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Original Article

Ultrasound Assessment of Fetal Biometry at Raden Mattaher Hospital

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ABSTRACT

Background: Fetal biometry is the cornerstone of modern prenatal care. This study aims to assess fetal size (fetal biometry at a given time point compared to normal charts) and estimate fetal weight (EFW) using the Hadlock formula.

Methods: A descriptive retrospective study in order to establish fetal biometry in the third trimester of pregnancy and incorporated into Hadlock's formula to estimate fetal weight. Four fetal biometry measurements (BPD, HC, AC and FL) were collected from ultrasonography examination results in Raden Mattaher General Hospital. Data were documented using case report form and being tabulated using Microsoft Excel 2011 Version 14.7.0 (161029). All data were analyzed using SPSS 25.0.

Results: There were 100 data of pregnant women who underwent fetal biometry ultrasound examinations from February 2021 to April 2023, 100 data samples were obtained that met the criteria for inclusion in the study. The data was distributed based on gestational age from 9 weeks to 41 weeks of gestation. Data on four biometric parameters were collected and calculated using Hadlock formula to obtain an estimate of fetal weight. In the study, it was estimated the weight of the fetus at the 33rd week of pregnancy was 1800 grams, which was in the 10-50 percentile on Hadlock curve.

Conclusion: Assessment of fetal biometry is one of the main components of modern prenatal care. Accurate pregnancy dating is essential for further interpretation of both fetal size and growth. Measuring biometrics parameters, including Head Circumference (HC), Biparietal Diameter (BPD), Abdominal Circumference (AC), and Femur Length (FL), and combining them into an estimated fetal weight should be part of the routine ultrasound exam.

INTRODUCTION

Fetal biometry is the cornerstone of modern prenatal care. Since the introduction of the ultrasonic fetal measurements in the 1960s, biometry assessment has become common practice and its use depends on the gestational age at ultrasound examination, with several objectives. First-trimester measurements are mainly used for pregnancy dating, which relies essentially on measurements of the Crown-Rump Length (CRL). Accurate estimation of gestational age is the key to further interpretation of fetal biometry. Later on, the main fetal biometric parameters measured are Biparietal Diameter (BPD), Head Circumference (HC),

Abdominal Circumference (AC), and Femur Length (FL). These measurements may be used to assess fetal size (fetal biometry at a given time point compared to normal charts) and growth (dynamic evolution of fetal biometry across gestation), along with their respective disorders and can also be combined to Estimate Fetal Weight (EFW) using various different formula (Hadlock).[1]

It is important to differentiate between the concept of fetal size at a given time point and fetal growth, the latter being a dynamic process, the assessment of which requires at least two ultrasound scans separated in time. Maternal history, symptoms, amniotic fluid assessment and doppler velocimetry can provide additional information that may be used to identify fetuses at risk of adverse pregnancy outcome.[2]

In order to improve maternal and neonatal health, including decreasing perinatal death, high quality antenatal care is a necessity. Not only by early detection of high-risk pregnancy, but also monitoring fetal growth. An accurate monitoring of fetal growth will provide proper obstetric management. Therefore, it will prevent under/over treatment, decrease morbidity and prevent mortality. Screening and adequate management of fetal growth abnormalities are essential components of antenatal care, and fetal ultrasound plays a key role in assessment of these conditions.[3].

METHOD

This was a descriptive retrospective study in order to assess fetal size (fetal biometry at a given time point compared to normal charts) and combined to Estimate Fetal Weight (EFW) using Hadlock formula. It was conducted in Raden Mattaher General Hospital Jambi.

Standard fetal biometry parameters measurement, including Biparietal Diameter (BPD), Head Circumference (HC), Abdominal Circumference (AC) and Fetal Length (FL) was collected from ultrasonography examination result in Raden Mattaher General Hospital Jambi, from February 2021 until April 2023.

Inclusion criteria in this study, including pregnant women underwent ultrasound fetal biometry examination in Raden Mattaher General Hospital Jambi toward February 2021 to April 2023; criteria for determining last menstrual period from regular cycle, duration 25 to 35 days. Last 3 months menstrual cycle was regular, serial ultrasound examination in Raden Mattaher General Hospital Jambi; Last menstrual period was determined by 2 out of 3 criteria; Ultrasound examination was conducted between 12 weeks of gestation until 42 weeks of gestation, singleton intrauterine live fetus, and pregnancy without complications.

We emphasize our study in the normal population. Therefore, there were some exclusion criteria in this study, including pregnancy with obesity, pregnancy with malnutrition, pregnancy with infection and chronic infection, pregnancy with mild and severe anemia, pregnancy with metabolic disorders, multiple pregnancy, intrauterine fetal death, fetal anomaly (lethal and non lethal), pregnancy with preeclampsia/ eclampsia, pregnancy with autoimmune disease, smoking and an alcohol consumption.

All data being documented using case report form and being tabulated using Microsoft Excel 2011 Version 14.7.0 (161029). All data were analyzed using SPSS 25.0. This study was approved by the Ethic Committee of

Faculty of Medicine and Health Sciences, Universitas Jambi - Raden Mattaher General Hospital Jambi.

