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Full Length Research Paper

The Effect of Gravidity on Anthropometric Indices of Pregnant Women in Enugu, South East, Nigeria.

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ABSTRACT:
Anthropometry in pregnancy is a comparative measure of size, proportion and composition of the body in relation to pregnancy. Anthropometric indices are useful in the assessment of nutritional status of pregnant women and predicting pregnancy outcome. To determine the effect of gravidity on anthropometric indices of pregnant women in Enugu, South East Nigeria. This was a prospective cross sectional survey of 578 pregnant women drawn from the general population of Enugu metropolis of Nigeria. These women were randomly selected from antenatal care attendees from four peripheral hospitals in Enugu. A self-administered structured pretested questionnaire was designed. The data were analyzed by descriptive and inferential statistics using SPSS version 12, and P value less than 0.05 was considered statistically significant. The mean values of the weight, body mass index (BMI), mid upper arm. Circumference (MUAC), calf circumference (CC), waist circumference and hip circumference of pregnant women in Enugu increased significantly from primigravida to those in their forth pregnancy ($P<0.05$). There were no significant differences in the age and gravidity of the women in these groups ($P>0.05$). Multigravid women have higher anthropometric indices in Enugu, Nigeria. There is need for education/enlightenment about reduction in weight gain during pregnancy after delivery.

Keywords: Gravidity, Anthropometric indices, pregnancy, Enugu-Nigeria.

INTRODUCTION

Anthropometry is defined as the comparative measurement and study of the human body (Brenner et al., 1986). It provides the single most portable, universally acceptable, inexpensive and non- invasive way of assessing the size, proportion, and composition of the human body. Anthropometric measurements have been used for many years to assess the nutritional status of individuals and population (Rodrigues et al., 1980). These measurements include: Weight, Height, Waist circumference, Hip circumference, abdominal circumference, Skin thickness, Mid Upper Arm circumference and Calf circumference. Traditionally, the Body mass index which is calculated by dividing the weight in kilogram by the square of the height in meters is used to classify pregnant women as underweight, normal, over weight and obese.

Anthropometric indices have been useful in the assessment of nutritional status of pregnant women, and

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predicting outcome of pregnancy (WHO 1995a). Various studies have shown that Mid Upper Arm Circumference (MUAC) can be used as an indicator of the progress of pregnancy and its outcome (WHO 1995a, Ricalde et al., 1998, Heiger et-al 2005., Khadivzadeh 2002). MUAC has been found to have excellent correlations with weight (Khadivzadeh 2002).

There is paucity of information on studies done on calf circumference, however, the study by Khadivzadeh *et-al.*, showed that calf circumference correlated with weight (Khadivzadeh 2002). Waist circumference has been studied extensively in both pregnant and non pregnant population and has been shown to correlate well with body fat (Lean 1996, Seidell et-al., 2001., Satter et-al., 2001). Abdominal adiposity, measured by waist circumference, is frequently used in non-pregnant women as a risk factor for diabetes and cardiovascular disease (Wendland et-al., 2007). In pregnancy, however, it is seldom used to predict risk, probably because it is believed to be unduly influenced by the increasing uterine volume. Among the various standardized sites for measuring waist circumference, the minimal waist, being most distant from the growing uterus, is likely to be less influenced (Wendland et-al., 2007).

Gravidity of pregnancies by a woman is believed to affect the woman's size. Generally, the more children a woman has the bigger she tends to become. Studies have shown that only 10-15% of women returned to their pre-pregnancy weight at 6 weeks post-partum (Schauberger et-al., 1992, Gunderson and Abrams 2000, Walker et al., 2005) .The epidemic of obesity has highlighted the contribution that weight gain from pregnancy may increase obesity development (Rossner 1997). Fat deposition is a substantial component of pregnancy related weight gain in the well-nourished women (Greene et-al., 1988). Weight gain and obesity development in child bearing women are of concern because of numerous adverse health outcomes such as hypertension, type 2 diabetes mellitus, osteoarthritis, coronary heart disease, and certain cancers (Abrams and Parker 1988, Naeye 1990, Garbaciak et-al., 1985).

A Swedish population-based observational study of 151,025 women examined the association of change in BMI between successive pregnancies with adverse outcomes during the second pregnancy (Walker et-al., 2004). The risk of pre-eclampsia, gestational diabetes mellitus (GDM), large-for-gestational-age babies, caesarean section and stillbirth was linearly related to inter-pregnancy weight gain (CMACE/RCOG 2010). This study was aimed at determining the effect of gravidity on anthropometric indices of pregnant women in Enugu.

MATERIALS AND METHODS

This was a cross sectional study of pregnant women drawn from the general population of Enugu metropolis of Nigeria who were attending antenatal care at Mother of Christ Specialist Hospital, St Patrick's Hospital and maternity, Colliery Hospital and Balm of Gilead Specialist Hospitals all located at different parts of Enugu.

