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Pattern of weight gain in pregnant women and effect on maternal and neonatal outcome in Abuja, Nigeria: A longitudinal multicentre study

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Abstract
Background: Normal pregnancy is usually associated with weight gain. Abnormal weight gain in pregnancy could result in adverse neonatal and maternal outcome. Studies related to this in Nigeria are limited.
Objective: The aim was to evaluate the pattern of weight gain in pregnancy and the feto-maternal outcome among women with different body mass indices attending antenatal clinic in the Federal capital territory (FCT).
Study design: This was a longitudinal, multicentre study.
Materials and Methods: Two hundred and twenty participants were recruited from 6 general hospitals in the FCT. Their body mass indices were calculated and they were categorized as underweight, normal weight, overweight and obese accordingly. They were followed up till 2 weeks postpartum. Maternal outcome sought included gestational hypertension, gestational diabetes and mode of delivery, postpartum haemorrhage, retained placenta and perineal injury. Neonatal outcomes included macrosomia, low birth weight, neonatal hypoglycaemia, shoulder dystocia, stillbirth and admission into special care baby unit (SCBU).
Result: The mean age of participants was 28.8 years ±4.7 with parities ranging from 0-8. The majority of them (39%) were overweight. While most of the women (118, 56.2%) had normal weight gain (NWG) in pregnancy, 15(7.1%) had low weight gain (LWG) and 77(36.6%) had high weight gain (HWG). Most (95%) of the HWG was among the overweight and obese women. There was a higher induction rate and postpartum haemorrhage among HWG women and postdate among the obese group. There was no difference in neonatal outcome among the groups.
Conclusion: This study demonstrated that HWG and LWG have more adverse pregnancy outcomes than NWG. Younger women (20-24years) with normal BMI at booking tend to gain suboptimal weight in pregnancy. HWG in pregnancy was commoner among overweight and obese women with increased induction of labour and postpartum haemorrhage among them. Post-date pregnancy was higher among the obese group. There was no difference in neonatal outcomes among the groups.

Keywords: Abuja, BMI, Body mass index, weight gain in pregnancy, maternal outcome, neonatal outcome, Nigeria

Introduction
Maternal weight gain in pregnancy can offer a means of assessing the well-being of the pregnant mother and by inference of that of her baby [1]. Suboptimal and excessive weight gain in pregnancy could predispose to perinatal and maternal morbidity and mortality [2, 3]. Maternal pre-pregnancy weight, body mass index (BMI), pattern of gestational weight gain, and total gestational weight gain are factors that determine the birth weight, weight for length, and adiposity of the newborn [4, 5]. Birth weight and adiposity are important because they have a major impact on neonatal morbidity and mortality, and also appear to affect early adult weight and long-term health [4-8]. As an example, low or high birth weight may affect the child's future risks of developing diabetes mellitus, hypertension, and cardiovascular disease. Gestational weight gain also impacts the mother, as excessive gestational weight gain increases her risk of postpartum weight retention and thus increase her risk of obesity or worsening obesity [9].
Normal weight gain in pregnancy at term is attributed to fetus (3.2 to 3.6 kg), fat stores (2.7 to 3.6 kg), increased blood volume (1.4 to 1.8 kg), increased fluid volume (0.9 to 1.4 kg), amniotic fluid (0.9 kg), breast enlargement (0.45 to 1.4 kg), uterine hypertrophy (0.9 kg) and placenta (0.7 kg) [9].

Given the importance of gestational weight gain and birth weight, guidelines regarding appropriate levels of weight gain in pregnancy have been promoted worldwide [10]. Although the importance of appropriate weight gain is well established, most women gain too little or too much weight during pregnancy [11-13]. Inadequate prenatal weight gain is a significant risk factor for intra-uterine growth restriction, pre-term delivery, respiratory distress stillbirth and low birth weight in infants [2, 3, 14, 15]. Obesity and excessive weight gain on the other hand are associated with adverse fetal and maternal outcomes such as pre-eclampsia, gestational diabetes mellitus, postdate pregnancy, induction of labour, caesarean section, perineal trauma, post-partum haemorrhage, retained placenta, macrosomia, meconium aspiration, neonatal birth trauma, stillbirths and neonatal hypoglycaemia [16-21]. Earlier research focused on the relationship between maternal weight and pregnancy complications but BMI is now widely accepted as a better measure of overweight or underweight [22]. More recently, the waist-hip ratio has been used to study the effects of obesity on pregnancy, but data relating to this parameter are seldom available [23]. The studies conducted so far relating to weight gain in pregnancy are from developed Western countries and there is a paucity of such data from developing countries [24].

