

Fetal Abdominal Circumference Growth in Bangladeshi Population

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Summary:

Objective: Fetal abdominal circumference is the single most important parameter for determining fetal growth. Determination of fetal growth abnormalities will be more accurate if we use tables prepared on our own population. A nomogram of fetal abdominal circumference in Bangladeshi population is therefore presented in this study. **Methods:** A prospective, cross-sectional study was conducted on well dated, singleton pregnancies. A table and a graph were prepared after fitting Polynomial regression models. **Results:** Fetal charts were constructed from 1223 subjects. 3rd, 10th, 50th, 90th and 97th percentiles, mean and standard deviations were derived. The models showed good fit to the data. There was a

gradual increase of the abdominal circumference measurements up to 37th week. Standard deviations showed increased variability as the pregnancy advanced. In the early second trimester Bangladeshi, Indian, and western measurements were similar but as pregnancy advanced there was variation between different races especially from the western. **Conclusion:** These findings suggest that this chart is unique for Bangladeshi population and can be useful for accurate assessment of fetal growth, especially in the 3rd trimester.

Key words: abdominal circumference, fetal growth, Bangladesh.

(J Bangladesh Coll Phys Surg 2008; 26: 124-127)

Introduction:

Any kind of abnormality in fetal growth whether growth restriction or growth acceleration is worrisome because it is associated with risk of prenatal and postnatal morbidity and mortality. Abdominal circumference (AC) is an important parameter for reliable assessment of fetal size and growth since it is very sensitive to fetal nutritional status.

Growth charts of fetal parameters that are used in our country to follow fetal growth have all been generated by studies on western population. But as their stature is different from ours, those charts are not appropriate for our population. Therefore different studies conducted here recommended that studies conducted on our own population should be used for reference in our country.¹⁻⁷ This study was designed to produce population based nomograms of fetal abdominal circumference for accurate fetal growth assessment in our country.

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Received: 5 March, 2008

Accepted: 6 August, 2008

Materials and Methods:

This was a prospective cross sectional study. It was conducted in BIRDEM from December 2004 to November 2006. Well informed consent of the patients was obtained before including in the study. Consecutive, healthy gravid women were studied who met the following criteria:

Regular periods, well- defined last normal menstrual period, that was consistent with a less than 20 week ultrasound scan within 10 days, singleton pregnancy, no oral contraceptive for 3 months prior to conception, no history of maternal medical, surgical or obstetric complication or malnutrition, no uterine anomaly or large fibroid and no congenital anomaly of the fetus.

The ultrasonographic scans were performed by a single sonologist on one ultrasound machine. This excluded inter-observer variations. All measurements were made by electronic calipers in mm. A 3.5 MHz curvilinear transducer was used. The patients had a complete ultrasonographic scan of fetal biparietal diameter, head circumference, abdominal circumference and femur length by standard methodology. Fetal abdominal circumference (AC) was measured at the level where the right and left portal veins were continuous with one another,

appearing like a J-shape. The appearance of the lower ribs was symmetric and the shortest length of the umbilical segment of the left portal vein was depicted. The fetal stomach represented a secondary landmark⁸. After this plane of section was frozen on the screen, the ellipse was fitted to the outer skin edge.

SPSS in the computer software was used for data entry and statistical analysis. Polynomial regression model was fitted to the data.

Results:

Fetal abdominal circumference was measured in 1223 healthy pregnant subjects. Majority of the patients

belonged to the middle income group and were aged between 17 to 40 years (Mean 26 ± 4.5 years). 55% were primipara. Range of parity was 0-5.

Table I, gives fitted centiles of estimated values of fetal abdominal circumference in mm. It also gives estimated mean and 2 standard deviation (2SD) of the data. At 13 weeks gestational age mean AC was 71.7mm (± 8.5 mm) (± 2 SD), at 36 weeks it was 304.6mm (± 31.5 mm) and at 40 weeks it was 331.9mm (± 35.5 mm).

Polynomial regression (cubic) model gave a good fit to the data. The coefficient of multiple correlation, $R^2 = 0.970$, ($p < .001$), which indicates a good correlation between the two variables.