These pregnant women were randomly selected (simple lucky dip of YES or NO). The women who were sure of the dates of their last menstrual period and were willing to participate in the study after information about the study were recruited. A self-administered structured pre-tested questionnaire was designed to cover background details, menstrual history, parity, past medical history, past obstetric history and the general health of the women. Those with hypertension in pregnancy, gestational diabetes, cardiac diseases, renal diseases, HIV infection and multiple pregnancies were excluded from the study after physical examination and routine investigations. Five hundred and seventy eight women at different ages and trimester that met the inclusion criteria were used for the study. Inclusion criteria are (1) Pregnant women who were sure of the dates of their last menstrual period. (2) Pregnant women who were willing to participate in the study after counselling. (3) Pregnant women without any pre-pregnancy chronic medical disease (e.g., hypertension, diabetes, cardiac diseases, renal diseases, sickle cell disease, and HIV infection) and (4) multiple pregnancies.

The weight and height were measured while the individual was minimally dressed without foot wears using T160 Health Scale by Techmel &Techmel USA which was checked with standard scales daily. Body mass Index was calculated using the formula; weight in kilograms divided by height in meters square. Mid arm circumference was measured to the nearest millimetres using, non-stretchable tapes at the midpoint between the acromion process and the olecranon process with the upper limb hanging loosely by the side. Calf circumference was taken while they are standing at the point of widest diameter of the calf. These Measurements were taken on the left .Waist circumference was measured by identifying the upper border of the hip bone and placing the non-stretchable tape round the subject at that level, with the tape on the navel. Hip circumference was measured at the widest portion of the gluteal region. Waist to Hip ratio was calculated by dividing the waist circumference by the Hip circumference. All measurements were taken between 9.00-12.00 hours.

The data were entered and analyzed by descriptive and inferential statistics using statistical software SPSS version 12. The results were presented as mean and standard deviation. The chi-square(x^2) test was performed to determine the association between the presence of gravidity and anthropometric indices. P value less than 0.05 was considered statistically significant.

RESULTS

There were 578 respondents. The women were between the ages of 15-40 years while the mean ages of the women in years were 28.86±5.26, 28.11±4.29 and 28.39±4.20 respectively in the first, second and third trimesters. Majority of the subjects were within the age range of 20-35 years. There were no significant differences in age in the three groups (f= 1.44, p=0.32) as shown in table1.

Fifty one percent of the women in first trimester were primigravida, twenty seven percent were gravida 2, twelve percent were gravida 3, six percent were gravida 4 while four percent were grand multiparous women. Among women in the second trimester, fifty one percent were primigravida, twenty one percent were gravida 2, fourteen percent were gravida 3, six percent were gravida 4 while the grand multiparous made up the remaining eight percent. Forty percent of the women in their third trimester were primigravida, twenty eight percent were gravida 2, fourteen percent were gravida 3, ten percent were gravida 4 while the grand multiparous women were eight percent. There was no significant difference in the gravidity of the women in these groups (X^2=3.39, f=0.18). These findings are shown in table 2.

The mean values of the weight, body mass index, MUAC, CC, waist circumference and hip circumference increased significantly from primigravida to higher gravidity as shown in table 3. (P=0.00). However, a drop in mean values was observed from gravid 4 women to grand multiparous women.

DISCUSSION

The mean age in this study was approximately 28±3.45 years. Majority of the women that participated in the study were in the age group 25-29 years. Worldwide, there is an upward trend in maternal age at first pregnancy increasing from approximately 21 years in the 1970's to 27 years in this decade (Chapman et-al., 2006, Hendrick 2009, Laws and Sullivan 2005). These changes may be as a result of women education, careers and financial security than child bearing (WHO 1995b).
Most of the women in the study were primigravida, while the multigravid women are progressively fewer. This agreed with earlier studies that use of health facilities by women decreased with higher gravidity (Gunderson et-al., 2004, Presley et-al., 2000).

Table 1:
Ages of women in different study groups

Age	**1st trimester**	**2nd trimester**	**3rd trimester**	**Total**
15-19	0(0%)	2(1%)	2(1%)	4
20-24	33(23%)	35(17%)	37(16%)	109
25-29	59(41%)	98(47%)	101(44%)	265
30-34	25(18%)	56(28%)	74(32%)	160
≥ 35	26(18%)	15(7%)	17(7%)	61
Total	143(100%)	206(100%)	229(100%)	578

Table 2:
Gravidity of the women in the different study groups.