In developed countries where preconception care is the norm, it is possible to know the pre-pregnancy weight of patients coming for antenatal care and therefore accurately assess their BMI and weight gain in pregnancy [18, 21]. In developing countries like Nigeria where pre-conception care is hardly practiced, most studies on weight gain in pregnancy use booking weight in early gestation as pre-pregnancy weight [14]. The amount of maternal weight gain that is compatible with a favourable outcome has been a matter of debate since the 1940s [25-27]. These have led to studies resulting in recommended weight gains in pregnancy and most reports favour the recommendations by the institute of medicine (IOM) [28].

This study aimed to find out the pattern of weight gain in pregnancy and its effects on neonatal and maternal outcomes in women of different BMI groups delivering singleton babies between gestational ages (GA) of 37 and 42 weeks.

Materials and Methods

Study location

The study was conducted at Abaji, Kwali, Kuje, Gwarimpa, Kubwa and Wuse General Hospitals, all within Federal Capital Territory, Abuja.

Study design

It was a prospective, longitudinal, multicentre study on weight gain in pregnancy and maternal and neonatal outcomes. The study population comprised of consenting pregnant women who met the inclusion criteria and followed up till 2 weeks post-partum.

This study was conducted for a period of 7 months (January 2016 to July 2016) after obtaining ethical approval from the FCT research and ethics committee, Abuja.

Sample size determination

Prevalence at Enugu, Nigeria was 10.7% [29]. The minimum sample size for simple proportion at 5% accuracy and 95% level of confidence was calculated using the Cochran's Formula below [30].

$$n = \frac{z^2 pq}{d^2}$$

Where

N = minimum sample size.

Z = the standard normal deviation, usually set at 1.96.

P = 0.107, derived from 10.7% prevalence of obesity in pregnancy in Enugu, Nigeria.

Q = 1-p=1-0.107=0.893.

D = degree of accuracy set at 0.05

$$n = \frac{1.96 \times 1.96 \times 0.107 \times 0.893}{0.05 \times 0.05}$$

Then,

N= 146.8

This was increased by 50% to increase the power of the study and hence the calculated sample size was 220.

Inclusion Criteria

Pregnant women with singleton fetus, at gestational age of 16 weeks or less who gave consent were recruited.

Exclusion Criteria

Women who declined consent, booking gestational age of greater than 16 weeks, multiple gestation, chronic hypertension, diabetes mellitus, HIV, ≥ 2 previous caesarean sections, history of infertility and fetal malformation were excluded.

Study location

The study was done in 6 general hospitals in FCT namely Abaji, Kwali, Kuje, Gwarimpa, Kubwa and Wuse General Hospitals.

Sampling technique

The 6 major health facilities in the FCT were used for the study. Convenient sampling technique was employed for the study population and consecutive consenting women who met the inclusion criteria were recruited for the study.

Subjects and Methods

Awareness about this study was created among hospital staff at the antenatal clinic, labour ward and emergency gynaecological outpatient clinic at each of the study facilities. Every eligible woman was counselled on the objectives of the study and consent was obtained after ensuring that they fully understood the concept of the research. Enrolment code was then generated for each participant to ensure confidentiality.

Consecutive women who qualified for the study were recruited. A structured interview was conducted at the first contact and information on demographic characteristics, clinical and obstetric history of each participant was collected. Gestational age was based on the best available estimate; either the woman's recollection of the date of her last menstrual period or earliest ultrasound scan estimated gestational age when she is not sure of her last menstrual period. The anthropometric measurements, including theweight and height of each participant were obtained. Thereafter, medical examination was done and the participants were booked for ante natal care. Each facility used a single weighing scale (SECA) for measurement of their weights to reduce errors. Each woman was made to stand erect on the scale bare footed facing the examiner while the weight was recorded. In measuring the height, each woman was also asked to stand erect bare footed with the back against a wall with calibrated measuring tape and a ruler was placed on the head and the point where it touched the wall was marked with a pencil. The height was recorded in metres from the floor to the mark on

the wall, which was the distance between the heel and the top of the head. Data collected at booking included demographic details, height and weight. Each participant's BMI was calculated using the formula: Weight (kilograms)/Height^2 (metres). The participants were eventually categorised into four groups according to their booking BMI which included underweight, normal, overweight and obese.

