to extract data about pregnant women who booked from January 1, 2019 to December 31, 2019 within 18 weeks of their gestation with singleton pregnancy. Data collected were analyzed using descriptive and inferential statistics. The results revealed a significant association between maternal BMI and Baby's birth weight with Chi-square X2 (91.66, df =1, p<0.05).The finding revealed that underweight mothers had higher chance of having small for gestational age babies (SGA) and LBW as compared to average weight mothers. The study concluded that there is a significant association between maternal BMI and birth weight. Based on the finding, the study recommended among others that the healthcare practitioners are to identify pregnant women who at risk of adverse birth outcomes and educate them appropriately. Pregnant mothers whose babies would need special care at birth should be referred to the health facility that can handle such cases before delivery to enhance the neonatal survival rate.*

KEYWORDS: maternal anthropometric status, neonatal outcomes, pregnant women, secondary health facilities

INTRODUCTION

The birth of a baby should be one of the most special and joyful experiences a family can have and it is the desire of every pregnant woman to have an eventful pregnancy and neonatal outcomes but in certain percentage of women reverse is the case due to many factors. Birth outcomes are major predictor of the survival of an infant. Infants whose birth weights are too low or too high have been shown to have higher mortality and morbidity than those of

appropriate weight for gestational age, and have an increased risk of complications such as peri-partum asphyxia and birth trauma. In 2015, 20.5 million new-borns, an estimated 14.6 per cent of all babies born globally that year, suffered from low birth weight and these babies were more likely to die during their first month of life and those who survived face lifelong consequences including a higher risk of stunted growth, lower intelligence quotient, and adult-onset chronic conditions such as obesity and diabetes (UNICEF, 2019). It was observed in one secondary health facility within Ibadan metropolis where the researcher has worked before that many overweight and obese pregnant women do deliver low birth weight and preterm babies which are at risks of complications. In other to prevent the death of under 5 children, it is essential to determine the relationship between maternal BMI and gestational weight gain as if affects the birth outcomes.

Devaki and Shobha (2018), the survey of preterm birth for the year 2014 revealed the prevalence of 13.4% in North Africa to 8·7% in Europe while sub-Saharan African and Asian countries recorded 78.9% of live births and 81.1% of preterm births globally. In Nigeria, the average prevalence of LBW is estimated to be about 16%, with a range of 6-21%. The study carried out by Chawanpaiboon et al (2019), revealed that about 5-6 million infants are born yearly with low birth weight with 100,000 deaths recorded. The prevalence of birth defects among new-born infants was also varied widely in sub-Saharan African countries. It was found to be 1.43 per 1000 in Gabon and 68.4 per 1000 in South Africa. The prevalence of stillbirth in Nigeria was 39.6 per 1000 birth (Okonofua et al, 2019) and birth defects 4.4% (Takai et al, 2019). An estimated 6% of babies worldwide are born with a congenital anomaly, resulting in hundreds of thousands of associated deaths. However, the true number of cases may be much higher because statistics do not often consider terminated pregnancies (WHO, 2018).

Nigeria is second to India in neonatal mortality, worse than most other Sub-Saharan African countries (Ezeh, et al., 2014). In 2015, neonatal mortality was projected to be 2.7 million worldwide and stillbirth was 2.6 million (WHO, 2018). Sub-Saharan Africa, including Nigeria, continuously experiences maternal deaths, neonatal mortality, low birth weight and related morbidity and disability compared to most other countries in the world.

Adverse neonatal outcomes such as low birth weight, preterm birth, congenital anomaly present economic, financial and emotional challenges to the family from birth to discharge from the hospital. This level of spending is relatively high considering the nature of the Nigerian economy and the financial situation of affected families (Kehinde, et al 2013). It also have a negative impact on the nation because of development of health problems later in life by this group thus decreasing the gross domestic product growth rate of the nation.