RESULT AND DISCUSSION

Based on Raden Mattaher General Hospital Jambi documentation and medical record data, there were 100 pregnant women who underwent fetal biometry ultrasound examination from February 2021 until April 2023. There were 100 samples that met inclusion criteria varied from 12 weeks of gestation until 42 weeks of gestation.

Main concern in this research is to evenly distribute the data in order to establish nomograms with good precision. Therefore, we performed data reduction from total data that met inclusion criteria. There were 100 samples evenly distributed from 20 weeks of gestation until 40 weeks of gestation. Fetal biometry characteristics were shown in Table 1.

Table 1. Fetal Biometry Parameters Characteristic

Biometry Parameters	Gestational Age	n	Mean ± SD	95% CI
Biparietal Diameter	21	100	52.0361 **±** 2.86	51.47 – 52.60
	25	100	65.7770 **±** 4.40	64.90 – 66.65
	29	100	75.9340 ± 4.07	75.13 – 76.74
	33	100	84.7675 ± 3.61	84.05 – 85.48
	37	100	93.2549 ± 3.20	92.62 – 93.89
	40	100	97.6262 ± 3.69	96.89 – 98.36
	41	100	100.2085 ± 5.50	99.12 – 101.30
Head Circumference	21	100	179.7609 ± 27.59	174.29 – 185.23
	25	100	228.1891 ± 17.05	224.81 – 231.57
	29	100	271.7787 ± 13.52	269.10 – 274.46
	33	100	304.0427 ± 4.76	303.10 – 304.99
	37	100	331.2598 ± 5.00	330.27 – 332.25
	40	100	345.0810 ± 5.11	344.07 – 346.09
	41	100	351.6689 ± 7.98	350.09 – 353.25
Abdominal Circumference	21	100	155.1891 ± 32.52	148.74 – 161.64
	25	100	193.1353 ± 51.37	182.94 – 203.33
	29	100	245.9987 ± 34.66	239.12 – 252.88
	33	100	272.9296 ± 68.90	259.29 – 286.60
	37	100	306.5266 ± 76.17	291.41 – 321.64
	40	100	350.0089 ± 33.62	343.34 – 356.68
	41	100	361.1515 ± 34.65	354.28 – 368.03
Femur Length	21	100	33.7947 ± 8.06	32.19 – 35.40
	25	100	44.0400 ± 10.44	41.97 – 46.11
	29	100	52.9347 ± 12.26	50.50 – 55.37
	33	100	63.6728 ± 16.32	60.43 – 66.91
	37	100	70.6302 ± 17.76	67.11 – 74.15
	40	100	79.1662 ± 11.16	76.95 – 81.38
	41	100	81.6761 ± 10.99	79.49 – 83.86

Numerical data evenly distributed were presented in mean ± SD

In this study from 20 weeks to 40 weeks (Figure 1) it was found that head circumference, biparietal diameter abdominal circumference and fetal femur length in the population in Jambi were in the normal percentile range between 10 to 90. In the population studied in this study, the fetal growth development was normal according to gestational age.

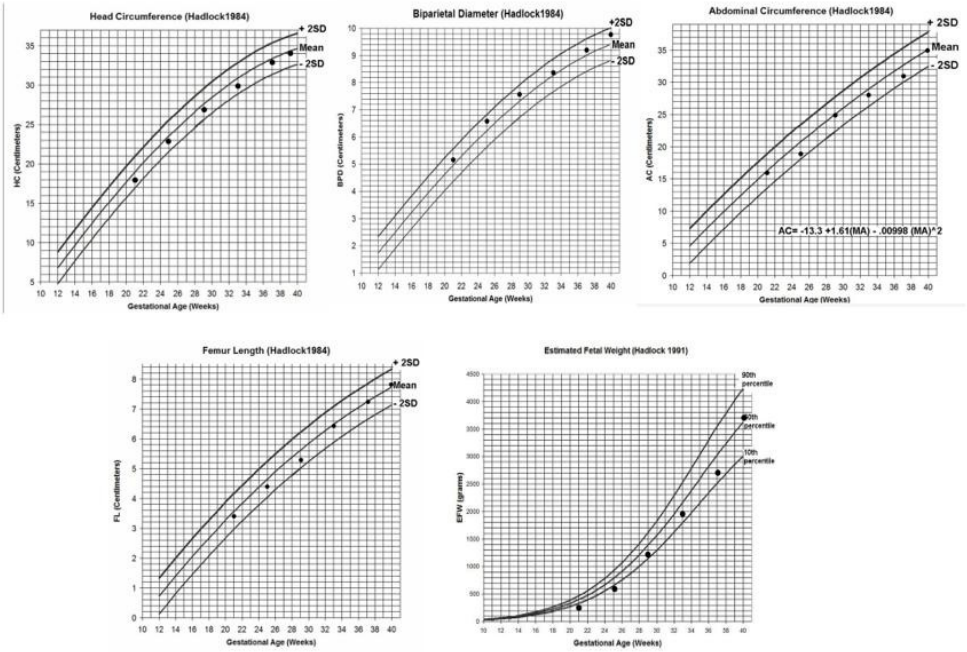

Figure 1. Fetal Biometry Based on Hadlock Curve

DISCUSSION

This descriptive retrospective study aimed to establish a fetal biometry nomogram based on the local normal population. The choice of nomogram used significantly influences the accuracy of fetal growth evaluation, as racial and ethnic differences between populations can affect biometric measurements. Fetal biometry remains a cornerstone of modern prenatal care.

