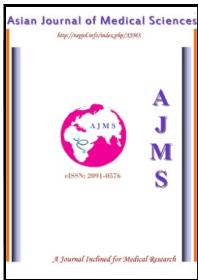


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Symphysio-Fundal Height Nomogram In Ultrasound Dated Pregnancies

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Abstract

Objective: Fundal height measurements in centimeters have always been an objective method of evaluating fetal growth in pregnancy. The accepted McDonald's rule refers primarily to Caucasians regrettably. Since fundal height may actually vary in an anthropological sense it was considered necessary to apply McDonald's rule to African subjects to see whether there is any significant difference. The aim of this study is to construct symphysio-fundal height nomogram for normal pregnant Nigerian women.

Material & Methods: In a cross sectional mode, four hundred and five pregnant Nigerian women were studied to examine how their fundal height values compared with those in the literature. A regression equation was derived for the 10th and 90th centiles. Values outside the range of 10 - 90th centiles are to be used for the prediction of small-for-dates and large-for-dates babies respectively. The prediction formulae for the various centiles derived from regression analysis and their usefulness in clinical anthropological practice using fundal height measurement are highlighted.

Results: The study demonstrated a significant difference in fundal height values of Nigerian women especially in late pregnancy compared with other published values in the literature. A positive linear correlation between symphysio-fundal height and fetal gestational age was found in Nigerians with a correlation coefficient of $R^2 = 0.9962$ ($p < 0.001$). The relationship is best described by the second order polynomial regression equation $y = -0.0024x^2 + 1.1255x - 1.8334$ where y is the symphysio-fundal height in centimeters while x is the gestational age in weeks.

Conclusion: Symphysio-fundal height chart is a valuable tool for assessing fetal growth in the antenatal clinic in as much as it is cautiously constructed for a given population and the same method of measurement is strictly adhered to by different observers in the same organization.

Key Words: Fundal Height; Predictive formulae; Nigerian women

1. Introduction

Fundal height measurement in centimeters (distance between pubic symphysis and fundus of the uterus) has been reported to be an objective method of evaluating fetal growth in pregnancy¹ and is generally regarded as an acceptable screening instrument for antenatal detection of intrauterine growth retardation.² This method (SFH measurement) has of late regained its fame in the assessment of fetal growth, especially in

centres where other more precise measurements such as those from ultrasound cephalometry are not available routinely.¹ Literature search showed that all the fundal height nomograms that have been published are derived from pregnancies dated from last menstrual period. A number of investigators have alleged to the high degree of sensitivity and specificity of SFH measurement in the detection of the growth-retarded fetus.³⁻¹¹ Others researchers have however, articulated fear over the use of this measurement.¹²⁻¹⁵ Before growth deviation can be assessed it is important that an accurate nomogram of this parameter against gestational age should be

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constructed for a given population. Calvert et al have opined that it may not be necessary to have individual nomogram for each institution for the Caucasian population in general, as they have found that the measurements at each gestation were comparable in these populations.⁴ The use of such a nomogram in the Nigerian population however may not be appropriate. Since fundal height may actually vary in anthropological sense it was considered necessary to construct a SFH nomogram in this environment basing on measurements in Nigerian pregnant mothers in north central part of the country, and comparisons made with other nomograms published in the literature.

2. Material and Methods

From January 2004 to July 2004, four hundred and five Nigerian women attending antenatal clinic at our lady of Apostle (OLA) Hospital Jos were selected for the study in a cross-sectional manner based on ultrasound dated pregnancies. Systematic sampling technique was employed in selecting the subjects for the study. All measurements were made by only one of the authors. At each antenatal visit, only one measurement from each woman was used from 14 through 40 weeks of gestation. The fundus was defined by placing the ulnar border of left hand against the upper border of the uterus. One end of a non elastic tape was placed on the upper border of the pubic symphysis and gently stretched over the midline of the abdomen and the fundal height was measured to the nearest centimeter. No allowance was made for presentation, station, obesity or liquor volume. The mean, standard deviation, standard error of mean, 10th percentile, 50th percentile and 90th percentile for each gestational age (GA) were estimated. Correlation and regression analysis were applied on the mean values, 10th centile and 90th centile of the fundal height measurements to determine its relationship to gestational age. The nomogram obtained was compared with those compiled by Belizan et al from Argentina, Quaranta et al from UK, Tian et al from Shanghai and Hextan et al from Hong Kong.^{3,7,9,17}