Birth outcomes are mostly influenced by the state of health of mothers. Improving neonatal outcomes is an important aspect of improving the health and survival rate of the neonates, thus reducing under-5 morbidity and mortality. Maternal anthropometric status is one and important factor that determines neonatal outcomes of pregnancy to a large extent. Neonatal outcomes are conditions of the neonate as at the time of birth which may include preterm birth (PTB) which is defined as a birth before 37 weeks of pregnancy, whether it is spontaneous or medically indicted, low birth weight (LBW) (defined as birth weight < 2500 g), Small for gestational age (SGA) (defined as birth weight below the 10th percentile for gestational age), macrosomia (defined as birth weight ≥ 4000 g), Large for gestational age (LGA) (defined as

birth weight above the 90th percentile for gestational age), stillbirth, fetal distress (defined as signs indicative of fetal hypoxia, which included fetal bradycardia, severe variable decelerations and persistent late decelerations), and neonatal asphyxia (defined as Apgar score < 7 at 1 min) (Ugwa, 2014). Infants born before 37 completed weeks of gestation represent a substantial public health concern because premature birth is the leading cause of neonatal deaths not associated with birth defects (Centre for Disease Control, 2018).

Maternal malnutrition is the most significant underlying determinant factor in adverse maternal and fetal outcome. A malnourished mother gives birth to undernourished infant who struggles to thrive. The maternal body mass index (BMI) and gestational weight gain are important predictors of maternal and neonatal health outcomes. Insufficient weight gain as seen in underweight category of BMI is associated with increased risks of preterm birth, delivery of a low-birth-weight infant, abortion and intrauterine growth restriction, which may further cause low Apgar scores and increased early neonatal deaths. Excessive weight gain as seen in overweight and obese women is associated with increased risks of adverse neonatal outcome (e.g. preterm delivery, low/high birth weight, congenital anomalies, neonatal asphyxia, neonatal death, hypoglycemia, and hyperbilirubinemia), increased requirement for neonatal intensive care, and a longer duration of hospital stay, gestational hypertension, preterm birth, delivery of a high-birth-weight infant, and caesarean delivery (Goldstein, et al, 2017).

Maternal overweight/obesity carries an increased risk of subsequent disease in the offspring. This can include impaired neurodevelopment outcome (cognitive problems, attention deficit hyperactivity disorder, and psychotic disorders), asthma, schizophrenia, insulin resistance, diabetes mellitus, hypertension, coronary heart disease, stroke, and even death. Emerging evidence suggests obesity is associated with increased complications during pregnancy, labour and delivery, and into the postpartum period, as well as adverse neonatal outcomes which include fetal growth abnormalities such as macrosomia, neural tube defects, and stillbirth (Liu, et al, 2019).

Globally, about 15 million babies are born preterm annually, i.e approximately 5% – 18% of all live births; however, this is responsible for more than 1million deaths among children under 5 years (WHO, 2018). There are about 20 million low birth weight (LBW) across 184 countries worldwide representing about 15 –20% of all births (WHO, 2018). Both preterm birth and low birth weight are responsible for some complications leading to neonatal mortality, although, they may not be the only predictors.

The new estimates show that preterm births during 2014 ranged from 13.4% in North Africa to 8·7% in Europe, though data on preterm birth in North Africa is very limited. The authors state that “Asian and sub-Saharan African countries accounted for 78.9% of live births and 81.1% of preterm births globally in 2014 (WHO, 2018). In Ghana, the prevalence of low birth weight (<2.5kg) was 9.69%, macrosomia (≥4.0kg) was 3.03% and Stillbirth rate was 27/1000 births (Agbozo, et al, 2016).

Casadei and Kiel (2019) defined general anthropometric measurements as a series of quantitative measurements of the muscle, bone, and adipose tissue used to assess the composition of the body. The height, weight, body mass index (BMI), body circumferences (waist, hip, and limbs), and skin fold thickness are features that are taken into consideration in

anthropometric measurements. Using this definition and description as basis, maternal anthropometry can be taken as a record of a pregnant woman's body mass index (BMI), height and weight-gain during the course of her pregnancy. Casadei and Kiel (2019) further established the importance of anthropometric measurements in stating that the measurements represent diagnostic criteria for obesity, which significantly increases the risk for conditions such as cardiovascular disease, hypertension, diabetes mellitus, and many more. There is further utility as a measure of nutritional status in children and pregnant women. Also in this vein, Devaki et al (2018) explain that maternal anthropometry includes an array of various maternal body measurements such as pre-pregnancy and pregnancy weight, pre-pregnancy body mass index (kg/m2), maternal weight gain patterns and height.

