

Validity of Ultrasound for estimation of fetal weight in term singleton pregnancies

Shahla Karim Mahmood Alalaf*

Media Ghazi Sedik**

ABSTRACT

Background and Objectives: To assess the accuracy of fetal weight estimation by Ultrasound to predict the actual birth weight.

Methods: A prospective cross-sectional study conducted in Maternity teaching hospital in North of Iraq, Kurdistan region, Erbil city from the 15th of August 2008 to the 28th of September 2009, to evaluate the validity of ultrasound estimation of fetal weight. 200 Kurdish, pregnant women with singleton, term, low risk pregnancies were enrolled in the study.

Real-time sonography was done to measure femur length and abdominal circumference, and then the weight of the fetus was estimated by Hadlock formula. Immediately after delivery the newborn weight was estimated in the labor ward by the same scale. The correlation between estimated weight and real weight was tested by correlation efficient and linear regression test.

Results: Mean maternal age was 26.625±5.62 years; mean gestational age at time of estimation of fetal weight was 38.825±0.910 weeks. 60% of cases delivered vaginally while 40% delivered abdominally. The mean difference between the predicted and actual weight was 50.810±293.92 gm and this difference was statistically highly significant.

Conclusions: Ultrasound estimation of fetal weight using Hadlock formula is regarded clinically a reliable method to estimate fetal weight as the mean difference between the actual and predicted weights was only 50gm, although the difference was statistically significant

Key words: Estimated fetal weight, Hadlock formula, Small for gestational age, newborn weight, Macrosomia.

INTRODUCTION:

The ultrasound estimation of fetal weight in term pregnancies is used to determine growth, and this may affect the timing and route of delivery^{1,2} Although antenatal care has focused more on the diagnosis of fetal growth restriction, the delivery of macrosomic infants is associated with higher rates of adverse outcomes for both mother and infant in comparison to the delivery of normal weight infants. Increased risks to the large infant include shoulder dystocia, brachial plexus injury, perinatal asphyxia, and neonatal death. Adverse maternal outcomes include prolonged

tract trauma, postpartum haemorrhage, and a higher rate of caesarean delivery³. Small –for-gestational-age (SGA) fetuses are vulnerable during stress of labour and delivery. Accurate identification of SGA fetuses allows for close monitoring and more informed decision-making about prolonging the pregnancy or operative delivery⁴. Ultrasound has been used since the mid-1960s as a tool for determining fetal size. Unfortunately, the many formulas used to estimate fetal weight by ultrasound have not been as accurate in predicting weight as clinicians desire to make management decisions⁵. Most of the fetal weight estimation models have been

*M.B.Ch.B, Clinical M.D obstet. & gynecol. Hawler Medical University- College of medicine

** M.B.Ch.B, Msc.Radiology. Hawler Medical University- College of medicine

from Western populations. Ethnicity and secular changes have been known to affect birth weight. Thus, birth weight models derived from one ethnic population and applied in another locality, without the validation of clinical applicability, might result in wrong estimations. It has been demonstrated that birth weight standards change over time, and therefore, it is necessary to regularly revalidate a model in a population⁶.

Aim of this study :

The aim of this study was to determine the reliability of Hadlock formula of ultrasound estimation of fetal weight performed antenatally at Maternity teaching hospital in singleton term (gestational age \geq 38 weeks) pregnancies delivered within 7 days of the ultrasound assessment to predict the actual birth weight.

PATIENTS AND METHODS:

A prospective cross-sectional study done on 200 women delivered in Maternity Teaching Hospital, Erbil city, Kurdistan region, North of Iraq, from the 15th of August 2008 to the 28th of September 2009, to evaluate the validity of ultrasound estimation of fetal weight to predicate the actual birth weight. The mothers of potential subjects were approached regarding participation in the study, all had a verbal consent. The study was approved by the scientific committee in the obstetrics and gynaecological department, Hawler Medical University, college of Medicine. The pregnant women were all of low risk obstetric complications or fetal abnormality, singleton, term pregnancies \geq 38 weeks' gestation, delivered within 7 days of ultrasound scanning. Fetal weight estimation done using Hadlock formula which depends on two fetal parameters {Abdominal circumference (A.C) and femur length (FL) }, all were made by a single observer (specialist in ultrasound) using standardized techniques. The ultrasound machine used was Siemens G60, 3.5 Megahertz (MHz) frequencies. The estimates were adjusted for weight gain

day⁷. Birth weigh was measured immediately after birth, always using the same scales and techniques of measurement. Statistical Package for Social Sciences (SPSS) version 13 used for data entry and analysis .Linear regression and Correlation coefficient were used to assess the validity between 2 variables. .T- test was used to assess the difference between two means, P value $>$ 0.05 was regarded non significant.

RESULT:

The demographic characters of the study population are given in (Table 1). Mean maternal age was 26.625 ± 5.62 years (range 16-43 years), the mean gestational age at time of ultrasound estimation of fetal weight was 38.82 ± 0.910 weeks (rang 38-42 weeks). All the mothers delivered within 7 days from the ultrasound estimation, 140 cases (70%) delivered vaginally while 60 cases (30%) delivered abdominally (Caesarean Section). Table (2) reveals correlation between actual and predicted weight, there was a strong correlation between the estimated mean fetal weight (3.482 ± 354.16 gm) and mean actual birth weight (3.431 ± 404 gm)

Correlation coefficient ($r = 0.708$, P value $<$ 0.001).

