

Ultrasonographic Assessment of Fetal Weight and its Correlation with Actual Birth Weight in Pakistani Population

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Abstract

Objectives: To assess the accuracy of ultrasonographic estimation of fetal weight and its correlation with actual birth weight in Pakistani population.

Subjects and Methods: This cross sectional study was conducted in departments of Radiology and Obstetrics & Gynecology, Sargodha Medical College, DHQ hospital Sargodha, from January 2021 to August 2021. Pregnant women of age between 18-40 years were selected for the study. Toshiba Xario with convex transducer 3-6 Mhz was used. The Hadlock 3 method was used to compute the foetal weight, which included ultrasonographic values of biparietal diameter (BPD), abdominal circumference (AC), and femur length (FL). The correlation of estimated foetal weight through ultrasound and actual birth weight was identified through pearson correlation coefficient.

Results: The mean age of the mothers was 28.45 ± 5.45 years and mean parity of 2.7 ± 1.6 . The mean gestational age was 38.55 ± 1.25 weeks. The mean value of mean bipartial diameter was 93.65 ± 0.85 mm. The mean values of femur length and abdominal circumference were noted to be $(77.45 \pm 1.05$ mm) and $(326.15 \pm 9.75$ mm). The mean value of actual birth weight was a bit higher (3.115 ± 0.432 vs. 3.088 ± 0.397 kg) than sonographically estimated fetal weight but this difference was not statistically (P -value > 0.05) significant. A strong and positive correlation ($r = 0.93$, P -value < 0.01) was found between ultrasound estimated fetal weight and actual birth weight of the babies.

Conclusion: A strong and positive correlation was found between ultrasound estimated fetal weight and actual birth weight of the babies. Estimated fetal weight based on multiple fetal parameters gives reliable and clinically useful information for most pregnant women.

Key Words: Ultrasonography, Foetal weight, Actual birth weight

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Introduction

Prenatal fetal weight determination is very important for fetal wellbeing as well as for the management plan of delivery. Fetal weight estimation is one of the most important predictors of fetal intrauterine growth restriction (IUGR). Underweight fetuses are at increased risk for different pathological conditions such as respiratory distress syndrome, type 2 diabetes, heart disease, stroke, kidney disease, gum disease, and nervous disease.^{1,2} Ultrasound is a non-invasive, fast, safe, accurate, easily performable, and cost-effective

imaging modality. Ultrasonography has been used for a long, for the diagnosis of different causes of pathological and physiological conditions, in this country.³

The importance of correct foetal weight estimation during pregnancy and childbirth has been widely demonstrated. It allows obstetricians to make informed decisions about delivery time, delivery mode, and helps in lowering the rate of unfavourable pregnancy outcomes. Various approaches have been evaluated

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for their accuracy in predicting actual birth weight over time. These methods include measuring the product of abdominal girth at various levels and the symphysis fundal height over the symphysis pubis in centimetres. Similarly, the measurement taken at the level of the umbilicus of abdominal girth's product with symphysis fundal height in centimetres and results expressed in grammes are used as estimated fetal weight at term are among most commonly used approaches for fetal weight estimation. There are some commonly used clinical methods which are used for fetal weight estimation, like Dawn's formula, Johnson's formula and McDonald equation etc.^{4,5}

In term pregnancies, ultrasound measurement of foetal weight is used to determine growth, which can alter birth time and route. For patients suspected of having foetal macrosomia, good management of labor and delivery depends upon exact estimation of fetal weight in the later period of pregnancy. This helps obstetricians to take the correct decision for trial of labor after one caesarean section or instrumental vaginal delivery etc.⁶

Clinical evaluation or ultrasound are the most common methods for estimating foetal weight; both have nearly equal accuracy, even in foetal macrosomia, it is not recommended to choose one over the other on scientific grounds. Nonetheless, utilizing ultrasonography to estimate foetal weight provides some objectivity above clinical estimates.⁷

Many factors influence the accuracy of ultrasonographic weight estimation. Studies have revealed limited predictive value at the extremes of weight (low birth weight and macrosomia). The accuracy of ultrasonography foetal weight assessment at term has been questioned.^{8,9} The accuracy of foetal weight estimation can be influenced by the scan delivery interval. The weight gain varies among different fetuses, some fetuses get rapid weight gain as compared to others. Foetal weight estimation is very important at term before delivery among both types of women, those who booked or who booked late, did not follow the antenatal recommended visits properly and did not had obstetric ultrasound at an earlier gestational age. It become more crucial for such women to have foetal weight estimation at term when it is obligatory and beneficial to do so.¹⁰ The ultrasonographic estimation of fetal weight become more critical among the women who has any comorbid condition or complication of pregnancy like diabetes mellitus during

the pregnancy, borderline or breech pelvis for birth. This estimation is necessary for clinicians and patients to determine the delivery route and make an informed decision about the mode of delivery. This present study was planned to assess the accuracy of fetal weight estimation through ultrasound at term and its correlation with actual birth weight in our population.

