

COMPARISON OF ACCURACY OF HADLOCK ULTRASOUND FORMULA FOR FETAL WEIGHT PREDICTION WITH ACTUAL BIRTHWEIGHT: EXPERIENCE AT A TERTIARY CARE CENTER

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ABSTRACT

OBJECTIVE: To compare the accuracy of Hadlock formula for birth weight prediction in third trimester ultrasound in making clinical decision for mode and time of delivery to avoid fetomaternal complications. **INTRODUCTION:** The estimation of fetal weight is important in clinical decision making to reduce the postpartum maternal morbidity and for planning the mode of delivery. The timely decision will also affect the fetal management which ultimately depends on estimated fetal weight on ultrasound examination. Ultrasound is noninvasive method and give sufficient information of fetus prior to delivery. The fetal birthweight is vital parameter that estimates the survival of neonate. Therefore, the aim of this audit is to assess the accuracy of estimated weight on ultrasound with postnatal actual fetal weight. **METHODS:** We included ultrasound reports of 100 pregnant patients having their third trimester ultrasound between 30-42 weeks of gestation in month of January 2022 and later delivered a term single baby in our gynae-obstetrics department. The reports were evaluated by two radiologists with five years of experience in obstetric ultrasound. The estimated fetal weight (EFW) was calculated with preprogrammed Hadlock formula and EFW was compared with actual birth weight at delivery. **RESULTS:** The average Estimated Fetal weight according to ultrasound was 2.99 kg and the average Actual Birth weight was 2.87 kg. The Discrepancy between Estimated Fetal Birth Weight and Actual birth weight is < 10% suggesting the accuracy of this method for estimation of fetal weight on ultrasound examination.

Keywords: Ultrasound, Hadlock method, Birth weight.

Introduction

In utero estimation of fetal weight is an important part of pregnancy management. Valuable information is provided through this modality to help physicians make informed decisions about timing and delivery route.^{1,2} It is also very helpful when selecting patients for vaginal delivery after caesarean section and assisted breech birth. Prenatal weight estimation is also an important tool in monitoring and detecting intrauterine growth restriction and macrosomia.^{3,4} Fetal

weight is therefore an independent risk factor in determining perinatal mortality.

Ultrasonography is currently the primary technology used in obstetrics to estimate fetal weight. It is unclear which ultrasound technologies, when used with one or two fetal biometric parameters compared to three or four parameters, produce a more accurate estimation.^{5,6}

Numerous studies have been conducted to determine

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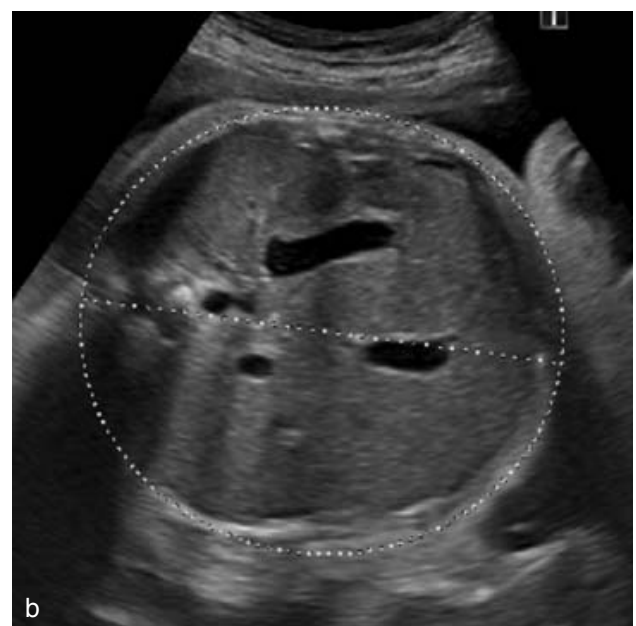
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how well different formulas that incorporate various ultrasonic measures can predict birth weight.^{7,8} EFW has been integrated into typical routine antepartum examination of high-risk pregnancies. However, no one formula or biometric measurement is more accurate than another.^{9,10} About 40-75% of estimations are within 10% of the actual birth weight, whereas the mean absolute error of sonographically predicted birth weight typically ranges between 6 and 12% of the actual birth weight.¹¹ Before the implication of ultrasound, the clinical measurement of fetal weight involved external palpation of the fetal components and uterine contour. Early research has shown that 69% of estimates come within 10% of the real birth weight and that 80-85% of clinical estimations are within 500 g of the true birth weight.¹² Accuracy is higher in the average birth weight range, taking through ultrasound examination, unrelated to obstetric education or experience. According to several researchers estimating fetal weight by palpating the uterus is unreliable. Although it is commonly acknowledged that sonographic measurements, which are objective and reproducible, provide estimates of birth weight that are more accurate than clinical assessment. The goal of the current study was to evaluate the accuracy of the estimated birth weight obtained from a regular antepartum ultrasonography, calculated with preprogrammed Hadlock formula with postpartum actual birth weight.