Gravidity	1st trimester	2nd trimester	3rd trimester	Total
Primigravida	73(51%)	105(51%)	94(40%)	272
Gravida 2	39(27%)	43(21%)	62(28%)	144
Gravida 3	18(12%)	30(14%)	32(14%)	80
Gravida 4	8(6%)	12(6%)	23(10%)	43
Grand multiparous	5(4%)	16(8%)	18(8%)	39
Total	143	206	229	578

Table 3:
Mean anthropometric indices for women of various gravidity at different trimesters

Gravidity	Trimester	Mean weight	Mean height	Mean BMI	Mean MUAC	Mean CC	Mean WC	Mean HC	Mean WHR
G1	IST trimester	69.26±10.81	1.61±0.03	26.54±3.75	29.43±3.04	36.37±2.88	88.63±7.25	103.20±6.07	0.86±0.04
	2nd trimester	71.29±8.32	1.62±0.04	27.19±2.81	28.95±2.70	36.05±2.36	93.09±7.01	102.89±5.56	0.91±0.05
	3rd trimester	77.84±11.54	1.63±0.05	29.24±3.72	29.07±3.09	36.85±2.97	101.93±8.87	106.30±7.90	0.96±0.05
G2	1st trimester	76.73±11.45	1.62±0.04	29.28±4.55	31.45±3.05	37.50±2.55	95.5± 8.00	107.85±7.57	0.89±0.03
	2nd trimester	80.09±10.67	1.64±0.06	29.78±3.17	31.49±2.85	37.67±2.78	101.63±7.54	109.51±7.50	0.93±0.05
	3rd trimester	81.10±9.55	1.62±0.05	30.94±3.51	30.17±2.91	36.56±2.98	107.90±7.49	108.98±6.58	0.99±0.04
G3	1st trimester	73.61±11.77	1.64±0.04	27.40±4.13	31.33±3.48	36.89±3.01	93.11±8.77	106.56±9.51	0.87±0.04
	2nd trimester	80.97±12.29	1.63±0.04	30.40±4.20	31.63±3.37	37.60±2.84	102.37±8.61	109.80±8.13	0.93±0.04
	3rd trimester	82.72±12.96	1.61±0.05	31.67±4.19	30.81±3.35	37.28±3.00	110.31±8.60	109.81±7.91	1.01±0.04
G4	1st trimester	74.25±8.50	1.62±0.05	28.34±2.36	31.50±2.25	37.75±3.25	92.50±5.00	108.00±6.00	0.86±0.02
	2nd trimester	82.67±11.30	1.62±0.05	31.60±3.97	33.08±2.60	38.17±2.33	106.58±5.58	108.75±5.25	0.99±0.05
	3rd trimester	92.46±10.18	1.66±0.05	33.63±3.32	33.22±2.49	39.39±2.06	112.52±7.93	114.78±5.64	0.98±0.04
GRAND MULTIP	1st trimester	75.13±13.63	1.58±0.02	30.04±5.83	31.75±3.25	36.00±3.50	101.75±14.2	105.25±9.25	0.96±0.05
	2nd trimester	80.50±15.13	1.62±0.05	30.43±4.98	30.56±4.12	37.19±3.46	100.44±11.1	107.43±10.12	0.93±0.04
	3rd trimester	79.60±10.95	1.59±0.05	31.19±3.86	30.07±2.26	36.27±3.03	108.40±8.28	109.07±7.28	0.99±0.05

From the study, the mean weight increased with gravidity for the women in the three study groups while the mean height remain unchanged. The mean body mass index therefore increased with gravidity. These findings are in conformity with earlier study done in Sweden (CMACE/RCOG 2010). There is increase in body mass index with successive pregnancies (CMACE/RCOG 2010). The mid upper arm circumference and calf circumference also increased with gravidity. These parameters seem to have excellent positive correlation with body mass index (Khadivzadeh 2002). From our study, the leaner women were found mainly among the primigravida. This is consistent with the works of Presly et-al., 2000, on anthropometric estimation of maternal body composition in late gestation.

The waist circumference also increased with gravidity. This agrees with a previous study that showed increase in waist circumference with gravidity (Wendland et-al., 2007, Abbate et-al., 2006). Waist to hip ratio (a measure of central obesity) also increased with gravidity. Grand multigravid women are at risk of preeclampsia and gestational diabetes. These women have been associated with higher waist to hip ratios in previous studies (El-Gilany and Hammad 2010).

There is no doubt that multigravid women have higher anthropometric indices. However, in this study, the relationship between gravidity and anthropometric indices was such that one would readily conclude that multigravid women of Nigeria have higher anthropometric indices. Furthermore, Nigerian women do not shed all the pregnancy weight gain after delivery before embarking on subsequent pregnancy.

The limitations of this study could be attributed to observer error in taking accurate measurements of the subjects. Another limitation was that self-reported measures were used, where objective, more precise measures would have been preferred. The accuracy of the anthropometric indices during pregnancy is not completely determined. However, this is a stepping stone towards further research on gravidity and anthropometric indices in pregnant Nigerians.

The foremost strength of our study is its prospective design. In addition, repeatedly assessed measures were computed into mean anthropometric indices which decreased standard errors of the correlates that were studied. Furthermore, the anthropometric indices for the three trimesters were presented (not average indices). This strategy allowed us to look at the importance of 1st, 2nd, or 3rd, trimester's of the gravidity with change in anthropometric indices.

Conclusion

The multigravid women have higher anthropometric indices in Enugu., There is need for education/enlightenment about reduction in weight gain during pregnancy after delivery.

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