

*Original Article*

## Fetal Biparietal Diameter and Abdominal Circumference Ratio in Bangladesh

SQ Rashid

### Abstract

*This study was conducted to determine fetal biparietal diameter and abdominal circumference ratio in Bangladesh. There is still no table of this ratio in our country. A prospective, cross-sectional study was conducted on well dated, singleton fetuses of healthy pregnant women. One table and two graphs were prepared by fitting Polynomial regression model. Percentiles, mean and two standard deviations were derived of the ratio. Fetal charts of the raw data with superimposed fitted curves were*

*constructed. The model showed a good fit to the data of 1223 subjects. It covered 95% of the population and gave 3rd, 10th, 50th, 90th and 97th percentiles. This chart can be useful for accurate assessment of fetal biparietal diameter and abdominal circumference ratio to determine the type of fetal growth abnormality, symmetrical or asymmetrical. This is the first time that this ratio has been studied in Bangladesh.*

*Key words: Biparietal diameter/ abdominal circumference.*

### Introduction

Ratios can be used to find out whether the fetal parts are growing normally or not. The ratio of fetal biparietal diameter with abdominal circumference is a useful ratio to assess fetal growth and to detect some fetal anomalies. It is used to see if the fetus is growing proportionately. The type of fetal growth restriction can be determined by it, whether it is symmetrical or asymmetrical growth restriction. In Bangladesh no table of this ratio has so far been prepared.

Ratios can be a powerful method of comparing two parameters, as long as one of the parameters can be determined to be normal. The most useful ratios are those that remain constant through some period, thus making them easier to remember. Ratios of the cranium are constant throughout the second and third trimesters. Many ratios become relatively constant after mid-pregnancy.<sup>1</sup>

Various studies in Bangladesh, have determined that our fetal measurements are smaller than the western fetal measurements.<sup>2-7</sup> Therefore we need reference tables based on our own population studies. This study was conducted to prepare a table with the percentiles, mean and 2 standard deviations (2SD) of this ratio based on Bangladeshi normal population.

### Subjects and Method

A prospective cross sectional study was carried out in which healthy gravid women were studied. Subjects studied were Bangladeshis (Bengalis). Inclusion criteria were- Regular periods, no oral contraceptive for 3 months prior to conception, certain last menstrual period (LMP) date with an ultrasonographic scan prior to 20 weeks gestation to confirm the date. No fetal congenital anomaly. No maternal malnutrition or any medical, surgical or obstetric complication. No uterine anomaly or large fibroids. Well informed consent of the patients were obtained. This study was conducted from Dec 2004 to Nov 2007. All the subjects had a complete ultrasonographic scan including measurements of the fetal biparietal diameter (BPD), head circumference (HC), abdominal circumference (AC) and femur length (FL) by standard methodology. A 3.5 MHz curvilinear transducer was employed. Biometric measurements were made by electronic calipers in mm.

The BPD was obtained at a level that showed a smooth symmetric head, a well-defined midline echo, paired Thalami, the cavum septum pellucidum, and the third ventricle. The cursors were placed on the outer edge of the near calvarial wall and the inner edge of the far calvarial wall. The AC measurements were obtained by tracing the appropriate circumference using an electronic trackball and calipers that open to the outline of a circumference. For abdominal circumference measurements, the section was as round as possible with porto-caval confluence in the section appearing like a 'hockey stick' or J-shape. With the fetal stomach representing a secondary landmark.<sup>8</sup>

---

**Corresponding author:** Dr. Sabrina Q. Rashid, Sonologist, Center for Diagnostic Ultrasound, 38, Green Super Market, Green Road, Dhaka

SPSS program in the computer software was used for data entry and analysis. The ratio between the two parameters was determined. One table and two graphs were prepared after regression analysis and fitting model. Values were expressed as mean and 2 standard deviations (2SD) of the sample.

### Results

A total of 1223 healthy pregnant women were included in the study. They all met the given criteria. The mean of the maternal age was 26.95 ( $\pm 4.49$ ) (1SD) and the range was from 17 to 40 years. Mainly middle class

population was studied. Primipara subjects were 54.7% and 45.3% were multipara. Mean BMI was 23.67 ( $\pm 3.4$ ), and mean maternal weight in the first trimester was 57.92 ( $\pm 9.2$ ) kg.

