



A REVIEW ON FETAL BIOMETRY: MODERN AND AYURVEDIC PERSPECTIVE

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ABSTRACT

The measurements of embryo/fetus are referred to as fetal biometry. Fetal biometric measurements reflect the growth and wellbeing of the fetus during the antenatal period. These parameters aid not only in detecting fetal anomalies but also in estimating the correct gestational age as well as to calculate the estimated date of delivery. The main biometric measurements available in a routine scan report are Crown Rump Length in the first trimester; Bi-parietal Diameter, Head Circumference, Abdominal Circumference, Femur Length in the second and third trimesters. Apart from these primary biometric measurements, secondary fetal parameters can also be assessed on demand. Measurement of parts of human body is referred to as *Pramana* (measurement) in Ayurveda. The *Pramana* (measurement) of adult human anatomy is well explained in the Ayurvedic classics under the topic of *Pramana Shareera* (Anthropometry) but that of *Garbha* (embryo/fetus) is very vague or almost nil. Details about the stages of growth and development of *Garbha* (embryo/fetus), its anomalies, signs and symptoms for the assessment of fetal gender etc. have been vividly narrated in the Ayurvedic classics but the parameters to assess the measurement of *Garbha* is not at all sufficient to come to a satisfactory conclusion. Here an attempt has been made to explore the Ayurvedic aspects of fetal biometry apart from its modern review.

KEYWORDS: *Pramana* (measurement), Fetal biometry, Bi-parietal Diameter, Head Circumference, Femur Length.

INTRODUCTION

Fetal biometry is a discipline devoted to the measurement of the several parts of fetal anatomy and their growth^[1]. Fetal growth is the time dependent body dimensions that occur throughout pregnancy^[2]. The measurement of various parts of human body is referred to as *Pramana* (measurement) as per Ayurvedic classics. *Pramana Shareera* (Anthropometry) vividly narrates the adult human body but details regarding that of *Garbha* (embryo/fetus) are very limited. Fetal biometric measurements are used to calculate gestational age and estimated date of delivery by means of Ultrasonography^[3]. A carefully performed ultrasound examination reveals vital information about fetal anatomy as well as fetal environment, growth and well being. The identification of fetal anomalies or defects can also be detected which allows either pregnancy termination or optimization of delivery. Here an attempt has been made to explore the Ayurvedic perspectives of fetal biometry.

Fetal biometry refers to the various measurements obtained from sonography which denotes the development of the fetus in a particular period of growth. It includes measurements that describe normal growth of fetal structures. These measurements are used to estimate the age & to monitor fetal growth. The commonly used measurements to assess fetal size are:-

1. Crown Rump Length - CRL
2. Bi Parietal Diameter - BPD

3. Head Circumference - HC
4. Abdominal Circumference - AC
5. Femur Length - FL^[4]

Measurements^[5]

- Crown Rump Length (CRL)-It is the best index of gestational length which denotes the longest axis of the fetus. This measurement is highly accurate for estimation of fetal age in the early pregnancy and is done between 7 - 13 weeks. It is the distance between crown of head and breech which is equivalent to the sitting height of an individual. (Fig.1)
- Crown Heel Length (CHL)- It is the distance between the crown of head and the heel. This is equivalent to the standing height of an individual.
- Bi-Parietal Diameter (BPD) -It refers grossly to the diameter of head. It is measured along a standard axial plane passing through the widest portion of the skull with both thalami and septum pellucidum in midline. BPD is the distance between the parietal eminences measured from outer bone to inner bone at the widest point. The distance is recorded between the leading edges of two temporoparietal bones. BPD should be disregarded in case of abnormal shape of fetal head. (Fig.2)
- Head Circumference (HC) - It is an important measurement of neonatal head growth and has gained

much importance in in-utero ultrasound because it is independent of shape of head. It is the measurement around the perimeter of the skull including the bone but not fetal hair and scalp. (Fig.3)