Biometric assessment has become standard practice,[1,2,3] and its application varies depending on the gestational age at the time of ultrasound examination, with several specific objectives. First-trimester measurements are mainly used for pregnancy dating, which relies essentially on measurements of the Crown-Rump Length (CRL). Accurate estimation of gestational age is the key to further interpretation of fetal biometry. Later on, the main fetal biometric parameters measured are Biparietal Diameter (BPD), Head Circumference (HC), Abdominal Circumference (AC), and Femur Length (FL). These measurements may be used to assess fetal size (fetal biometry at a given time point compared to normal charts) and growth (dynamic evolution of fetal biometry across gestation), along with their respective disorders and can also becombined to Estimate Fetal Weight (EFW).

Crown-Rump Length (CRL) is currently the most reliable fetal measurement for pregnancy dating in the first trimester.[4,5,6,7,8] Ideally, the measurement should be performed for a CRL between 45 and 84 mm, along with the assessment of fetal anatomy and screening for common aneuploidies.[7,8] In addition to fetal Crown-Rump Length (CRL), the main measurements used for pregnancy dating are Biparietal Diameter (BPD) and Head Circumference (HC). Both should be measured on a symmetrical axial section of the fetal head. Landmarks used to assess thequality of the measurements include the midline third ventricle, interhemispheric fissure and falx separating symmetrically both hemispheres and choroid plexuses. Whenever possible, cephalic measurements should be performed on the trans-thalamic plane.[8]

Appropriate assessment of fetal biometry is a prerequisite for the estimation of fetal weight (EFW), size, and growth. To this end, according to ISUOG guidelines, the Biparietal Diameter (BPD), Head Circumference (HC), Abdominal Circumference (AC), and Femur Length (FL) should be measured routinely for the assessment of fetal size and performed in a standardized manner.[9,10,11,12,13]

Assessing for fetal growth, a dynamic process across gestation, requires serial measurements throughout the pregnancy. After a second ultrasound performed around 18–22 weeks of gestation to assess for fetal morphology and biometry, there is currently no consensus on the frequency of ultrasound examination in the third trimester, that should depend on local guidelines and the presence of risk factors for abnormal growth.[9] Given the approximately 15% error in estimation of fetal weight, the time interval between scans should typically be at least 2–3 weeks, to minimize false-positive detection of fetal growth disorders.[14]

Growth disorders mainly consist of fetal growth restriction, often associated with Small Gestational Age (SGA), or Large Gestational Age (LGA), which may lead to fetal macrosomia at delivery. Growth and size disorders are associated with a variety of adverse maternal and perinatal outcomes. Hence, biometry is used to determine the optimal management of these pregnancies and the best timing for delivery. Nonetheless, as for all non-automatic measurements and estimates, fetal biometry is subject to bot inter and interobserver variability that could be reduced by standardizing acquisitions and routine quality control of ultrasound images.[15]

Pregnancies characterized by intrauterine growth restriction should be referred to an appropriate unit for individualized management. Evaluation of the pregnancy is twofold: **Maternal evaluation**: in the absence of fetal malformation, pregnancies affected by growth restriction should trigger a clinical and/or biological maternal evaluation to screen for preeclampsia, as the association is frequent due to a placental dysfunction. This includes maternal hypertension, proteinuria, and specific complications. **Fetal assessment**: early identification of fetuses that will require emergency and/or preterm delivery is the priority in this situation, along with finding the optimal timing for antenatal corticosteroid administration when necessary. Antenatal testing strategie include regular controls of cardiotocography, amniotic fluid volume assessment and fetal Doppler patterns of the umbilical artery, fetal middle cerebral artery and cerebroplacental ratio, and aortic isthmus or ductus venosus flow. The frequency of surveillance depends on local guidelines and the severity of fetal growth restriction (FGR).[17,18,19,20]

This study is important to assess fetal size based on local normal population that can be applied to influence evaluation accuracy in monitoring fetal growth andmay be used to identify fetuses at risk of adverse pregnancy outcome.

This research has some weaknesses, including retrospective data. This influences data accuracy due to non-optimal confounding factors control. Due to limitations of medical record data, such as height, body weight, hemoglobin and socio-economic; Validation data is needed in order to generalize data to be applied for Indonesian population.

CONCLUSION

High quality of antenatal care is a necessity in order to improve maternal-neonatal health and decrease perinatal death. Thus, detection of high-risk pregnancy during antenatal care, including fetal growth monitoring in detecting fetal growth disturbances. Each biometry distributed to Hadlock Curve in 10, 50 and 90 centile curves according to gestational age represents a fetal biometry nomogram based on normal population in Jambi.

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