Table I, gives fitted percentiles of biparietal diameter/abdominal circumference ratio. It gives the estimated values of 3<sup>rd</sup>, 10<sup>th</sup>, 50<sup>th</sup>, 90<sup>th</sup> and 97<sup>th</sup> percentiles and the mean with 2 standard deviations of the data. At 13 weeks gestational age mean BPD/AC was 0.34mm ( $\pm 0.04$ mm), at 36 weeks it was 0.29 ( $\pm 0.03$ ) and at 40 weeks it was 0.28 ( $\pm 0.02$ ). These are estimated values

### Fitted percentiles of BPD/AC (estimated)

Table I

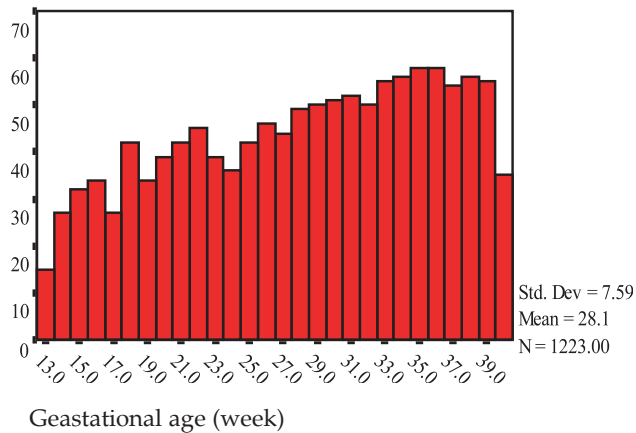
*Fitted percentiles of biparietal diameter/abdominal circumference (BPD/AC) ratio. Estimated values*

Weeks of gestation (w)	No. of fetuses	3rd	10th	50th	90th	97th	Mean	2SD
13	15	0.3	0.31	0.34	0.36	0.38	0.34	0.04
14	27	0.3	0.31	0.34	0.36	0.37	0.34	0.04
15	32	0.3	0.31	0.33	0.36	0.37	0.33	0.04
16	34	0.29	0.31	0.33	0.36	0.37	0.33	0.04
17	27	0.29	0.3	0.33	0.36	0.37	0.33	0.04
18	42	0.29	0.3	0.33	0.35	0.37	0.33	0.04
19	34	0.29	0.3	0.33	0.35	0.36	0.33	0.04
20	38	0.29	0.3	0.32	0.35	0.36	0.32	0.04
21	43	0.28	0.3	0.32	0.35	0.36	0.32	0.04
22	45	0.28	0.29	0.32	0.34	0.36	0.32	0.04
23	39	0.29	0.3	0.32	0.34	0.34	0.32	0.03
24	36	0.29	0.29	0.31	0.33	0.34	0.31	0.03
25	42	0.28	0.29	0.31	0.33	0.34	0.31	0.03
26	46	0.28	0.29	0.31	0.33	0.34	0.31	0.03
27	44	0.28	0.29	0.31	0.33	0.34	0.31	0.03
28	49	0.28	0.29	0.3	0.32	0.33	0.3	0.03
29	50	0.27	0.28	0.3	0.32	0.33	0.3	0.03
30	51	0.27	0.28	0.3	0.32	0.33	0.3	0.03
31	52	0.27	0.28	0.3	0.32	0.33	0.3	0.03
32	50	0.27	0.28	0.3	0.31	0.32	0.3	0.03
33	55	0.27	0.27	0.29	0.31	0.32	0.29	0.03
34	56	0.26	0.27	0.29	0.31	0.32	0.29	0.03
35	59	0.26	0.27	0.29	0.31	0.32	0.29	0.03
36	57	0.26	0.27	0.29	0.31	0.31	0.29	0.03
37	54	0.26	0.26	0.28	0.3	0.31	0.28	0.03
38	56	0.25	0.26	0.28	0.3	0.31	0.28	0.03
39	55	0.25	0.26	0.28	0.3	0.31	0.28	0.03
40	35	0.26	0.26	0.28	0.29	0.3	0.28	0.02

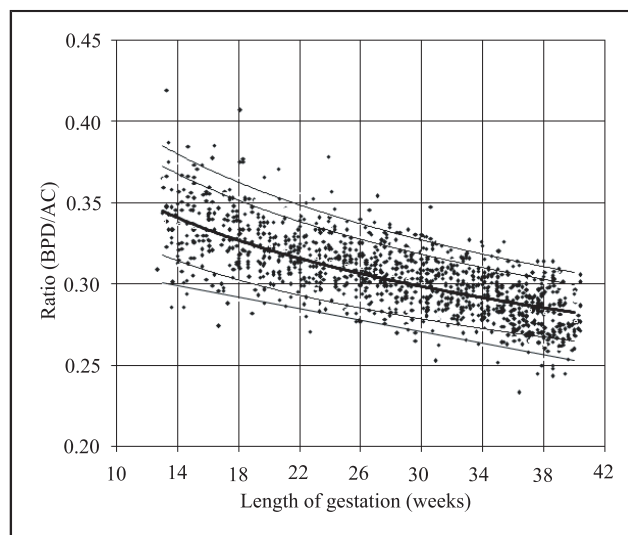
after fitting the model. The coefficient of multiple correlation  $R^2 = 0.519$ , ( $p < .001$ ). Range of the ratio is 34 to 28 or  $31 \pm 3$ .

Figure-1, gives distribution of data in each week of gestation. Figure-2, shows the raw data for biparietal diameter/abdominal circumference with fitted 3rd, 10th, 50th, 90th and 97th percentile limits superimposed on it. The values are higher in the early part of gestation and then gradually decrease in the later part. It is of 95% confidence interval (CI) and Figure-3, shows assessment of goodness of fit of model: Plot of standard deviation score against gestational age, showing expected 2 standard deviations.