The ideal maternal anthropometry status is a function of the overall maternal health, and still, according to Devaki et al (2018) it is also an indicator of her nutritional status. Furthermore, maternal health, as a factor, has been established as a determinant of the rate of occurrence of infant mortality. In this regard, maternal obesity in particular has been discovered to be a risk factor for stillbirth and congenital abnormalities (Meehan, et al, 2014). The Centers for Disease Control and Prevention (2018) also asserts that the heavier a woman is before she becomes pregnant, the greater her risk of pregnancy complications, including pre-eclampsia, GDM, stillbirth and caesarean delivery.

Most of the factors that contribute to adverse neonatal outcomes in Nigeria are preventable (Okonofua, et al., 2019; WHO, 2018). However, Nigeria has consistently performed poorly compared to other Sub-Saharan African countries such as Ghana and Uganda (Okonofua, et al., 2019). One of the common problems in Nigeria is lack of local research to generate indigenous evidence peculiar to our people and environment that will take into account the weight, height, gestational weight gain of Nigerian women and their connections with birth outcomes. It is therefore imperative for the researcher to have local evidence about the maternal anthropometric status (maternal BMI in early pregnancy and at term and gestational weight gain) and its relationship with neonatal outcomes as at the time of birth (low birth weight, macrosomia, preterm birth, stillbirth, and birth asphyxia).

On these premise, the current study determine the maternal anthropometric status as a correlate of neonatal outcomes among pregnant women in selected secondary health facilities in Ibadan metropolis, Oyo State, Nigeria. Specific objectives of the study were to;

1. identify anthropometric status (maternal BMI) of mothers of neonate in the selected secondary health facilities in Ibadan metropolis; and
2. determine the gestational age of neonate at birth in different maternal BMI categories.

Research Hypotheses

The following hypotheses were tested:

Ho1: There is no significant association between maternal BMI and birth outcome

Ho2: There is no significant association between maternal BMI and gestational age of neonates at delivery

Ho3: There is no significant association between maternal BMI and baby's birth weight

METHODOLOGY

A retrospective descriptive research design was adopted to determine maternal anthropometric status as a correlate of neonatal outcomes among pregnant women in four selected secondary health facilities namely: Adeoyo Maternity Teaching Hospital, Ring Road State Hospital, Jericho specialist Hospital, Our Lady of Apostles Catholic Hospital, Oluyoro in Ibadan, Oyo State. The study population however, comprises of pregnant women who attended the selected secondary health facilities within Ibadan metropolis during their pregnancy and also delivered their babies in these health facilities from January 1, 2019- December 31, 2019. Total enumeration of 299 records of women and their babies who met the inclusion criteria for the study were used in all the secondary health facilities chosen for this study in Ibadan Metropolis**.** A purposive sampling technique was adopted for this study, in which all pregnant women who booked on or before 18 weeks gestational period and delivered in the same facility were identified from the total deliveries in the maternity ward of various health facility and Medical Records Department.

The data were extracted from the patients case notes using a 4-sectioned self-developed checklist on maternal anthropometric status as a correlate of neonatal outcomes. The validity of the research instruments was done through face and content validity techniques. The checklist was subjected to thorough examination, scrutiny and elimination of ambiguity by experts in the field of maternal and child health.