Methodology

In this cross-sectional study, all the pregnant women visiting the departments of Radiology and Obstetrics & Gynecology, Sargodha Medical College, DHQ hospital, Sargodha were included. The study was conducted over nine months from June 2021 to February 2022. The ethical approval was taken from the institutional ethical committee. A nonprobability sequential sampling strategy was used to enroll patients who satisfied our selection criteria. The study protocol was explained to all of the participants who were chosen for the study, and the researcher obtained their informed written consent. The confidentiality of both medical and non-medical information was respected. The study involved a total of 122 individuals. The sample size was calculated by the WHO sample size calculator based on a 95% confidence level, and the anticipated population proportion (rate of accurate estimation of fetal weight by ultrasound) was 72% and with an 8% absolute precision level.¹⁰

Pregnant women of age between 18-40 years, having a single-tone pregnancy, at term (> 37 weeks of gestation) were selected for the study. Women with any comorbid disease like diabetes, hypertension, gestational hypertension, and anomalies babies were excluded from the study. Toshiba Xario with convex transducer of 3-6 Mhz was used. The Hadlock 3 method was used to compute the foetal weight, which included ultrasonographic values of biparietal diameter (BPD), abdominal circumference (AC), and femur length (FL). On a transverse picture of the skull, the BPD revealed a smooth symmetric head, a well-defined midline echo, thalami, the cavum septum pellucidum, and the third ventricle. The callipers were inserted from the outside margin of the parietal bone to the inner margin of the opposite side. The foetal AC was calculated using a transverse image taken at the level where the right and left portal veins were connected in a "J shape" and the shortest length of the left portal vein's umbilical segment was represented. The foetal stomach served as a secondary landmark, with the vertebrae lying horizontally.

The abdominal circumference was measured by placing electronic callipers ellipse to the outer skin edge. The measurement of FL was performed by identifying the iliac bone and the complete length of the femur as horizontal as possible. The femoral bone's outer margins' distance from the diaphysis indicates the FL. The information related to demographic parameters like parity, gestational age, last menstrual period, estimated foetal weight, gender of the neonate and actual birth weight was investigated. All this information, along with details of ultrasound delivery interval, mode of delivery, and maternal weight, were recorded on a peridesigned performas. All of this information was recorded on a Performa that had been pre-programmed.

For analysis, all of the data was entered into SPSS v. 25. Quantitative factors were based on mean and standard deviation, whereas qualitative variables were reported as frequency and percentages. The Pearson correlation coefficient was used to determine the relationship between the baby's estimated and actual birth weight. P-value ≤ 0.05 was taken as significant.

Results

In this cross-sectional study, a total of 120 pregnant women were enrolled in the study. The mean age of the mothers was 28.45 ± 5.45 years, with a minimum value of 18 and a maximum of 39 years. The minimum parity of the women was 0 and the maximum was 7 in the study sample with a mean parity of 2.7 ± 1.6 . The mean gestational age was 38.55 ± 1.25 weeks, ranging from 36 to 41 weeks. The mean value of mean bipartial diameter was 93.65 ± 0.85 mm (92.45 - 96.1 mm). The mean values of femur length and abdominal circumference were noted to be (77.45 ± 1.05 mm) and (326.15 ± 9.75 mm), having a range of 73.65 - 78.25 mm and 305–357 mm. The mean estimated fetal weight through ultrasound was 3.09 ± 0.40 kg with a minimum value of 2.34 and a maximum of 3.84 kg. The mean value of actual birth weight was 3.12 ± 0.43 kg, ranging from 2.42 to 3.92 as elaborated in Table I.

According to the result of the study, it was noted that there was no statistically significant (P-value > 0.05) difference between the estimated fetal weight through ultrasound and the actual birth weight of the babies. Although the mean value of actual birth weight was a bit higher (3.115 ± 0.432 vs. 3.088 ± 0.397 kg) than sonographically estimated fetal weight but this difference was not statistically (P-value > 0.05) significant as elaborate in table II.

Table I: Descriptive statistics of different characteristics of the study sample

Variable	Minimum	Maximum	Mean	SD
Maternal age	18	39	28.45	5.45
Parity	0	7	2.7	1.6
Gestational age	36	41	38.55	1.25
Bipartial diameter (BPD)	92.45	96.1	93.65	0.85
Femur Length (FL)	73.65	78.25	77.45	1.05
Abdominal Circumference (AC)	305	357	326.15	9.75
Ultrasonographic Estimated Fetal Weight	2.34	3.84	3.09	0.40
Actual Birth Weight	2.42	3.92	3.12	0.43

Table II: Comparison of estimated and actual fetal weight

Fetal Weight	N	Mean	Std. Deviation	P-value
Ultrasound Estimated Fetal weight	120	3.088	0.397	0.064
Actual Birth Weight	120	3.115	0.432	

Table III: Correlation of estimated fetal weight and actual birth weight

	Pearson Correlation	Ultrasound Estimated Fetal weight	Actual Birth Weight
Ultrasound Estimated Fetal weight	1	1	0.930**
	Sig. (2-tailed)		0.000
	N	120	120