Material and Method

In this single center retrospective study ultrasound reports of 100 pregnant patients were included who had third trimester ultrasound between 30-42 weeks of gestation in radiology department of Aga Khan university Hospital in month of January 2022 and later delivered a term single baby in our gynaecology department. Days from ultrasound to delivery were equal to or less than 2 weeks. All study participants had their fetal weight estimated via ultrasound, which was done under the direction of a consultant radiologist with expertise in the field. At the level of the falx cerebri, the thalamus, and the cavum septum pellucidum, the biparietal diameter (BPD) was measured from the outer table of the proximal fetal skull to the inner table of the opposite

side of the skull. Femoral length (FL) was calculated as the distance between the greater trochanter and the femoral condyles along the ossified diaphysis of the fetal femur. The fetal abdomen's abdominal circumference (AC) was gauged at the point where the portal sinus and umbilical vein converge. With the aid of elliptical calipers, the head circumference (HC) was calculated, as shown in (Fig.1). The reports were saved and available on Picture archiving communication system (PACS) for review. These reports were evaluated by two radiologists with five years of experience in obstetric ultrasound. The estimated



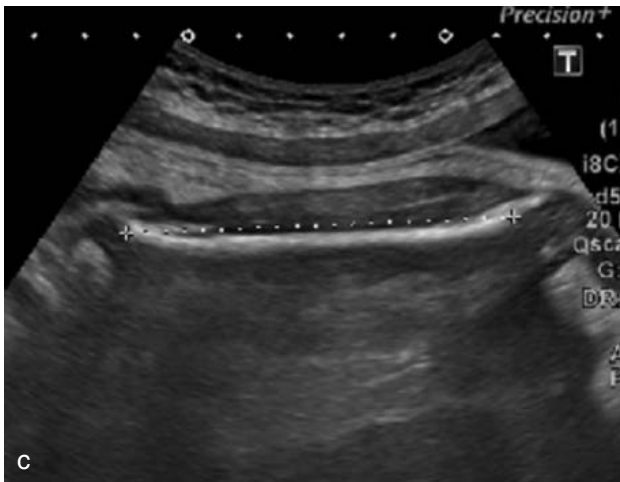


Figure 1(a): The estimation of BPD and HC at the level of thalami and septum pellucidum **(b):** AC at the level of portal vein, stomach bubble and spine **(c):** estimation of femur length

fetal weight (EFW) was calculated with preprogrammed Hadlock formula and EFW was compared with actual birth weight at delivery. The accuracy of fetal weight estimation was examined by calculating the mean percentage difference (error) using the formula. $(EFW - BW / BW) \times 100$

Results

The 100 ultrasound reports of 15 Radiologists shows the average Estimated Fetal weight was 2.99 kg and the average Actual Birth weight was 2.87 kg. The Discrepancy between Estimated Fetal Birth Weight and Actual birth weight is + 110 grams showing <10% discrepancy range of estimated fetal weight with actual birth weight and accuracy of 96% indicating the reliability and success rate of Had lock method for estimation of fetal birth weight. (Fig.2)

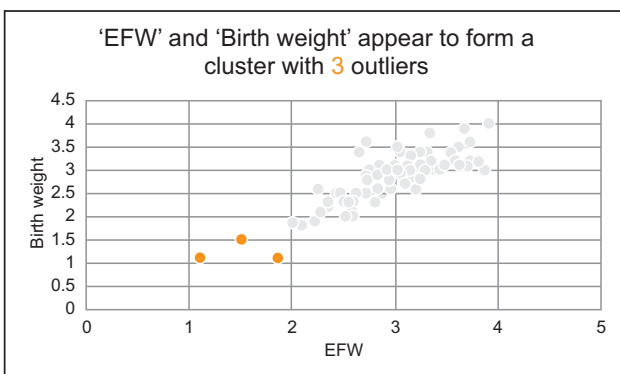


Figure 2: The chart shows relation of estimated fetal weight with actual birth weight

