

## **Pregnancy Weight Gain, Body Mass Index and Blood Pressure of Pregnant Women in Zaria, Nigeria**

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### **ABSTRACT**

Recent reports have shown that inappropriate gestational weight gain has direct effect on both maternal health and fetal growth, and that the prevalence of higher gestational weight has been increasing. The present study was designed to examine the levels of changes in women due to pregnancy. The parameters examined include pregnancy weight, pregnancy body mass index (BMI) and blood pressure (BP). The sample included 337 women from four different hospitals in Zaria, age between 15-50 years. There was a gradual increase in the means of the weight from week 14 ( $54.33 \pm 13.5$ ) to term ( $70.65 \pm 13.15$ ). There was a significant increase in weight and BMI ( $P < 0.001$ ) as pregnancy advances towards term, however blood pressure, pulse pressure, and mean arterial pressure did not show any significant difference. Correlation analysis indicated significant relationship between BMI, blood pressure parity and birth weight with  $P < 0.05$  and  $P < 0.001$  respectively. The study showed that pregnancy significantly increased body weight gain, BMI, but not BP.

**Keyword:** Pregnant women, weight gain, body mass index, blood pressure, ethnic groups, Nigerians

The human body responds to pregnancy through a variety of ways and these ways directly influence fecundity, fertility and intrauterine morbidity and mortality (Rockwell et al 2003). Some of these responses include increase in blood pressure (BP) which may reach morbid stages in some cases (Roberts et al 2003, Sorensen et al., 2003) and increase in body weight and body mass index (Piperata et al 2002, Kirchengast and Hartmann, 2003). The increase in body weight is a physiological adaptation to deal with energetic stress of pregnancy and at the same time prepare for the more energetically demanding period of lactation (Norgan 1997, Piperata et al 2002).

Although the average amount of weight retained as a result of pregnancy is modest and many women return to their pre-pregnancy body weights, the amount of weight retained is highly variable and some women retain significant amounts of weight (Ohlin and Rossner 1990, Schauburger et al 1992). Gunderson and Abrams (1999) stated that gestational weight gain is the primary and most important determinant of weight change from preconception to post partum, but post partum behaviours may also influence postpartum weight change.

For adult women, it is generally suggested that a total weight gain of 11kg - 14kg is appropriate (Buschman et al 2001). For adolescents under 16 years, a weight gain of

0.23kg - 0.4kg per week depending on height for weight or body mass index (BMI) may be adequate (Stevens-Simon and Mc Anarnay 1992).

Among women of normal weight, excess weight gain during pregnancy increases the risk of being overweight in post partum period approximately three fold (Gunderson et al 2000). Among teenage primi gravidas who have low income or are from minority racial and ethnic groups, the risk of new obesity in post partum period is increased more than six fold by excess gestational weight gain (Scholl et al 1996). The aim of the present study is to investigate the degree of changes in weight, BMI and blood pressure of pregnant women in Zaria.

### **MATERIALS AND METHODS**

#### **Demographics**

The study was a longitudinal survey which was conducted on 337 pregnant women who gave their informed consent to participate in the study. The data for 337 pregnant women were collected from women who are attending ante-natal clinic at the Ahmadu Bello University Health Services, Zaria, Samaru Clinic and Maternity, Zaria, Salama Infirmary and Maternity, Kwangila Zaria and St. Luke's Hospital Wusasa, Zaria.

#### **Anthropometric Measurements**

Measurements of the weight and BP were

done once in a month for second trimester and twice in a month for third trimester. Anthropometric variables and BP were taken from pregnant mothers attending ante-natal clinic at the four study locations. Weight was measured using a digital scale (SECA, Australia) with minimal clothing and it was recorded in kilogram (kg). The subjects were asked to stand erect and the height was measured using a meter rule and recorded in meters (m). The body mass index was calculated using the formula weight (kg)/ height (m<sup>2</sup>) (Nichols and Cadagon, 2008).

### Measurement of Blood Pressure

The armlet was wrapped around the right upper arm, placing centre of the rubber bag over the brachial artery and keeping it as high on the upper arm as it will go. The armlet was wrapped not tightly, but so strongly so that it will not slip down the arm and it was wrapped neatly so as to support the distended pneumatic pad uniformly. The pulsation of the brachial artery below was felt, the maximum pulsation was noted. The stethoscope was placed in the ears and the bell (diaphragm) was held in the left hand on the mark over the brachial artery. Then the pressure was rapidly increased highly then it was allowed to slowly fall until the first tapping sound is heard. The sound is synchronous with the pulse beat, it was recorded as the systolic blood pressure. The air was continuously allowed to escape slowly until the sound disappears, the point at which the sound just disappears was then recorded as the diastolic blood pressure in sitting position, this method was adopted as described by Ibu and Adeniyi (1989).