- Abdominal Circumference (AC)-is measured in a location that estimates liver size. Liver is the largest organ in the fetal body and its size reflects aberrations of growth, restriction of body growth and macrosomia. Transverse diameter of liver is the greatest. This can be determined sonographically as the position where right and left portal veins are continuous with one another. It gives an estimate of weight and size of fetus. (Fig.4)
- Femur Length (FL) - It is measured along the long axis of the diaphysis of femur disregarding the curvature of medial border and non-ossified epiphyseal cartilages. Due to its size, visibility and ease of measurement femur is generally preferred over other long bones. The FL can be a factor in calculating the gestational age of a pregnancy via ultrasound or may serve as a marker for conditions such as dwarfism^[6]. (Fig.5)

Secondary Biometric Parameters^[7]

- Head Perimeter-It is the total cranial circumference which includes maximum anteroposterior diameter.
- Occipito Frontal Diameter- Front to back measurement from outer table of skull on both sides.
- Ocular Diameter-Measured from medial inner wall to lateral wall of the orbit
- Interocular Distance-This is measured from medial inner wall of one orbit to medial inner wall of other orbit.
- Binocular Distance-Measured from lateral inner wall of one orbit to the lateral inner wall of other orbit
- Thoracic Perimeter-Transverse section through fetal thorax which assesses thoracic size or thoracic perimeter and cardiothoracic ratio.
- Gestational sac volumes are determined by sonar in first trimester of pregnancy.
- Cephalic Index is a gestational age dependent biometric parameter. The effect of head shape on BPD is useful in estimating fetal age especially in second trimester

Measurements Used in Assessing Fetal Weight, Growth and Body Proportions^[8]

Body Weight BW = (BPD × AC × 9.337) – 229

BW = AC³ × 0.0816

Fetal Body Ratios

1. FL/BPD × 100
2. FL/HC × 100
3. FL/AC × 100

Fetal body ratios in second trimester are useful tools for identifying chromosomal abnormalities and predictors of IUGR.

DISCUSSION

BPD and HC gives correct information regarding the development of head. Studies prove that increased fetal head size is significantly associated with extremes of maternal age^[9]. Parity and sex also seems to have influence

on HC^[10]. Studies report that the growth of the BPD in the mid trimester is linear and rapid biological variation at each week of gestation is small^[11]. BPD maintains the closest relationship with gestational age in second trimester. Studies show that maternal height has statistically significant influence on BPD^[12]. Maternal height has a positive effect on BPD, HC, AC, FL and parity has a positive effect on AC^[13]. AC is used for monitoring fetal growth & is proved to have significant association with extremes of maternal age and booking weight^[14]. FL is a very useful biometric parameter in the second trimester. It grows linear throughout and is best measured after 14 weeks of gestation. Maternal booking weight is said to have direct influence on FL^[15]. Even though sex of the fetus has little relation with FL, maternal height and pregnancy BMI are positively associated with FL^[16]. Studies have proved that FL is influenced by dairy intake during pregnancy. Dairy products contain Calcium which accounts for 2/3rd of its contents. This has direct influence on both maternal bone mass and fetal bone^[17]. These fetal biometric parameters are considered as the gold standard for the assessment of gestational age and fetal size and they collectively assess the gestational age to the highest degree of accuracy^[18].

Fetal biometry is of great interest in obstetrical practice. Fetal biometric measurements represent the growth and development of the fetus. It is helpful in the estimation of gestational age especially in women who do not remember the dates of their last menstrual period or whose fundal height on abdominal examination does not correspond to dates. The practice of assessing gestational age in early gestation is valuable in detection of growth aberration in the later stages of pregnancy. In addition, fetal biometry distinguishes the normal from abnormal fetal structures. The ultimate goal of fetal biometry is to enable the user to predict information concerning a fetus and to verify how closely the fetus confirms to the prediction. Studies have proved that maternal and pregnancy characteristics have a significant influence on in-utero fetal biometry.