All participants were followed through pregnancy, delivery and two weeks postpartum. At each subsequent visit their weights were recorded until delivery. All participants were given a dedicated phone number to call in case of any outcome of interest. The participants were contacted by their expected date of delivery and two weeks after pregnancy.

Two hundred and twenty women were recruited for the study, however, 3 had spontaneous miscarriage, 5 had preterm delivery, 1 had post term delivery and 1 was lost to follow up. These 10 women were not analysed because this study was restricted to those whose delivery occurred between 37 weeks to 42 weeks gestational age.

Weight gain in pregnancy was obtained by subtracting the maternal booking weight from the maternal weight measured within one week prior to delivery at GA of 37-42 weeks. Depending on the booking BMI, gestational weight gain was categorised as low weight gain, normal weight gain and high weight gain according to the recommendation by IOM [28].

Antenatal, intrapartum and postpartum outcomes of interest were recorded. These included:

Antenatal: Gestational hypertension, gestational diabetes, pre-labour rupture of membranes, postdate pregnancy, induction of labour, intrauterine growth restriction (IUGR) and intrauterine fetal death (IUFD).

Intra-partum: Maternal outcomes were route of delivery either vaginal or caesarean section. In vaginal delivery, was the labour spontaneous or induced? Was delivery spontaneous or assisted? Fetal intra-partum outcome such as shoulder dystocia was also noted.

Postpartum: Maternal outcomes were postpartum haemorrhage, retained placenta and perineal injury. Neonatal outcome of interest included admission to special care baby unit (SCBU), low birth weight, macrosomia, hypoglycaemia, meconium aspiration, respiratory distress and stillbirths.

Data analysis

Frequency and proportional distribution were made to assess the distribution of observations under the three categories – low, normal and high weight gains.

Data were coded and analysed using the Statistical Packages for Social Sciences (SPSS), version 20 (SPSS, Chicago, IL, USA) and the Epidemiological Calculator, version 2.7.0 (EpiCALC).

The Chi square test was used to analyse dependent social and demographic variables for any significant association or otherwise about the three categories of weight gains. This was done by multivariate analysis. Analysis of variance (ANOVA) was employed to determine the mean, range, proportion and standard deviation of variables for any significant relationship. The level of significance was set at p value less than 0.05 at 95% confidence interval (CI).

Ethical considerations

Approval to conduct the study was sought from the research and ethical committee of Federal Capital Development Agency, Abuja. The research information was anonymously collected to ensure Clients' privacy and confidentiality. There was no health or other risks with the study approach. No client was denied any form of services upon refusal of consent nor any client promised facilitation of services to coerce them into giving consent.

Result

The 220 women recruited at booking, 10 were dropped at the end of the study and hence their data were not analysed and only 210 were eventually analysed.

The mean age of participants was 28.8 years±4.7. Their parities ranged from 0 to 8 with a median of 1 and mode of 1.

Out of the 210 analysed, 3(1.4%) were underweight, 66(31.4%) had normal BMI, 82 (39.0%) were overweight and 59(28.1%) obese. After followed up till delivery, a total of 15(7.1%) had low weight gain (LWG), 118(56.2%) had NWG and 77(36.7%) HWG group. Thirteen out of the 15 women (86.7%) with LWG, had normal BMI. In the overweight BMI group, 46.8% had HWG and this was statistically significantly higher than those with LWG and NWG (0.0% vs 39.0%, p 0.003) respectively. In the obese BMI group, HWG was 48.1% and this was statistically higher than both LWG (6.7%, $p < 0.001$) and NWG (17.8%, $p < 0.001$). There was no statistically significant difference in weight gain within the underweight group as shown in table 1.