Data was collected by sorting out of antenatal (ANC) files and birth records using inclusion criteria to know the mothers who booked for antenatal care on or before 18^{th} week of their gestation and delivered their babies in the same health facilities where they booked. Exclusion criteria was also used to eliminate records of mothers who had multiple births e.g. twins and triplets, those with underlying medical conditions in their first trimester and pregnant women who booked for their antenatal care after 18^{th} week of their gestation. Relevant data were extracted from the birth records and corresponding mother's ANC case notes using structured checklist which was carried out by the researcher and with the help of three (3) research assistants who help the researcher in the sorting out of the case notes of the pregnant women, organization and documentation of data. Socio-demographic as well as maternal and obstetrical data, maternal anthropometric measurements such as weight and height were extracted from ANC files while baby's birth weight, sex, birth outcomes were extracted from birth records. The research assistance undergone training session on how to use checklist to extract data from client's case note. Formats of antenatal record as well as the delivery record were shown to them and the meanings of ambiguous terms were explained.

Data gathered from the records of those that met the inclusion criteria on socio-demographic characteristics from each facility were analysed using descriptive statistics of frequency count and percentage. Height and weight was used to compute BMI using the formula below:

$$BMI = \frac{\text{Weight (kg)}}{\text{Height}^2\ (M^2)}$$

The BMI was categorized into four groups: underweight (less than 18.5), normal weight (18.5–24.9), overweight (25.0–29.9), and obese (30.0 or more). The result was presented using table. The birth weight was captured using descriptive statistics of minimum, maximum, mean/median. Birth weight was classified thus:

Low birth weight (LBW) < 2.5kg
Normal weight 2.5 – 3.99kg
Macrosoma ≥ 4.0kg
The result was presented using table while descriptive analysis of frequency and percentage were used to determine the rate of occurrence of preterm birth among the study population. Neonatal outcomes were analysed. The outcomes were categorized thus: Low birth weight, Macrosomia, Preterm birth, Birth Asphyxia and Stillbirth. Maternal BMI was cross tabulated with the duration of pregnancy (gestational age) and Chi square, degree of freedom and level of significance were reported. Maternal anthropometrics was correlated with neonatal birth weight. The clinical characteristics of the study participants in different ranges of BMI were compared by a Chi-square. Participants in the normal BMI range were used as the reference group.

RESULTS

Table 1: Maternal weight at booking, weight at delivery, maternal heights and Body mass Index

Variable		Frequency	Percent
Maternal weight	Less than 50kg	21	7.0
	50-59kg	75	25.1
	60-69kg	90	30.1
	70-79kg	51	17.1
	80-89kg	43	14.4
	90-99kg	14	4.7
	100 and above	5	1.7
Weight at delivery	Less than 50kg	1	0.3
	50-59kg	37	12.4
	60-69kg	78	26.1
	70-79kg	78	26.1
	80-89kg	58	19.4
	90-99kg	33	11.0
	100-109	14	4.7
Maternal heights	Less than 1.5m	4	1.3
	1.5-1.6m	112	37.5
	1.61-1.7m	151	50.5
	1.71-1.8m	29	9.7
	1.81-1.9m	3	1.0
BMI	less than 18.5	16	5.3
	18.5-24.9	43	14.4
	25.0-29.9	171	57.2
	>30.0	69	23.1

Table 1 shows maternal weight, weight at delivery, maternal heights and body mass index. The mothers that has weight less than 50kg were 21 (7.0%), 50-59kg were 75(25.1%), 60-69kg were 90(30.1%), 70-79kg were 51 (17.1%), 80-89kg were 43(14.4%), 90-99kg were 14 (4.7%) and those with 100kg and more were 5(1.7%); those with weight at delivery are less than 50kg were 1 (.3%), 50-59kg were 37 (12.4%), 60-69kg and 70-79kg were 78(26.1%) respectively, 80-89kg were 58 (19.4%) 90-99kg were 33 (11.0%) while those with 100-109kg weight were 14 (4.7); mothers with heights less than 1.5m were 4 (1.3%), 1.5- 1.6m were 112 (37.5%), 1.61-1.7 were 151(50.5%) 1.71-1.8 were 29 (9.7%) while those with heights of 1.81-1.9m were 3 (1.0%); the mothers with body mass index less than 18.5 were 16 (5.4%), those with body mass index 18.5-24.9 were 43(14.3%), those with BMI of 25.0- 29.9 were 171 (57.2%), those with BMI of >30.0 were 69 (23.1%).