### Ethical consideration

Permission to conduct this study was given by the Scientific and Ethical Committee on Human Research of the Faculty of Medicine, Ahmadu Bello University, Zaria and participants gave their informed consent before participation in the study.

### Statistical Analyses

Data were expressed as mean  $\pm$  standard deviation. Student's t-test was used to test the

difference between second and third trimester pregnancy weight, BMI and BP. One way analyses of variance was applied to check for significant differences in all the parameters in the 2 stages (second trimester and third trimester). The data were analysed with statistical significance acceptable at  $P < 0.05$ , using SigmaStat 3.5 (Systat Inc, Point, Richmond, CA).

### RESULTS

A total of 337 women aged  $27.58 \pm 5.79$  years (15-50) were used for this study. Analysis was limited to the women who supplied the relevant information in the study questionnaires. The mean value of weight in weeks is shown in Fig. 1. There is a gradual increase in the mean value of the weight from week 14 ( $54.33 \pm 13.5$ ) which was maintained at week 24 to 26 ( $67.27 \pm 12.29$ ) and then increases towards term ( $82.56 \pm 3.30$ ). The blood pressure decreased slightly by week 24 ( $65.88 \pm 8.77$ ) and increased slightly towards term ( $70.65 \pm 13.15$ ) (Fig. 2).

The means of weight gain, BMI, and BP according to trimesters are shown in Table 1. There is a significant increase in weight and BMI ( $P < 0.001$ ) as pregnancy advances towards term. Systolic and diastolic blood pressure had no significant increase ( $P = 0.15$ ). The same lack of significant difference was also observed for pulse pressure and mean arterial BP between second and third trimester ( $P = 0.40$ ).

There was strong and positive relationship of weight with the other maternal parameters studied. Weight showed strong relationship with parity ( $P < 0.001$ ) and birth weight ( $P < 0.010$ ) both in the second and third trimester. Correlation analysis (Table 2) also indicated significant relationship between BMI, BP, parity and birth weight ( $P < 0.05$  and  $P < 0.001$ ) in both second and third trimester. Systolic BP had strong correlation with parity ( $P < 0.05$ ) but not with birth weight ( $P = 0.29$ ). Diastolic BP also had correlation with only parity ( $P < 0.01$ ) as shown in Table 2.

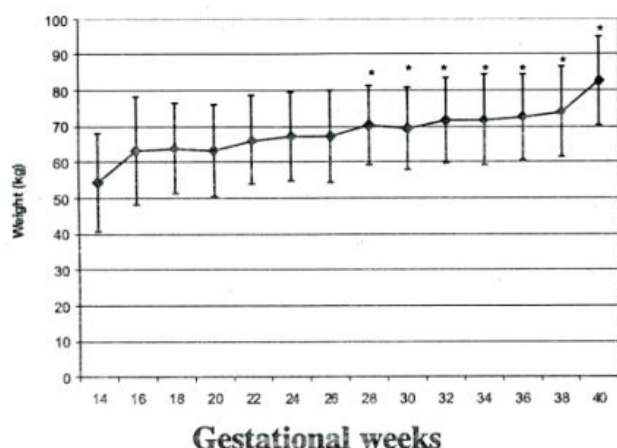


Fig. 1: Mean  $\pm$  SEM of weight gain in weeks. Significant increase in maternal weight is observed from week 28 (\*  $P < 0.01$ ) and above.

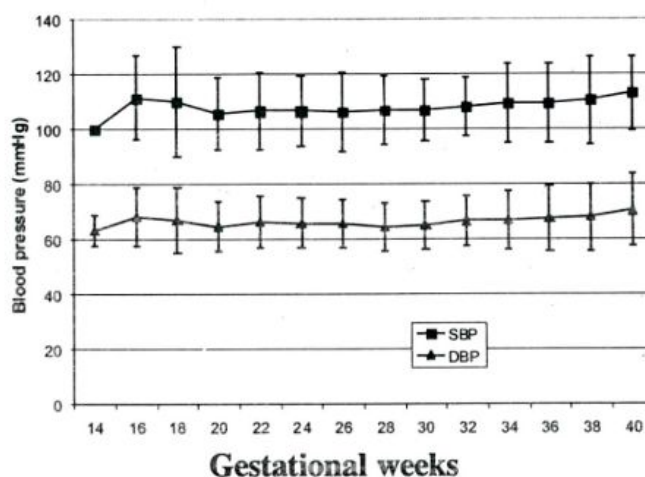


Fig. 2: Mean  $\pm$  SEM of systolic and diastolic BP in pregnant women from 14 to 40 weeks of gestation.