There was no significant difference between weight gain in pregnancy and parity. There was also no difference between occupation and weight gain.

Table 2 summarised the maternal outcome. There was a statistically significant difference in onset of spontaneous labour in women with LWG and NWG compared to those with HWG (p 0.007). HWG group had significantly higher induction rate (p 0.022) and postpartum haemorrhage (0.03) than LWG and NWG groups. Gestational hypertension/preeclampsia was commoner among the HWG but not statistically significant. There was no significant difference among the three categories of weight gain with respect to parity, occupation and educational level of the women. There was also no significant difference in instrumental delivery, retained placenta, caesarean section and perineal injury among the 3 groups.

Table 3 summarized the neonatal outcomes of the groups which showed no statistically significant difference. The mean birth weight among the three weight groups i.e., LWG, NWG, HWG was 3.2±0.2, 3.4±0.4, 3.2±0.4 respectively (95% C.I:1.605, p 0.203).

Table 4 summarised the maternal and neonatal outcome based on BMI of the participants.

Postdate pregnancy was statistically significantly higher in the obese group than the overweight, normal BMI and underweight groups (25.4% vs 7.3% vs 15.2% vs 0.0%, respectively p 0.024). Other maternal outcomes did not show significant association with BMI.

Neonatal outcome based on BMI revealed some significant association. Low birth weight (LBW) was 33.3% in the underweight group and was significantly higher than in other BMI groups (0.0% vs 0.0% vs 1.7%; P<0.001). Normal birth weight (NBW) occurred in 98.5% in the normal BMI group and was also significantly higher than in the other BMI groups (underweight, overweight and obese) which were (66.7%, 93.9%, 89.8%, respectively p 0.048). Admission into the special care baby unit (SCBU) was also statistically higher than in the underweight than in the normal, overweight and obese BMI groups as shown (33.3% vs 0.0% vs 10.4 vs 10.2; respectively p 0.020). Other neonatal outcomes within the booking BMI groups which were not found in this study included IUGR, shoulder dystocia, birth trauma and meconium aspiration.

Table 1: Demographic characteristics of study participants at booking

Weight Gain				
Characteristics	**Low N = 15, N (%)**	**Normal N = 118, N (%)**	**High N = 77, N (%)**	**P-Value**
Age Group (Mean ± SD) 28.8±4.7	25.5±4.2	29.1±5.1	28.9±3.9	0.021
< 20	0(0.0)	2(1.7)	1(1.3)	0.867
20-24	8(53.3)	16(13.6)	10(13.0)	<0.001
25-29	4(26.7)	42(35.6)	26(33.8)	0.785
30-34	2(13.3)	42(35.6)	35(45.5)	0.050
35-39	1(6.7)	14(11.9)	5(6.5)	0.425
≥ 40	0(0.0)	2(1.7)	0(0.0)	0.455
BMI				
underweight	1(6.7)	2(1.7)	0(0.0)	0.129
Normal	13(86.7)	49(41.5)	4(5.2)	<0.001
overweight	0(0.0)	46(39.0)	36(46.8)	0.003
Obesity	1(6.7)	21(17.8)	37(48.1)	<0.001
Parity				
Nullipara	0(0.0)	34(28.8)	17(22.1)	0.042
Primipara	5(33.3)	34(28.8)	24(31.2)	0.901
Multipara	9(60.0)	47(39.8)	35(45.5)	0.297
Grandmultipara	1(6.7)	3(2.5)	1(1.3)	0.452
Occupation				
Housewife	4(26.7)	40(33.9)	21(27.3)	0.578
Civil servant	2(13.3)	33(28.0)	19(24.7)	0.458
Trader	7(46.7)	29(24.6)	28(36.4)	0.065
Farmer	0(0.0)	1(0.8)	0(0.0)	0.676
Artisan	1(6.7)	4(3.4)	4(5.2)	0.743
Unemployed	0(0.0)	5(4.2)	1(1.3)	0.382
Student	1(6.7)	6(5.1)	4(5.2)	0.967

