

Comparison Between Accuracy of Sonographic Fetal Weight Estimation Versus Actual Baby Weight at the Time of Birth

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Abstract:

Estimation of fetal weight before the birth is a key to plan a safe mode of delivery. It helps to overcome many health outcomes in later life.

Objective:

To compare accuracy of sonographic fetal weight estimation versus actual baby weight at the time of birth.

Methods:

A prospective comparative study with a sample size of 108 was conducted, at Diagnostic Ultrasound department of Al-Khidmat Teaching Mansura Hospital, Lahore. All patients referred to the department of radiology for obstetrical scanning during 37, 38, 39 & 40 weeks of gestation were included in this study. All cases were performed at My lab 50 gray scale machine and transducer frequency range were 3.0-5.0 MHz. Data were entered in Microsoft excel and analyzed by using SPSS version 21.0.

Results: Total number of patients included in this study were 108. The mean of the estimated fetal weights was 3.3979 kg and the mean of actual baby weights at birth were 3.4089 kg. By comparing the both values no considerable difference was observed and hence concluded that, ultrasound precisely measures the fetal weight.

Conclusions: Estimation of fetal weight from all the statistical parameters measured and compared with actual birth weights found closely related to each other. Hence concluded that sonography is an important tool for predicting birth weights and planning a safe mode of delivery.

Key words:

Estimated fetal weight, actual birth weight,

sonography, femur length, biparietal diameter, abdominal circumference

Introduction:

The sonographic scale of fetal weight is a technique to determine the size of the baby. To determine whether the child is too large, too small, or according to gestational age.¹ Estimation of embryonic weight is a systematic and predictive method to overcome the complication after birth because birth weight is directly correlated with perinatal outcomes. Mortality rates and perinatal mortality are very high in our country. This problem is largely related to prematurity and low birth weight. The complications associated with low birth weight are: prematurity, Intra-Uterine Growth Retardation (IUGR), or both. Macromosomic children are at risk of plexus injury during labor, shoulder dystocia and obstetric injuries.² These infants will be subject to operational delivery or a caesarean section.³ These complications may be limited by an appropriate assessment of fetal weight, which can facilitate safe and planned delivery and reduce the risk of delivery to the mother and child.² Ultrasound imaging is considered to be highly accurate to estimate fetal weight, which may be clinically applicable. Ultrasound has been shown to determine the fetal weight within 15% of the actual birth weight as shown in a previous study conducted in Germany by Hellmeyer L *et al.*, where the deviation of actual weight from the estimated weight were recorded within 10% and this difference increased with the length of the gestation.⁴ Different ultrasound measurements are used to estimate fetal weight. Head Circumference (HC), Bi-Parietal diameter (BPD),

Abdominal Circumference (AC) and Femoral Length (FL).^{5, 6} These measurements are then converted using mathematical formulae to Estimate Fetal Weight (EFW). There are different formulas known with different names and incorporating two or three of these measures. Out of many Hadlock formula is considered more accurate as there is no significant difference found btw estimated and actual birth weights similar to a previous study conducted in Bangladesh. But by using ferrero and hansmann the difference were greater between estimated and actual weight.⁷ Although widely applied in estimating fetal weight, there are many 'technical' limitations to sonographic estimation. These include; maternal obesity, height and thickness of the uterus, oligohydramnios, anterior placenta. From all of the limitations macrosomy is the only factor which mostly effect the estimation of fetal weight because of its underestimation by technicians. As shown in a study conducted by midwives.⁸ Estimation of fetal weight is key tool to predict the baby size and estimation near the term increase the chance of the prediction to be correct as a previous study by Pregerine E *et al.*, in the gynecological and obstetrics department shows.⁹ The purpose of this study is to compare the accuracy of sonographic fetal weight estimation with actual baby weight at the time of birth

Methods:

The study design was prospective comparative and the calculated sample size was 108. The sample was collected from accessible population during 6 months using non probability convenient sampling technique. The study was conducted at Diagnostic Ultrasound department of Al-Khidmat Teaching Mansura Hospital, Lahore. Study was conducted on patients who were referred to radiology department for obstetrical scanning during 37, 38, 39 and 40 weeks of gestation. Patients who refused to participate in this study and with congenital anomalies were excluded. The ultrasound was performed on My lab 50 with 3-5 MHz

transducer. Outcome of the study showed that estimated fetal weights (EFW) were almost equal to the actual birth weights of babies. Data were entered in Microsoft excel and analyzed by using SPSS version 21.0.

Results:

The mean of the estimated fetal weights was 3.3979 ± 0.317 kg and the mean of actual baby weights at birth was 3.408 ± 0.46077 Kg, Table 1.

Weight	N	Range	Min. Weight (Kg)	Max. Weight (Kg)	Mean $\pm$ SD
Estimated Fetal Weight	108	1.55	2.50	4.05	3.3979 $\pm$ 0.317
Birth Weight	108	2.50	2.00	4.05	3.408 $\pm$ 0.46077

Table 1: Comparison between EFW and BW

According to Table 2, among 108 patients 44 (40%) were scanned during 37th week and the mean of the sonographic estimated weights was 3.2736 ± 0.3080 Kg and the mean of actual birth weights was 3.3205 ± 0.5563 Kg. 36 (33%) patients were scanned during 38th week and the mean of their sonographic estimated fetal weights was 3.4375 ± 0.2736 Kg and the mean of actual birth weights was 3.4733 ± 0.3334 Kg. 25 (23%) patients were scanned during 39th weeks and mean of their sonographic estimated weights was 3.4752 ± 0.3340 Kg and the mean of actual birth weights was 3.472 ± 0.4498 Kg. 3 (2%) patients were scanned during 40th week and the mean of the sonographic estimated weights were 3.5 ± 0.1732 Kg and the mean of actual birth weights were 3.4 ± 0.1732 Kg.