Fitted Centiles of Fetal Abdominal circumference (estimated)

Table I

Fitted centiles of fetal abdominal circumference (mm). Estimated values (n=1223)								
Weeks of gestation (w)	No. of fetuses	3rd	10th	50th	90th	97th	Mean (mm)	2SD (mm)
13	15	63.7	66.3	71.7	77.1	79.7	71.7	8.5
14	27	71.3	74.0	80.0	86.0	88.7	80.0	9.3
15	32	80.3	83.4	90.0	96.6	99.7	90.0	10.3
16	34	90.9	94.3	101.5	108.7	112.1	101.5	11.3
17	27	102.3	106.0	114.0	122.0	125.8	114.0	12.5
18	42	110.7	114.7	123.2	131.7	135.7	123.2	13.3
19	34	121.3	125.5	134.7	143.9	148.1	134.7	14.3
20	38	130.2	134.8	144.5	154.2	158.8	144.5	15.2
21	43	141.5	146.4	156.8	167.2	172.1	156.8	16.3
22	45	151.3	156.5	167.6	178.7	183.9	167.6	17.3
23	39	162.1	167.6	179.4	191.2	196.7	179.4	18.4
24	36	171.2	176.9	189.3	201.7	207.4	189.3	19.3
25	42	181.1	187.2	200.2	213.2	219.3	200.2	20.3
26	46	191.1	197.5	211.2	224.9	231.3	211.2	21.4
27	44	199.8	206.5	220.8	235.1	241.8	220.8	22.3
28	49	209.0	216.0	231.0	246.0	253.0	231.0	23.4
29	50	218.8	226.1	241.7	257.3	264.6	241.7	24.4
30	51	228.1	235.8	252.1	268.4	276.1	252.1	25.5
31	52	236.0	243.9	260.8	277.7	285.6	260.8	26.4
32	50	244.6	252.9	270.4	287.9	296.2	270.4	27.4
33	55	252.1	260.6	278.8	297.0	305.5	278.8	28.4
34	56	260.8	269.6	288.5	307.4	316.2	288.5	29.5
35	59	268.1	277.3	296.8	316.3	325.5	296.8	30.5
36	57	275.0	284.4	304.6	324.8	334.2	304.6	31.5
37	54	281.2	291.0	311.7	332.4	342.2	311.7	32.4
38	56	287.1	297.1	318.4	339.7	349.7	318.4	33.3
39	55	292.7	302.9	324.9	346.9	357.1	324.9	34.3
40	35	298.5	309.2	331.9	354.6	365.3	331.9	35.5

There was a gradual increase of abdominal circumference at 3rd, 10th, 50th, 90th and 97th centiles up to 37th week of gestation. Thereafter a slower growth rate was observed.

Fig.-1, shows assessment of goodness of fit of models for fetal abdominal circumference. Plot of standard deviation scores against gestational age, shows expected 2SD and Fig.-2, shows the fetal growth profile for abdominal circumference measurements. Raw data of abdominal circumference with fitted 3rd, 10th, 50th, 90th and 97th percentile curves superimposed on it. It covers 95% of the population.

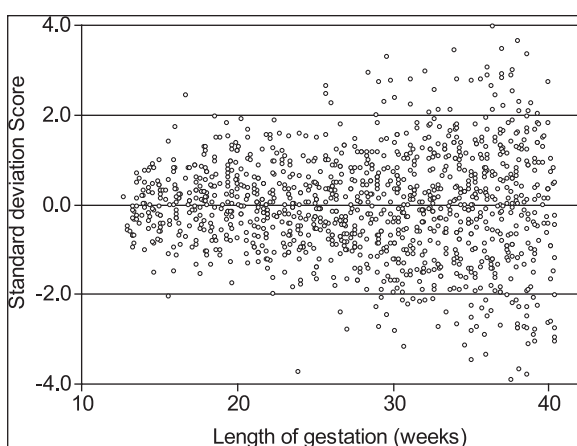


Fig.-1: Assessment of fit of model for AC plotted: Plot of standard deviation score against gestational age, showing expected 2SD.