Table 2: Maternal outcome

Weight Gain					
Outcome	**Low, N (%)**	**Normal, N (%)**	**High, N (%)**	**Chi- Square**	**P-Value**
Gestational hypertension/preeclampsia	0(0.0)	5(4.2)	9(11.7)	5.311	0.070
Gestational diabetes mellitus	0(0.0)	1(1.7)	2(2.6)	1.247	0.536
Postdate pregnancy	1(6.7)	15(12.7)	15(19.5)	2.538	0.281
PROM at term	1(6.7)	0(0.0)	4(5.2)	6.686	0.035
Spontaneous Labour	14(93.3)	95(80.5)	49(63.6)	9.959	0.007
Induced Labour	1(6.7)	17(14.4)	22(28.6)	7.669	0.022
Vaginal delivery	15(100.0)	107(90.7)	68(88.3)	2.003	0.367
Caesarean section	0(0.0)	7(5.9)	7(9.1)	1.901	0.387
Vacuum/forceps delivery	0(0.0)	2(1.7)	2(2.6)	0.517	0.772
Breech delivery	0(0.0)	2(1.7)	0(0.0)	1.574	0.455
Postpartum haemorrhage	0(0.0)	0(0.0)	4(5.2)	7.043	0.030
Retained placenta	0(0.0)	0(0.0)	1(1.3)	1.736	0.420
Perineal injury	0(0.0)	2(1.7)	4(5.2)	2.531	0.282

Table 3: Foetal outcome

Outcome	**Weight gain**				
	Low, N (%)	**Normal, N (%)**	**High, N (%)**	**Chi-square**	**P-value**
Birth weight	3.2±0.2	3.2±0.4	3.2±0.4	1.605*	0.203
LBW ≤ 2.50kg	1(6.7)	1(0.8)	0(0.0)	5.946	0.051
Normal BW (2.51-3.99kg)	14(93.3)	112(94.9)	71(92.2)	0.594	0.743
Macrosomia ≥4.00kg	0(0.0)	5(4.2)	6(7.8)	2.079	0.354
Neonatal hypoglycaemia	0(0.0)	1(0.8)	3(3.9)	2.631	0.268
Respiratory distress	1(6.7)	1(0.8)	2(2.6)	2.724	0.256
Neonatal jaundice	0(0.0)	0(0.0)	3(3.9)	5.257	0.072
Neonatal Sepsis	0(0.0)	2(1.7)	2(2.6)	0.517	0.772
SCBU admission	1(6.7)	6(5.1)	8(10.4)	1.982	0.371
Still birth	0(0.0)	1(0.8)	1(1.3)	0.256	0.880
IUGR	0(0.0)	0(0.0)	0(0.0)	0(0.0)	
IUFD	0(0.0)	0(0.0)	0(0.0)	0(0.0)	
Birth trauma	0(0.0)	0(0.0)	0(0.0)	0(0.0)	
Shoulder dystocia	0(0.0)	0(0.0)	0(0.0)	0(0.0)	