Table 2: The gestational age of neonates at delivery in the different BMI categories

BMI	<37 weeks	≥ 37 weeks
18.5-24.9	14 (4.7%)	107 (35.8%)
25.0-29.9	8 (2.7%)	50 (16.7%)
30.0->30.0	6 (2.0%)	114 (38.1%)
Total	28 (9.4%)	271 (90.6%)

Table 2 shows the gestational age at delivery from three categories of BMI. From this table 28 (9.4%) of the participants had preterm birth irrespective of their BMI category. In the category of normal BMI, 14 (4.7%) of the participants had preterm delivery, 8 (2.7%) in overweight and 6 (2.0%) in the obese category while others 271 (90.6%) had term pregnancies.

Table 3: Baby's Birth Weight in kilogram

Variable		Frequency	Percent
Baby's weight in kg	Low birth weight (<2.5kg)	20	7.0
	Normal weight (2.5-3.9kg)	248	83.0
	Macrosomia (≥4.0kg)	30	10.0
Total		299	100.0

Table 3 shows baby's birth weight in kilogram (Kg). Those with <2.5kg were 20 (7.0%) which are low birth weight, 248 (83.0%) were of normal birth weight (2.5-3.9kg) and 30 (10.0%) were macrosomia (>4kg)

Table 4: Apgar scores in 1minutes and 5minutes

Apgar scores in 1 minute	Frequency	Percent
Severe asphyxia (0-3)	4	1.4
Mild Asphyxia (4- 6)	33	11.4
Normal Apgar score (7-10)	253	87.2
Apgar score in 5 minutes		
Severe asphyxia (0-3)	3	1
Mild asphyxia (4-6)	4	1.4
Normal Apgar score (7-10)	283	97.6

Table 4 output indicates Apgar test run on the babies 1 & 5minnute after birth. From close observation of the table below, some columns were having two readings this simply means the test was carried out two times on the baby. A good number of 253 (87.2%) babies score between 7 to 10 in 1 minute after delivery, 33 (11.4 %) score between 4 and 6 in 1minute which means they were mildly asphyxiated and Only 4 (1.4 %) babies score between 0 and 3 in 1 minute. This means a good number of babies' precipitated good health after birth in 1 minute Apgar test. Other needful information was in the table below. These same babies were tested 5 minute after birth, 283 (97.6%) of the children score between 7 and 10, 4 (1.4%) of them score 4-6 while 3 (1%) score between 0 and 3. This signifies that 283 (97.6%) of the babies need little or no medical attention unlike those ones who score far below 7 point in both 1 and 5 minute. A sharp comparison between the two tests carried out on the babies. Most babies on Apgar test in 5 minute exhibit good health after birth compare to babies on Apgar test in 1minute after birth. There were nine (9) missing data on apgar score.

Test of Hypotheses

Ho1: There is no significant association between maternal BMI and birth outcome

Table 5: Association between maternal BMI and Birth outcome

Cross tabulation							
		Birth outcome		Total	X^2	df	p-value
		Live birth	Stillbirth				
BMI	less than 18.5	16 5.4%	0 0.0%	16 5.4%			
	18.5-24.9	161 54.6%	1 33.3%	162 54.4%			
	25.0-29.9	76 25.8%	2 66.7%	78 26.2%			
	≥ 30	42 14.2%	0 0.0%	42 14.1%	2.735	3	0.96
TOTAL		295	3				

KEY

df = degree of freedom, P- value = level of significance

Table 5 shows that there was no significant association between maternal BMI and Birth outcome. From the output above, Chi-square table shows X^2 (2.73, df=3, 0.96>0.05). This simply mean association between maternal BMI and birth outcome was not significant. Therefore, null hypothesis is not rejected**.**

Ho2: There is no significant association between maternal BMI and gestational age of neonates at delivery

Table 6: Association between maternal BMI and Gestational age of neonates at delivery