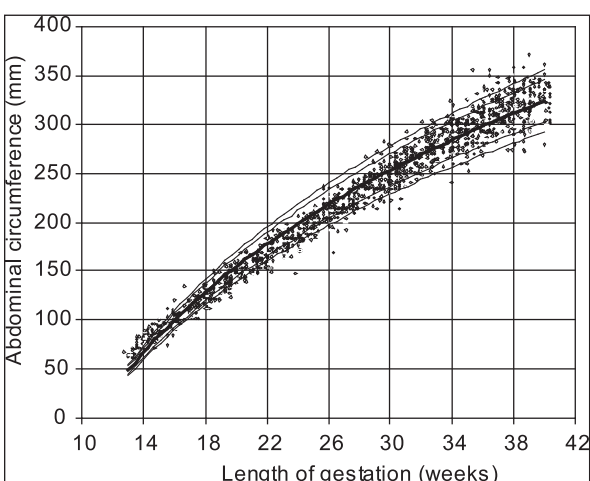


Fig.-2: Raw data for fetal abdominal circumference with fitted 3rd, 10th, 50th, 90th and 97th percentiles.

Discussion:

Accurate assessment of fetal size and growth is of utmost clinical importance, both in normal and abnormal pregnancies. The effects of maternal diseases on fetal development and the problems associated with prematurity and growth restriction are being more clearly understood now and so the precise measurement of fetal size in relation to menstrual age is gaining more importance.

In the present study at 13 weeks gestational age mean abdominal circumference was 72 mm (± 8.5 mm) (2SD), and at 40 weeks it was 332mm (± 35.5 mm). Polynomial regression (cubic) model showed a good fit to the data. There was gradual increase of 2SD towards term, from 8.5mm to 35.5mm, showing increasing dispersion of data towards term. The body parameter is approximately twice as variable as those of the head.

In the other Bangladeshi studies, at 28 weeks gestational age mean abdominal circumference was 240mm and at 40 weeks it was 370-375mm⁹, at 16 weeks gestational age abdominal circumference was found to be 110mm (± 11 mm) and at 40 weeks it was found to be 328mm (± 22 mm)⁶. In a study in Bangladesh, gestational age obtained by ultrasonography, from the measurement of abdominal circumference using Hadlock et al's table of 1982, was found to be constantly smaller after 24 weeks gestational age. At 40 weeks gestational age the abdominal circumference age was 37 weeks (± 3 w) by using the western table. At 40 weeks abdominal circumference was 359mm by Hadlock's table but 330mm by Bangladeshi table. Therefore a table was prepared to give the mean abdominal circumference measurements of our fetuses, so that in one glance the obstetricians can get an accurate idea of the fetal nourishment at a particular gestational age⁴.

In an Indian study at 13 weeks gestational age abdominal circumference was 74mm (± 16 mm) and at 40 weeks it was 334mm (± 25 mm) (Observed values)¹⁰.

In a Western study at 14 weeks abdominal circumference was 73mm (± 6 mm) (2SD) and at 40 weeks 353mm (± 29 mm)¹¹ and in another study at 13 weeks abdominal circumference was 69mm (± 3 mm) (2SD) and at 40 weeks it was 354mm (± 3 mm)¹². In Deter's series at 13 weeks age abdominal circumference was 74mm (± 1 mm) (2SD) and at 40 weeks it was 370mm (± 5 mm)¹³.

In the evaluation of abdominal circumference all studies showed that in the early second trimester the Bangladeshi, Indian, and western measurements were similar but as pregnancy advanced there was variation between the different races especially between the subcontinent and western measurements. The findings of this study were similar to other local studies except from Biswas' study where abdominal circumference was bigger than even the western studies. Methodological error could be a reason. The observed values of abdominal circumference measurements of the Indian study was little bigger than this study at term, by 2mm only, whereas western values of abdominal circumference were much bigger at term than this study, by 21 to 28mm.

The limitation of this study was that poor patients could not be included in the study as they usually do not go to doctors for antenatal checkup and even if they do they are unable to give their correct LMP. A multi-center based study can be conducted covering the whole of Bangladesh to prepare a National standard, till then this nomogram can be used as our standard. It can be installed in the ultrasound machines in the hospitals and clinics so that it can be promptly used to give the patient an accurate report based on our own nomogram.

Conclusion:

Prenatal ultrasound studies can enable accurate determination of the boundaries of normal fetal growth. The findings of this study suggest that this chart is unique for Bangladeshi population and can be useful for reliable assessment of fetal growth, especially in the 3rd trimester.

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