Table 5: Foeto-maternal outcome from Booking BMI

Maternal Outcome	Booking BMI				Chi- Square	P-Value
	Underweight N=3(%)	Normal BMI N=66(%)	Overweight N=82(%)	Obese N=59(%)		
Gestational hypertension/preeclampsia	0(0.0)	3(4.5)	3(3.7)	8(13.6)	6.389	0.094
Gestational diabetes mellitus	0(0.0)	0(0.0)	1(1.2)	2(3.4)	2.637	0.451
Postdate pregnancy	0(0.0)	10(15.2)	6(7.3)	15(25.4)	9.470	0.024
PROM at term	1(33.3)	2(3.0)	1(5.2)	1(1.7)	13.081	0.004
Spontaneous Labour	2(66.7)	56(84.8)	58(70.7)	42(71.2)	4.804	0.187
Induced Labour	1(33.3)	10(15.2)	17(20.7)	12(20.3)	1.261	0.738
Vaginal delivery	3(100)	63(95.5)	72(87.8)	52(88.1)	3.268	0.352
Caesarean section	0(0.0)	2(3.0)	7(8.5)	5(8.5)	2.388	0.496
Vacuum/forceps delivery	0(0.0)	0(0.0)	2(2.4)	2(3.4)	2.161	0.540
Breech delivery	0(0.0)	1(1.5)	1(1.2)	0(0.0)	0.880	0.830
Postpartum haemorrhage	0(0.0)	0(0.0)	1(1.2)	3(5.1)	4.739	0.192
Retained placenta	0(0.0)	0(0.0)	1(1.2)	0(0.0)	1.568	0.667
Perineal injury	0(0.0)	0(0.0)	3(3.7)	3(5.1)	3.274	0.351
Foetal outcome						
Birthweight: LBW ≤ 2.50kg	1(33.3)	0(0.0)	0(0.0)	1(1.7)	35.114	<0.001
Normal BW, (2.51-3.99kg)	2(66.7)	65(98.5)	77(93.9)	53(89.8)	7.900	0.048
Macrosomia, ≥4.00kg	0(0.0)	1(1.5)	5(6.1)	5(8.5)	3.376	0.337
Respiratory distress	0(0.0)	0(0.0)	2(2.4)	2(3.4)	2.161	0.540
Neonatal hypoglycaemia	0(0.0)	0(0.0)	2(2.4)	2(3.4)	2.161	0.540
Neonatal jaundice	0(0.0)	0(0.0)	1(1.2)	2(3.4)	2.637	0.451
SCBU admission	1(33.3)	0(0.0)	8(10.4)	6(10.2)	9.839	0.020
Sepsis	0(0.0)	1(1.5)	2(2.4)	1(1.7)	0.251	0.969
Still birth	0(0.0)	0(0.0)	1(1.2)	1(1.7)	1.070	0.784
IUGR	0(0.0)	0(0.0)	0(0.0)	0(0.0)		
IUFD	0(0.0)	0(0.0)	0(0.0)	0(0.0)		
Birth trauma	0(0.0)	0(0.0)	0(0.0)	0(0.0)		
Shoulder dystocia	0(0.0)	0(0.0)	0(0.0)	0(0.0)		

Discussion

Being a multicentre study, women of various socio-economic background, ethnicity and different BMI groups at six health delivery centres within Abuja, Nigeria were recruited. Of the 210 women whose data were analyzed, 1.4% were underweight, 31.4% had normal BMI, 39.0% were overweight and 28.1% were obese. The trend was different from results of similar studies done in Ghana, Bangladesh and Norway where by women with normal BMI were recorded most [31-33]. It is however, similar to findings of studies from USA and Canada showed more women in the overweight and obese groups [34-36]. This could be due to adoption of western dietary habits and life style. The mean booking BMI in our study was 27.56±4.8 kg/m^2 which was similar to the mean booking BMI of 28.1±5.1 reported by Iyoke *et al* in Southeast Nigeria [37]. It was also similar to findings of Addo and Nazlima from Ghana and Bangladesh respectively [31, 32]. It was however higher than pre-pregnancy BMI of 24kg/m^2 in Norway [33]. This could be due to genetic and environmental factors. In our study, 86.7% of women with LWG had normal BMI at booking, 39% of NWG were overweight and 17% of HWG were obese. The tendency to gain less weight in normal BMI group and normal weight in overweight group may be due to racial differences, nutritional and environmental factors as similar studies showed African American women and not Caucasians are at an increased risk of LWG in normal BMI category [38, 39]. However, this is not in support of why more HWG was observed in the obese group in this study. The LWG observed in normal BMI women and the HWG in mostly obese women suggest that these two groups need more weight gain monitoring than overweight women whose weight gain is mostly normal.

The mean age of the women at booking was found to be 28.8±4.7 years which was similar to 27.1±5.1 years reported by Iyoke *et al* in south east Nigeria [37]. This was slightly higher than findings from a similar study in Norway showed a mean age of 30.3 years [33]. However, the modal age for women in our study was within the 30-34 years age range which is different from findings of Ifene, *et al*. that showed a modal age range of 25-29 years old [40]. This is probably because Abuja, the capital of Nigeria is a more urban population with people of civil service oriented jobs who are likely to have delayed getting pregnant. Suboptimal weight gain was higher among the women within the 20-24 years age range with normal BMI. This may be because they are younger and are likely to be more active. They are also likely to be nullipara with higher risk of malaria in pregnancy which may prevent weight gain.