Cross- tabulation						
		Gestational Age in weeks at delivery				
		Less than 37 weeks	Greater than 37 weeks	X^2	Df	p-value
BMI	< 18.5	2 7.1%	14 5.1%	3.01	1	0.383
	18.5-24.9	16 57.1%	146 53.9%			
	25.0-29.9	7 25.0%	72 26.6%			
	≥ 30.0	3 10.7%	39 14.4%			
Total		28	271			

Table 6 shows that there was no significant association between maternal BMI and gestational age of neonates at delivery. From the analysis above, Chi-square table shows X^2 (3.01, df = 1, 0.383>0.05). This simply mean association between maternal BMI and gestational age at delivery was not significant. Therefore, null hypothesis is not rejected.

Ho3: There is no significant association between maternal BMI and baby's birth weight

Table 7: Association between BMI and Baby's birth weight

	BMI * Baby weight Cross tabulation						
		Less than 2.5kg	2.6-3.9kg	>4.0kg	X^2	df	p-value
BMI	Underweight (<18.5)	3 15%	13 5.2%	0			
	Normal BMI (18.5-24.9)	10 50%	142 57.3%	9 30%	25.567	1	.000
	Overweight (25.0-29.9)	6 30%	64 25.8%	9 30%			
	Obese (>30.0)	1 5%	29 11.7%	12 40%			
Total		20	248	30			

Table 7 shows that there was no significant association between maternal BMI x baby's birth weight at delivery. From the analysis above, Chi-square table shows X^2 (25.567, df =1, 0.000<0.05). This simply mean association between maternal BMI and baby's birth weight at delivery was significant. Therefore, null hypothesis is rejected.

DISCUSSION OF FINDINGS

The results of the study revealed that majority of the participants 171(57.20%) were overweight, 69 (23.10%) were in the obese category, 43 (14.40%) were in the normal BMI and

16 (5.30%) were in the underweight category. This corroborates the study carried out by Coliins et al (2019) on estimated global overweight and obese burden in pregnant women in which there is increase in the number of overweight and obese pregnant women both in the high and middle income countries.

The study also revealed that 28 babies were born preterm (< 37 weeks) irrespective of their mother's BMI, out of this, 2 (7.1%) babies belong to the category of the underweight mothers, 12 (42.9%) were in the normal weight category, 8 (28.6%) and 6 (21.4%) were in the category of overweight and obese respectively. The results revealed that majority (42.9%) of the preterm babies were in the normal weight category of BMI. Preterm birth is the leading cause of neonatal morbidity and mortality (Liu et al, 2019).

The study revealed that the association between maternal BMI and birth outcome was not significant. This study disapproved the findings of Agbozo, et al (2016) which stated that the risk of stillbirth increases with the increasing maternal BMI as a result of lower sensitivity with regard to detection of fetal complications, on the part of monitoring tools or maternal ability to detect changes in fetal movement and Ugwa (2014) which stated that obesity increases complications during pregnancy, labour and delivery, and into the postpartum period, as well as adverse neonatal outcomes which include fetal growth abnormalities such as macrosomia, neural tube defects, and stillbirth.

The study further revealed that the association that existed between maternal BMI and gestational age was not statistically significant. Out of the 299 case notes explored 28 (9.4%) of the babies were born preterm i.e before 37 weeks of gestation while the remaining 271 babies were born at term. From the 28 cases of preterm birth 2 (7.1%) were delivered by the underweight mothers, 16 (57.1%) were delivered by women who were under normal BMI category, 7 (25.0%) were delivered by the overweight and the remaining 3 (10.7%) were given birth by the women in obese category of BMI.