The mean difference between the predicted and actual weight was 50.8100gm.

Using linear regression analysis (Figure 1) the estimated fetal weights by ultrasound was also strongly correlated with actual birth weights

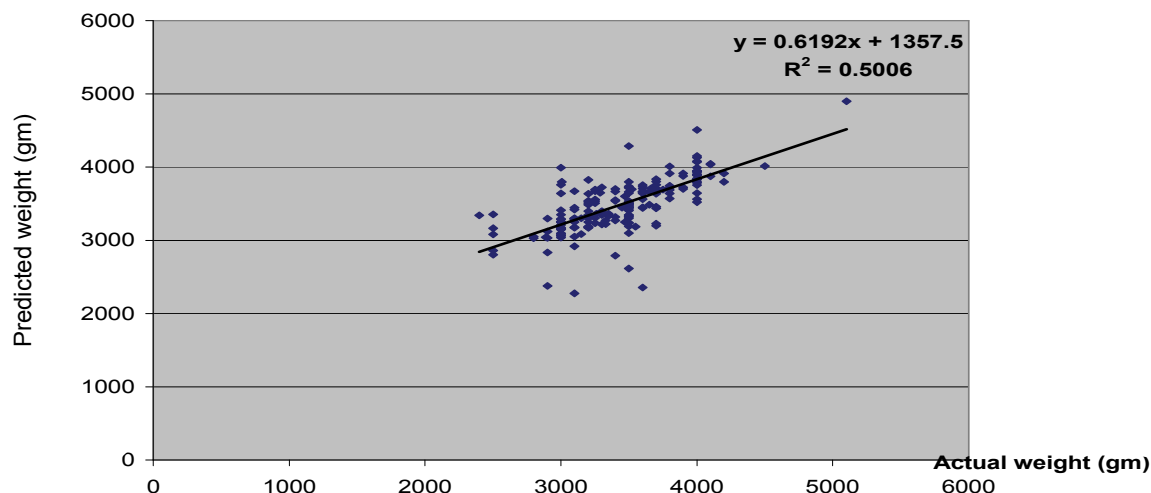
Table 1: Characteristics and mode of delivery of sample size.

characteristics	Range	mean±S.D
Age(year)	16-43	26.72±0.62
Gestational age(week)	38-42	38.82±0.91
Mode of delivery	Vaginal 14 (10%)	Caesarean Section 70 (30%)

Table 2: Correlations between actual (newborn) birth weight and predicted (Ultrasound) fetal weight

Mean fetal weight (gm) ±standard deviation	Mean newborn weight(gm) ±standard deviation	Mean weight difference	*P. value
3.482±354.16	3.431.365±404	50.810±293.926	.01

***Highly significant**

**Figure 1. Correlation between actual and predicted birth weight**

DISCUSSION :

Estimation of fetal birth weight gives useful information about fetal growth, which helps determine the viability of the fetus or its chances of survival as well as the time and type of delivery⁸. The age of the mother have no effect on the estimated fetal weight and this result is in agreement with a study done in obstetric clinic, Shahid Sadoughi Hospital, Yazd, Iran by Firoozabadi et al⁶. Our study revealed ultrasound estimation of fetal weight was associated with a mean

standard error of 20.78 % and a mean difference between the actual and predicted value of 50.81 gm a figure that compares favorably with other published data, a retrospective study done on pregnant women who had undergone ultrasound estimation of fetal weight <7 days prior to a term delivery (≥37 weeks gestation) over the period of July 1998–June 2005, at the Wellington Perinatal Ultrasound Unit, Wellington hospital (Wellington City, New Zealand), to assess the reliability of ultrasound estimation of fetal weight undertaken antenatally,

there result was the ultrasonic estimation of fetal weight significantly correlated with actual birth weight for all infants ($R=0.879$, $p<0.001$)³. Although there was a statistically significant difference between the fetal and newborn weights this difference is not regarded clinically significant as Ultrasound measurements give the appearance of precision, but the accuracy of ultrasonic estimations of fetal weight is limited by the fact that the mature fetus is an irregular, three dimensional structure of varying density, the weight of which cannot be calculated with certainty from biometric measurements. It is therefore not surprising that the Australasian Society for Ultrasound in Medicine states that "No formula for estimating fetal weight has achieved an accuracy which enables us to recommend its use"⁹. Despite the large number of

CONCLUSION:

formulae available¹⁰.

The accuracy of Hadlock formula in estimation of fetal weight in term singleton, Kurdish pregnant mothers was at least similar to that reported in other studies. The mean difference between fetal weight and

RECOMMENDATIONS:

actual birth weight was 50.810 ± 293.926 gram.

-The choice of the appropriate formula for estimation of fetal weight in a given population should be based on objective and explicit criteria. Consideration of bias and precision for the formula in the population being assessed is critical and may affect clinical care.

-Kurdish ethnic community needs a specific protocol to determine fetal weight, as ethnicity potentially plays an important role in the fetal body weight estimation, which provides a valid guide for determining management

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