Valuable information regarding the development of *Garbha* (embryo/fetus) at different stages of growth has been contributed by Acharyas of Ayurveda. The shape of *Garbha* (embryo/fetus) like *Pinda* (mass), *Peshi* (elongated) & *Arbuda* (tumour like) by which it's sex can be assessed as *Pum* (male), *Stree* (female), *Napumsaka* (hermaphrodite) respectively, attainment of *Sthiratwa* (compactness), development of *Angapratyangas* (parts & subparts) & other structures have been narrated while explaining *Masanumasikagarbhavidhi* (month wise development of embryo/fetus); but nowhere clear cut description regarding *Pramana* (measurement) of *Garbha* (embryo/fetus) has been mentioned in the classics. Kashyapa Samhita & Charaka Samhita state the various features, structure of the body & intrauterine life period of humans in different *Yugas* (span of time) but references related to the measurement of *Garbha* (embryo/fetus) cannot be found^[19,20]. Ashtanga Hrudaya narrates the features exhibited by the pregnant lady by which one can predict whether she will give birth to a male or female baby or even a hermaphrodite. In case of *Yamalagarbha*

(twin pregnancy) abdomen appears bulged on both sides & depressed in the middle^[21]. Ashtanga Hrudaya describes particular signs & symptoms to assess certain fetal anomalies like *Upavishtaka* (growth retardation), *Nagodara* (growth retardation) etc^[22]. Sharngadhara too has described eight types of *Garbahvyapat* (fetal anomalies) but references regarding the dimensions of *Garbha* (embryo/fetus)^[23] are too scanty in the classical text books of Ayurveda.

CONCLUSION

The move towards measurement of several parts of the fetal anatomy has been called fetal biometry. The purpose of this approach is to evaluate body proportion and symmetry of growth of different organ systems in the hope of elucidating subtle patterns which might be recognized as abnormal in very early stages when some form of prenatal management might improve reproductive outcome. Even though immense knowledge about the features regarding the stages of development, gender & anomalies of *Garbha* (embryo/fetus) have been narrated in the Samhitas of Ayurveda, description regarding its dimensions & measurements are not given. *Garbha pramana* (measurement of embryo/fetus) can be correlated to fetal biometry, the details regarding which are almost nil or very vague in the available classical text books of Ayurveda.

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Fig. 1: Crown-Rump Length

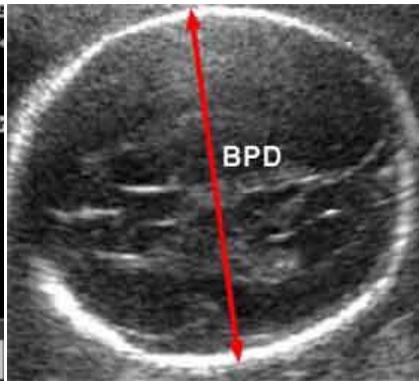


Fig. 2: Bi-parietal Diameter

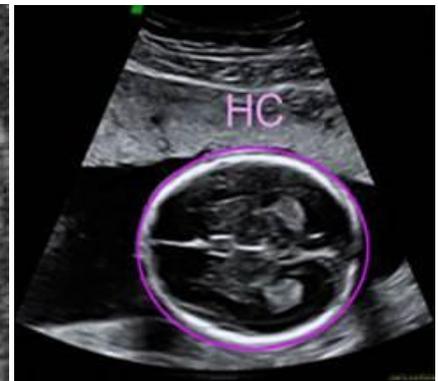


Fig 3: Head Circumference



Fig 4: Abdominal Circumference

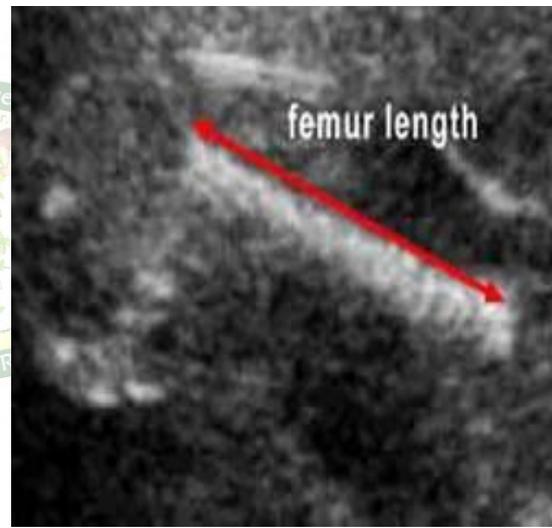


Fig 5: Femur Length

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