The study also revealed that the association between maternal BMI and birth weight is statistically significant. This is supported by the study carried out by Okonofua et al (2019) which states that inadequate weight gain is a major risk factor for adverse foetal / neonatal outcomes such as IUGR, preterm birth and low birth weight. 12 (75%) had appropriate for gestational age babies and no large for gestational age baby. In the average/ normal BMI group 8 women (5.7%) had low birth weight babies, 247 women (82.6%) had appropriate for gestational age babies and 7 women (5.0%) had large for gestational age babies. Also in the category of the overweight 10 women (13.9%) had low birth weight birth (<2.5kg), 62 women (86.1%) had babies who were appropriate for their gestational age with no baby large for gestational age (>4.0kg). In the obese category, 1woman (1.4%) had low birth weight baby, 49 (70.0%) had appropriate for gestational age babies and 21 (30.0%) had large for gestational age babies. The analysis results showed that the association between maternal BMI and birth weight is statistically significant.

It was also supported by the study carried out by Trombe, et al (2020) which found that high frequency of pre-gestational excess weight was found to be independently associated with high birth weight. Underweight had more chance of having small for gestational age baby (SGA) and LBW as compared to average weight mothers. Mothers who are overweight or obese

during gestation have more chance of having infants that are macrosomic or LGA (Catalano & Shankar, 2017). Therefore, both extremes of maternal BMI range may influence the risk of neonatal adverse outcomes.

CONCLUSION

Inadequate and excessive weight gain during pregnancy represents a significant threat for both the mother and the baby. Generally there is an increase in the prevalence of overweight and obesity and this also affect the women of child bearing age. Though, there was no significant association between gestational age at delivery and birth outcomes, the results of this study revealed negative neonatal outcomes more in women that are in the category of underweight and overweight; thus, nutritional counselling in a patient-centred manner by health care professionals is essential to reach an optimal BMI before conception when planning a pregnancy.

Health care providers are in a strategic position and should encourage women to start the pregnancy with a BMI in the normal weight category and limit their GWG to the range specified for their pre-pregnancy BMI. GWG was positively correlated with BW/GA for heavier neonates whose birth weights were similar to the average neonatal weight according to world standards. However, caution might be required for low-birth-weight neonates because increased GWG does not always result in increased birth weight.

The guidelines recommended by the IOM 2009 on weight gain during pregnancy by pre-pregnancy BMI, are germane and used worldwide to monitor and evaluate maternal health. Based on the findings of this study, excess GWG is common and is associated with negative pregnancy and birth outcomes.

Recommendations

Based on the findings from the study, the following recommendations are made:

1. Gestational weight gain is envisioned to assist practitioners who care for pregnant women, policy makers, educators, researchers, and the pregnant women themselves to understand the role of gestational weight gain and to provide them with the tools needed to promote optimal pregnancy outcomes.
2. Healthcare practitioners are to identify pregnant women who at risk of having adverse birth outcome by calculating their BMI and know the group they belong (underweight, normal weight, overweight and obese) and also help to educate them appropriately.
3. Pregnant women whose babies would need special care at birth should be referred to the health facility that can handle such cases before delivery to enhance the neonatal survival rate.
4. Pregnant women should book early for antenatal care once they have confirmed they are pregnant, so as to be closely monitored before the formative period of all organs in the fetal body are completed to prevent adverse birth outcomes e.g congenital malformations.
5. Health care providers who care for pregnant women should determine a woman's BMI at the initial prenatal visit. It is important to discuss appropriate weight gain, diet, and exercise at the initial visit and periodically throughout the pregnancy.

Implication to Nursing

Preconception counselling should include prevention of obesity, ideally from childhood. Obese women are at risk for cardiac and pulmonary diseases, gestational hypertension and diabetes, and obstructive sleep apnoea. Obesity in pregnancy may result in higher risk for congenital anomalies, operative birth, and surgical complications. Nurses are frequently the main educators for their pregnant patients. Counselling obese pregnant women about nutrition and food choices and using collaborative goal setting for weight gain can prevent pregnancy risks and avoid weight gain that may persist beyond pregnancy.

When the pregnant women are exposed to the adverse neonatal related problems and their possible prevention, it will assist them to adopt healthy practices that we promote positive neonatal outcomes. This will therefore assist in reducing the rate of morbidity and mortality among the mothers and their babies. Hence, it is necessary for nurses and midwives to understand the importance of weight management prior pregnancy and how diet can promote healthy neonatal and maternal pregnancy outcomes.

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