Gastational age at weeks	N	BPD (Mean $\pm$ SD)	AC (Mean $\pm$ SD)	FL (Mean $\pm$ SD)	EFW (Mean $\pm$ SD)	BW (Mean $\pm$ SD)
37 week	44	9.325 $\pm$ 0.2902	33.43 $\pm$ 1.13	7.270 $\pm$ 0.2119	3.273 $\pm$ 0.3080	3.320 $\pm$ 0.5563
38 week	36	9.461 $\pm$ 0.24175	33.78 $\pm$ 1.058	9.280 $\pm$ 11.09	3.437 $\pm$ 0.2736	3.473 $\pm$ 0.3334
39 week	25	48.89 $\pm$ 10.815	34.27 $\pm$ 1.370	7.468 $\pm$ 0.2854	3.475 $\pm$ 0.3346	3.472 $\pm$ 0.4498
40 week	3	9.733 $\pm$ 0.0577	34.50 $\pm$ 0.8888	7.533 $\pm$ 0.0577	3.500 $\pm$ 0.1732	3.400 $\pm$ 0.1732

Total	108	18.54± 86.84	33.77± 1.198	7.993± 6.415	3.397± 0.3173	3.408± 0.4607
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Table 2: Descriptive measures at different weeks

Discussion:

Precise prediction of fetal weight is of great interest to obstetrics. Since fetal weight cannot be directly measured, it must be estimated from the anatomical characteristics of the fetus and the mother. Among the most common methods are clinical and ultrasound methods as in the current study. The macromosaic embryo and inhibition of intrauterine growth increases the risk of perinatal mortality and diseases, as well as long-term neurological and developmental disorders.^{9,10} Correct sonographic estimation of fetal weight, intrauterine growth and macrosomia will reduce the likelihood of fetal morbidity and mortality.^{10,11} The mean actual birth weight in current study was 3.40±0.46 kg. This was similar to the mean actual birth weight of 3.254 ± 0.622 Kg reported by Shittu AS *et al.*, in Ife, Nigeria.¹² It is slightly higher than 3.08 ± 0.610kg in Makurdi, Nigeria.¹³ However, it is lower than 3.568 ± 0.496 Kg documented in United Kingdom.¹⁴ Several factors may affect birth weight such as regional (epidemics like malaria which cause maternal anaemia related to low birth weight), maternal factors (blood pressure, maternal weight gain, maternal height, age) and socioeconomic factors (education, financial hardships, parental divorce, home conditions, unemployment).¹⁵ The mean of ultrasonic weight estimation in this study was 3.397 ± 0.317 kg. When the results were compared with “actual birth weight” and “clinically estimated weight”, no significant difference was found. The finding was in sharp contrast to the study by Ugwu EO *et al.*, where ultrasound estimation was significantly more accurate than clinical prediction.¹ However, it is similar to the findings obtained in some earlier studies.^{16,7,17} The sensitivity and specificity of predicting birth

weight by ultrasound measures were 12.6% and 92.1% and by clinical palpation were 11.8% and 99.6% and by maternal estimate were 6.3% and 98.0% respectively. Clinicians estimates of birth weight in term pregnancy were as accurate as routine ultrasound estimation in the week before delivery. Parous women's estimates of birth weight were more accurate than either clinical or ultrasound estimation.¹⁶ Furthermore, formulae used for the estimation of fetal weight are significantly important. In this study there is no such difference between estimated and actual birth weight by using Hadlock which is similar to a previous study in Bangladesh where Using Hadlock *et al.*,¹⁹ method, the mean EFW was 2753.4 (±716.4; range, 1200–4184) Kg, which was not significantly different from the mean actual BW of 2817.9 (±783.0) Kg. The actual BWs ranged from 1200 g to 4500 g. The mean EFW was 65 Kg less than the mean of the BW. The mean absolute difference between EFW and BW was _ 64.5 (± 218.5) g (95% CI of the difference, _116.2 g to _ 12.7 g), and the mean relative difference or the mean percentage error of fetal weight estimation [100(EFW- BW)/BW] was _1.4% ± 7.6%. A good correlation was found between sonographic EFW using the HC/FL/AC and actual BW (r = 0.961) in contradiction to a study done in Germany where difference is greater by using Hansmann and ferrero method. In a previous study the comparison of the accuracy of eight sonographic formulas for predicting fetal BW at term in a multiethnic population, pregnant women at term were reported. The mean absolute error ranged from a minimum of 0.3% (±11.3%) for Hadlock (BPD, HC, AC, and FL) to a maximum of 37.5%(±10.0%) for Warsof (FL only).⁷ In another study in Bangladesh, the mean EFW was calculated to be 3.07 (±0.47) Kg using the biparietal diameter (BPD)/AC formula of Shepard. BWs ranged from 2.2 kg to 4.1 kg, and the mean was 3.15 (±0.43) kg. The mean EFW was 0.08 kg less than the mean BW. The mean percentage error was -2.5%. This study concluded that ultrasonography is a reliable tool

to estimate fetal weight to help the obstetricians in the proper management of a case.¹⁷ Using Hadlock and Campbell's formulas and Shepard and Merz's formulas, the percentage errors of EFW varied from $-4.0 \pm 8.5\%$ to $1.3 \pm 8.5\%$ between examiners.¹⁸

Conclusions:

Estimation of fetal weight from all the statistical parameters measured and compared with actual birth weights found closely related to each other hence concluded that sonography is an important tool for predicting birth weights and planning a safe mode of delivery.

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