Table 1: Means of weight, BMI and blood pressure in the pregnant women

	Second Trimester	Min. – Max.	Third Trimester	Min. – Max.	t	p
	Mean $\pm$ SD		Mean $\pm$ SD			
Weight (kg)	65.77 $\pm$ 12.89 (n=191)	39.26 – 108.5	71.14 $\pm$ 12.35 (n=241)	44.50 – 117.67	-4.40	<0.001
BMI (kg/m <sup>2</sup> )	25.77 $\pm$ 5.50 (n=185)	16.63 – 47.36	28.52 $\pm$ 6.19 (n=235)	18.29 – 59.95	-4.75	<0.001
SBP (mmHg)	107.09 $\pm$ 12.19 (n=183)	155.00 – 80.00	108.72 $\pm$ 10.52 (n=228)	150.00 – 86.67	1.45	0.147
DBP (mmHg)	66.35 $\pm$ 8.57 (n=183)	95.00 – 50.00	66.63 $\pm$ 8.40 (n=228)	120.00 – 50.00	0.33	0.74
PP (mmHg)	41.23 $\pm$ 9.96 (n=174)	20.00 – 90.00	42.18 $\pm$ 6.97 (n=225)	20.00 – 76.00	-1.12	0.26
MAP (mmHg)	79.54 $\pm$ 10.21 (n=174)	29.70 – 111.45	80.31 $\pm$ 8.02 (n=225)	63.20 – 109.80	-0.84	0.40

Min. = Minimum, Max. = Maximum SD = Standard deviation

Table 4: Correlations matrix of anthropometric and blood pressures of pregnant Women in second (n= 180) and third trimester (n= 245) .

	Weight	Height	BMI	SBP	DBP	Parity	BW
Weight	-	0.33 <sup>c</sup>	0.90 <sup>c</sup>	0.43 <sup>c</sup>	0.40 <sup>c</sup>	0.27 <sup>c</sup>	0.35 <sup>b</sup>
Height	0.18 <sup>b</sup>	-	-0.09	0.08	-0.03	0.05	0.14
BMI	-0.77 <sup>c</sup>	0.46 <sup>c</sup>	-	0.41 <sup>c</sup>	0.45 <sup>c</sup>	0.28 <sup>c</sup>	0.25 <sup>a</sup>
SBP	0.37 <sup>c</sup>	0.00	0.32 <sup>c</sup>	-	0.71 <sup>c</sup>	0.15 <sup>a</sup>	0.13
DBP	0.41 <sup>c</sup>	-0.02	0.36 <sup>c</sup>	0.70 <sup>c</sup>	-	0.21 <sup>b</sup>	0.10
Parity	0.20 <sup>c</sup>	0.05 <sup>a</sup>	0.14 <sup>a</sup>	0.15	0.09	-	0.11
Birth weight	0.29 <sup>c</sup>	0.14	0.11	-0.01	-0.13	0.12	-

*a P < 0.05 b P < 0.01 c P < 0.001 Light fonts = Second trimester Bold fonts = Third trimester*

## DISCUSSION

The results of this study confirms that there is a significant increase in weight and BMI ( $P < 0.001$ ) as pregnancy advances toward term, which is in line with the report of Richard (2007) who reported that most women gain more weight than the Institute of Medicine recommendations (12-14 kg per body weight) while a few gain less than recommendations. Other study (Neave et al 2003) have established relationship between height, weight and BMI. The present study investigated the same phenomena in the pregnant women. Ochsenein-Kolble et al (2004) reported that there is an association of BMI with blood pressure. The findings from this present study confirm these reports that there is a very strong relationship between BMI and blood pressure ( $P < 0.001$ ).

The present study also show that there is an association between BMI and birth weight ( $P < 0.05$ ), this also agrees with previous report (Richard 2007). It is well known that inadequate maternal weight gain during pregnancy is associated with low infant birth weight and that infant weight tends to follow socioeconomic gradients with poorer women giving birth to smaller size infants. In addition, maternal stature influences birth weight with taller women giving

birth to heavier infants (Piperata et al 2002). This relationship may be a function of the positive association between maternal height and weight gain during pregnancy (Kirchengast and Hartmann 2003, Richard, 2007). In addition this study also establishes a correlation between BMI, birth weight and parity. However blood pressure did not show any significant increase as pregnancy progresses towards term. Conclusion

Positive and significant relationships exist between height, weight, BMI and blood pressure, but the association between blood pressure and parity was weak. There seems to be no association or relationship between parity and birth weight in both second and third trimester.

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