3. Results

The mean age of the study sample was about 27 years. The maternal age group of 25 - 29 years was about 34.57 percent and was higher than the other groups. The lowest age was 14 years and the highest was 52 years. The number of deliveries in the pregnant women was classified Para 0 to Para 13 with multipara constituting 37.4 percent followed by those women who are pregnant

but have never given birth before making 31.5 percent of the women that were scanned. A closer look revealed that Para 0 women were the highest in number in the study sample (32%). As the parity increases, the number of women that were scanned dropped.

Table-1: Mean, Standard deviation, standard error of mean and percentile for gestational age of Nigerian women symphysio-fundal height.

GA (wks)	Sample size (n)	Mean SFH (cm)	SD	std error	Percentile		
					10th	50th	90th
14	2	14.5	0.07	0.50	14.0	14.5	15.0
15	10	14.4	0.83	0.30	13.0	14.5	15.3
16	4	15.1	0.38	0.20	14.7	15.1	15.6
17	11	16.8	0.67	0.20	16.0	16.7	18.0
18	5	16.5	1.49	0.01	14.2	16.3	17.8
19	4	18.7	0.96	0.48	17.3	19.0	19.5
20	5	18.9	0.27	0.12	18.5	19.1	19.1
21	8	20.9	0.74	0.20	19.8	20.9	22.0
22	8	22.5	1.54	0.50	20.5	23.0	24.3
23	14	23.3	1.10	0.30	21.3	24.0	24.4
24	6	23.9	1.50	0.60	22.0	24.4	25.1
25	13	24.4	0.40	0.10	23.8	24.4	24.9
26	11	25.6	0.95	0.30	24.3	25.6	27.1
27	13	26.8	1.40	0.40	23.8	27.0	28.1
28	10	28.2	0.63	0.20	27.3	28.3	28.9
29	17	29.1	1.00	0.30	28.2	28.8	31.5
30	22	29.8	1.40	0.30	28.7	29.5	32.0
31	17	30.8	0.90	0.20	29.9	30.4	32.4
32	23	31.9	1.70	0.30	30.6	32.0	32.3
33	35	32.8	1.50	0.30	31.0	32.9	33.9
34	27	33.4	1.70	0.32	32.0	33.2	36.0
35	30	33.9	1.60	0.30	31.7	34.2	35.9
36	28	35.7	1.90	0.40	33.3	35.8	37.4
37	30	36.7	2.20	0.40	34.5	36.1	39.5
38	35	38.3	1.60	0.30	36.3	38.1	40.7
39	14	38.1	2.80	0.80	31.8	39.0	40.2
40	3	39.1	2.10	1.20	37.0	39.3	41.1
Total	405						

A total of 405 symphysio-fundal height measurements were made. The mean, standard deviation, standard error of mean, 10th percentile, 50th percentile and 90th percentile for each gestational age (GA) are as shown in table 1.

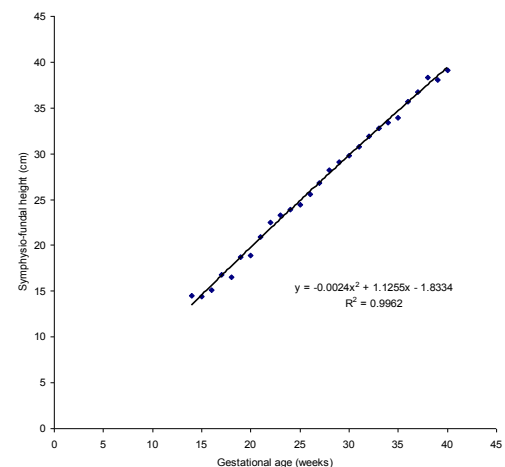


Figure-1: Correlation and regression equation of mean symphysio-fundal height values in 405 Nigerian women plotted against gestational age in weeks

The highest mean value was 39.1 centimeters at 40 weeks gestation while the lowest mean value was at 14 weeks. Mathematical modeling of data demonstrated that the best-fitted regression model to describe the relationship between symphysis-fundal height and gestational age was the second order polynomial regression equation $y = -0.0024x^2 + 1.1255x - 1.8334$ with a correlation coefficient of $R^2 = 0.9962$ ($P < 0.0001$) where y is the symphysis-fundal height in millimeters and x is the gestational age in weeks (fig 1).