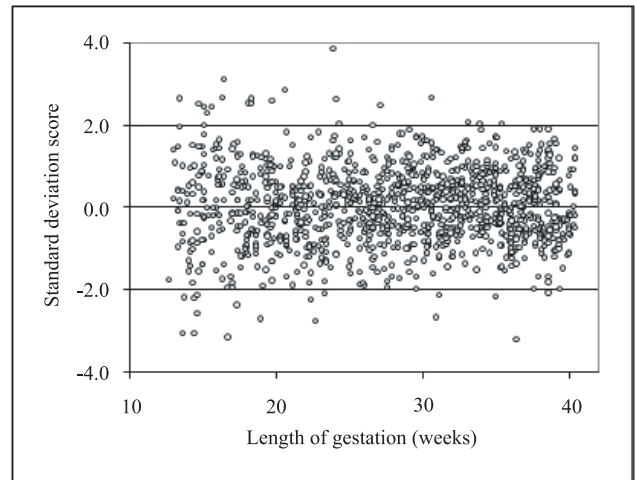
Sample size  
Distribution of observations in each week



**Fig.-1:** Distribution of data in each week of gestation. Fitted percentiles of BPD/AC (estimated)



**Fig.-2:** Raw data for biparietal diameter/abdominal circumference (BPD/AC) ratio with fitted 3rd, 10th, 50th 90th and 97th percentiles.



**Fig.-3:** Assessment of fit of model for BPD/AC plotted: Plot of standard deviation score against gestational age, showing expected 2SD.

**Discussion**

Estimated values of the raw data were derived. At 13 weeks mean BPD/AC ratio was 0.34mm ( $\pm 0.04$ mm) and at 40 weeks it was 0.28 ( $\pm 0.02$ ), with 95% CI of 0.26 to 0.30.  $R^2 = 0.519$ , ( $p < .001$ ).

The ratio in this study was slightly high in the beginning and gradually decreased till term. At 13 weeks it was 34 ( $\pm 4$ ) and at 40 weeks it was 28 ( $\pm 2$ ). It covered 95% of the population.

Assessment of goodness of fit of model for fetal BPD/AC ratio was done. The percentile curves derived by fitting the model were superimposed on the scatter diagram. The boundaries were at 3rd, 10th, 50th, 90th and 97th percentiles. By Regression analysis the quadratic model gave a good fit to the data.

In one western study, Sonographic criteria for large for gestational age in diabetic mothers: performance characteristics of low BPD/AC - Sensitivity is 83%, Specificity 60%, Positive predictive value 71%, Negative predictive value 75%.<sup>9</sup>

**Limitations**

One limitation was this study was mainly conducted on middle class population.

**Recommendations**

This chart can be used to see if the fetus is growing proportionately. More such charts should be prepared by conducting studies on Bangladeshi population.

### Conclusion

This chart has been prepared on Bangladeshi population for the first time. It will be useful to assess growth proportions of the fetus, especially in fetuses of diabetic mothers where the increase in growth is not so proportional.

### References

1. DuBose TJ. Size/ Age analysis. In: DuBose TJ (ed.), *Fetal Sonography*. 1st Ed. Philadelphia, WB Saunders. 1996. p.95- 156.
2. Moslem F, Latifa S, Iffatara B, Shamsuddin AK, Nasreen M, Momen A, et al. Relation of BPD with gestational age in Bangladeshi fetus. *Bangladesh J Ultrasonogr* 1996; 3: 3- 8.
3. Bala KG. Ultrasound assessment of fetal BPD during normal pregnancy in Bangladeshi women and review of literatures. *Bangladesh J Ultrasonogr* 1991; 1: 3.
4. Rashid SQ. Gestational age estimation from fetal Head circumference in Bangladesh. 11th Congress of the World Federation for Ultrasound in Medicine and Biology (WFUMB). Seoul. South Korea. Paper presented. *Ultrasound in Medicine and Biology*. Clinical Obstetrics 2006; 32 (5S) 2361: 163.
5. Rashid SQ. Fetal abdominal circumference growth in Bangladeshi population. *J Bangladesh Coll Phys Surg* 2008; 26 (3): 124-127.
6. Rashid SQ. Predicted Gestational Age for Biparietal diameter in Bangladesh. Asian Federation of Societies for Ultrasound in Medicine and Biology (AFSUMB) Congress. Bangkok. Thailand. Paper presented. Nov. 2007.
7. Rashid SQ. Fetal Biometry and Fetal weight in Bangladeshi population. Dissertation DMUD (USTC) 2002; 53- 69.
8. Hadlock FP. Ultrasound determination of menstrual age. In: Callen PW(ed), *Ultrasonography in Obstetrics and Gynecology*. Philadelphia, PA. Saunders Co. 1994; 86-99.
9. Bracero LA, Baxi LV, Rey HR, et al. Use of ultrasound in antenatal diagnosis of large-for-gestational age infants in diabetic gravid patients. *Am J Obstet Gynecol* 1985; 152: 43.