Their parities ranged between 0-8 with a median of 1 and mode of 1. This is lower than the median of 2 reported from Ghana [31]. Educational level of the women did not show any significance association among the three weight gain groups. However, those with tertiary level of education were highest (50.5%) while those without formal education were the least (10.5%). This may be due to the fact that, Abuja city, being federal capital of Nigeria is mostly populated by civil servants and educated people looking better jobs. The lower value of women without formal education and higher rate of educated women found in this study was similar to the findings from Ghana, Bangladesh and Benin [31, 32, 41].

This study did not show any significant difference regarding weight gain and the women's occupation. However, majority were house wives, traders and civil servants who were up to 31%, 30.5% and 25.7% respectively.

Out of the 210 women followed up to delivery, 15 (7.1%) had LWG, 118 (56.2%) had normal weight gain (NWG) and 77 (36.7%) had high weight gain (HWG). This result was similar to findings by Addo in Ghana, where majority of the women had

NWG [31]. Our finding was however, different from similar studies in Canada and United States of America where most of participants had HWG [38, 39]. This could be due to the higher socioeconomic status of women in these developed countries attributable to life style and dietary differences [40].

This study has demonstrated that HWG and LWG have more adverse maternal outcomes than NWG as seen in similar studies [2-8, 31, 32]. We recorded higher proportion of gestational hypertension, preeclampsia, gestational diabetes, postdate pregnancy, caesarean sections, assisted vaginal delivery, retained placenta and perineal tears but these were not statistically significant as reported in other studies [31, 32].

HWG was associated with more induction of labour and postpartum haemorrhage as was shown in many studies [2-8, 31, 32]. This was however at variance with findings from Turkey which showed no association with these variables [43]. This difference may be due to difference in methodology and study design as theirs was a retrospective study while ours was prospective. Perhaps, if their study design was prospective, the result could have been similar. Other adverse maternal outcome that occurred proportionally higher in the HWG group but not statistically significant were; caesarean section (9.1%, p 0.387), vacuum/forceps delivery (2.6%, p 0.772), perineal injury (5.2%, p 2.531) and retained placenta (1.3%, p 0.420). The adverse maternal outcomes found in this study were fewer than the reports in the developed countries. This could be due to the higher proportion of HWG in other studies especially in the high-income countries.

The neonatal outcome in this study did not show any significant difference among the 3 weight gain groups. However, in the HWG group the following were observed; macrosomia, neonatal hypoglycaemia, neonatal jaundice, neonatal sepsis, SCBU admission and still birth but the difference was not statistically significant. The LWG group recorded LBW and respiratory distress syndrome but not statistically significant as was observed in some studies [31, 32]. Shoulder dystocia, IUGR, birth trauma and meconium aspiration were not recorded in this study and this could be attributed to the level of care patients received in the FCT.

Obesity was significantly associated with postdate pregnancy. Gestational hypertension and preeclampsia occurred more in the obese group but not statistically significant. Pre-labour rupture of membranes at term was statistically higher in the underweight than in other BMI groups but this should be interpreted with caution as there were only 3 women in the underweight group as the comparison may not be balanced. However, other studies reported similar finding of increased prelabour rupture of membranes among the underweight women [2-8, 31-33, 37]. In our study, the BMI did not show any significant difference in maternal and neonatal outcomes in terms of gestational diabetes mellitus, spontaneous labour, induced labour, vaginal delivery, caesarean section, vacuum/forceps delivery, breech delivery, postpartum haemorrhage, retained placenta and perineal injury. SCBU admission and LBW were significantly higher in the underweight group than in other BMI groups and NBW was significantly higher in the normal BMI group. These outcomes were similar to reports from other studies [2-8, 31, 32].

Conclusion

This study has demonstrated that HWG and LWG significantly have more adverse maternal and neonatal outcomes than NWG. Younger women (20-24years) with normal BMI at booking tend to gain suboptimal weight in pregnancy. Obesity and overweight women were more likely to have HWG in pregnancy. HWG in pregnancy was associated with increased induction of labour and postpartum haemorrhage. Post-date pregnancy was higher among the obese group. There was no significant difference in neonatal outcomes among the groups.

Recommendation

Adequate weight gain in pregnancy should be encouraged to prevent adverse maternal outcomes associated with suboptimal and excessive weight gain.

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