Table 2. Comparison of mean values of symphysis-fundal height between the present study and other published data

GA (wks)	Mean SFH Value				
	Tian et al	Hextan et al	Present study	Belizan et al	Quaranta et al
20	15.9	17.9	18.9	18.5	20.2
24	18.9	22	23.9	22.5	24.1
28	23.2	25.9	28.2	26.5	28.1
32	26.7	29.5	31.9	30.5	31.8
36	30	32.8	35.7	33.5	34.7
40	32	36.1	39.1	34.5	36.3

When the 10th centile values of symphysis-fundal height were plotted against gestational age in weeks, a positive polynomial correlation with a correlation coefficient of $R^2 = 0.98$ ($P < 0.0001$) in Nigerian women was found. The relationship is best described by the third order polynomial regression equation $y = -0.0012x^3 + 0.0865x^2 - 1.0841x + 14.518$ where y is the SFH 10th centile and x is the gestational age in weeks. Again, When the 90th centile values of symphysis-fundal height were plotted against gestational age in weeks, a positive polynomial correlation with a correlation coefficient of $R^2 = 0.9918$ ($P < 0.0001$) in Nigerian women was found. The relationship is best described by the second order polynomial regression equation $y = 0.0013x^2 + 1.1281x - 1.3704$ where y is the SFH 90th centile and x is the gestational age in week.

4. Discussion

This is the first report of fundal height nomogram constructed from pregnancies dated by ultrasound scan in this environment. The prediction formulae for the 10th and 90th centiles derived from regression analysis were obtained can be used for the prediction of small-for-dates and large-for-dates babies especially when the values are outside the range of 10 - 90th centiles. Fundal height is an important clinical index for intrauterine growth assessment.^{12,13} Routine assessment of fundal growth with reference to anatomical landmarks such as xiphisternum, umbilicus etc., only allows a semiquantitative assessment not accurate enough for clinical application. However, standardization of fundal height nomogram is subject to

errors. It may be difficult to locate the top of uterine fundus accurately. As shown by Calvert et al,⁴ there may be significant concurrent intra and inter observer errors with coefficients of variations up to 4.6% and 6.4% respectively. In our study, inter observer error was eliminated by assigning only one investigator measuring the fundal height. Parametric statistical method using a second degree polynomial mathematical model can provide a more accurate estimation of the mean SFH throughout the period of pregnancy. More importantly is the efficiency of estimation of percentiles for the nomogram by examining the residual sum squares. From the nomogram compiled, intrauterine growth retardation can be picked up by serial measurement of SFH for an individual pregnant woman. Comparisons with other nomograms (table 2) showed that there are differences between the mean SFH values obtained by other investigators and those of this study. Not only is there difference in absolute values, the trends also appear to be different, especially after about 32 weeks. This might be as a result of the well known phenomenon in Africans where the fetal head remains unengaged until term. Apart from this, differences with different nomograms can be the result of population differences, such as different size of babies and varying maternal weight and obesity. Methodological difference in measurement may be a more significant factor, although the methods of measurement described in the studies are similar.^{3,4,7,8,11} The marked difference between the 2 nomograms from the 2 hospitals in Shanghai illustrates that even minor discrepancies in the practice of measuring symphysis-fundal height affect the measurements.^{9,11} It therefore would appear that a nomogram of SFH should be made, preferable by as few observers as possible, for a local population before the measurement is put to use in detecting growth deviation in the fetus. It would appear to be equally important that the same method that was used in measuring the SFH when the nomogram was prepared most be strictly adhered to in the same institution to minimize any inter observer error.

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