** Correlation is significant at the 0.01 level (2-tailed).

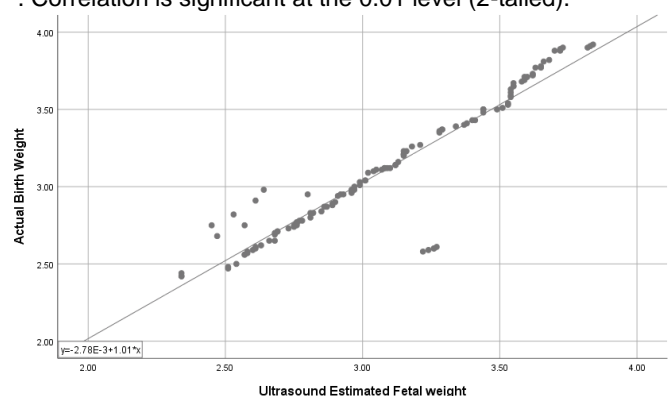


Figure 1. Correlation of estimated fetal weight and actual birth weight

The results showed a very strong and positive correlation between ultrasound estimated fetal weight and actual birth weight of the babies. The correlation coefficient was noted to be ($r = 0.93$) with a highly

significant (P -value < 0.01) as elaborated in Table III. Figure 1, also showed a linear and positive significant relationship between estimated and actual birth weights.

Discussion

Fetal weight estimation has great importance in antenatal care strategies. It is not only used to determine the delivery route, but it also plays an important role in the management of high-risk pregnancies for foetal growth tracking. The estimation of foetal weight has been used as an important component of antepartum examination among high-risk pregnancies. The single most critical indicator of newborn survival is the infant's birth weight. Low and high foetal weights at birth are linked to a higher risk of infant problems during labour and puerperium. It has been argued that precise foetal weight assessment will assist in the appropriate management of labour and newborn care, as well as the avoidance of complications associated with intrauterine foetal macrosomia and low birth weight neonates, hence lowering perinatal morbidity and mortality rates.^{11,12}

In the obstetrician's collaborative decision-making process with the expectant mother, accuracy of foetal weight estimation is crucial, when it comes to the manner of delivery and exact time, if it is required to induce labour. This has been a topic of debate for many years. A 500-gram difference could have a considerable impact on the shared decision-making process, particularly when it comes to international cut-off values.¹³

Prenatal foetal weight estimation is acknowledged to be a crucial component of routine antenatal treatment, as it minimizes both mother and newborn morbidity and death. Fetal weight is a crucial driver of newborns' well-being in the first year of life and one of the variables of the outcome of pregnancies. Birth canal and pelvic floor injuries, as well as postpartum haemorrhage, are among the maternal hazards linked with the delivery of an abnormally large foetus.¹⁴ Accurate foetal weight prediction helps with labour management and decreases macrosomia-related problems, lowering maternal and neonatal morbidity and mortality. Ultrasound is commonly used in clinical models to estimate foetal weight and rule out congenital abnormalities in preterm babies.¹⁵ Ultrasonographic estimation of any single parameter can be used to predict foetal weight, like abdominal circumference,

femur length, biparietal diameter and head circumference, and gestational age, but a combination of these parameters may help in a better estimation of the weight of the fetus.¹⁶

The data of this present study showed that the estimated fetal weight on the basis of ultrasound was not significantly (P -value > 0.05) different from the actual birth weight of the neonates (3.115 ± 0.432 vs. 3.088 ± 0.397 kg) than the sonographically estimated foetal weight, but this difference was not statistically (P -value > 0.05) significant. These findings are consistent with previous research, such as a study conducted by Taha EAS, which found similar results without a significant difference.¹⁷ Similarly, many other studies as well as the current study found that there was no significant difference found between ultrasonographic foetal weight, actual birth weight and a strong link was found between ultrasound estimated weight and actual birth weight. As a result, ultrasonographic foetal weight estimation can be recommended for assessing foetal weight, which is critical for antenatal care and delivery planning.^{18,19}

In this present study, it was also observed that the average difference between sonographic estimated fetal weight and actual birth weight was 27 grams and the absolute average difference between estimated fetal weight and actual birth weight was 85.92 grams. These results are parallel to the findings of other studies.²⁰ In 1976, Kurjak and Breyer were the first to use ultrasound for foetal weight estimation. Since then, a lot of improvement in the field of ultrasound machines and techniques has been emerged. Especially in recent decades, the quality of ultrasound machine and enhanced training combined with various parameters have improved the accuracy of foetal weight estimation. As a result, ultrasonography will continue to play an important role in estimating foetal weight. This will aid the clinician in making informed decisions about the fetus's monitoring and delivery route.¹⁰

Conclusion

The results of this study revealed that the ultrasound estimated foetal weight was not considerably different from the actual birth weight of the baby. Significantly and positively correlated were the estimated foetal weight and actual birth weight of the babies. Estimated fetal weight based on multiple fetal parameters gives reliable and clinically useful information for most pregnant women. Although there remains an

acceptable, variation between the actual birth weight and sonographically estimated fetal weight.

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