Discussion

Fetal weight is the most important variable affecting fetal and neonatal morbidity and mortality. Both macrosomia and intrauterine growth restriction increase the risk of perinatal morbidity and long-term neurological and developmental disabilities. Identification of an intrauterine growth-restricted fetus after 37 weeks of gestation is a delivery indicator that reduces the risk of intrauterine fetal death. Similarly, the diagnosis of fetal macrosomia, especially pelvic macrosomia, may be an indication forces are an delivery.^{13,14} Therefore, accurate estimation off etal weight has important implications for fetal health and delivery management.

The current audit was done to evaluate the accuracy of Hadlock method for prediction of fetal weight on ultrasound which includes head circumference (HC) for EFW. The average Estimated Fetal weight according to ultrasound was 2.99 kg and the average Actual Birth weight was 2.87 kg. Our results show less than 10% mean percentage error for Hadlock method which is slightly more effective then study done by Abalka A.etal.¹⁵ Thus, indicating that ultrasound is accurate in determining fetal weight.

Several studies have been conducted to compare fetal weight estimation through ultrasound to actual birth weight.^{2,16,17} A study conducted by Gurung et al showed that accuracy of ultrasound in estimating fetal weight is closer to the actual birth weight. Other studies have also shown that ultrasound estimation is more accurate in estimating fetal weight.¹⁹

One study sought to assess whether maternal weight was a modifier in the ultrasound assessment off etal weight, but the results were inconclusive. In oligo-hydramnios, amniotic fluid volume has been shown to reduce the accuracy of abdominal circumference (AC) measurements, as it can become difficult to locate the fetal skin boundary.

Our study also has some limitations, in few cases there was difficulty in taking the fetal parameters due to reduced liquor and in some cases, there was suboptimal visualization of fetal structures due to thick maternal abdominal wall. These confounders have to some extent affect the actual results. However, despite these limitation s ultrasound method of fetal weight estimation was effective with less discrepancy to actual birth weight.

Conclusion

Our results support estimation of fetal weight (EFW) through ultrasound with less discrepancy and high accuracy to actual fetal weight and thus increasing the chances to detect the fetus for intrauterine growth restriction or small for gestational age and helps the clinician for further management and decision making for mode of delivery, to avoid maternal morbidity and fetal mortality rate.

References

1. Njoku C, Emechebe C, Odesolu P. Determination of accuracy of fetal weight using ultrasound and clinical fetal weight estimations in Calabar South, South Nigeria. *Int Sch Res Notices*. 2014; **2014**: 970973.
2. Rashid SQ. Accuracy of sonographic fetal weight estimation in Bangladesh. *Journal of Medical Ultrasound*. Jun 2015; **23(2)**: 82-5.
3. Simms-Stewart D, Hunter T, Fletcher H, Dacosta V, Walters C, Reid M. Comparison of ultrasonographic estimated fetal weight and actual birth weight performed by residents in training at the University Hospital of the West Indies. *West Indian med. j*. 2013: 831-4.
4. Milner J, Arezina J. The accuracy of ultrasound estimation of fetal weight in comparison to birth weight: A systematic review. *Ultrasound*. Feb 2018; **26(1)**: 32-41.
5. Dudley NJ. A systematic review of the ultrasound estimation of fetal weight. *Ultrasound in Obstetrics and Gynecology: The Official Journal of the International Society of Ultrasound in Obstetrics and Gynecology*. Jan 2005; **25(1)**: 80-9.
6. Melamed N, Yogev Y, Meizner I, Mashiach R, Bardin R, Ben-Haroush A. Sonographic fetal weight estimation: which model should be used? *Journal of Ultrasound in Medicine*. May 2009; **28(5)**: 617-29.
7. Hadlock FP, Harrist RB, Carpenter RJ, Deter RL, Park SK. Sonographic estimation of fetal weight. The value of femur length in addition to head and abdomen measurements. *Radiology*. Feb 1984; **150(2)**: 535-40.
8. Salomon LJ, Alfirevic Z, Da Silva Costa F, Deter RL, Figueras F, Ghi TA, et al. ISUOG Practice Guidelines: ultrasound assessment of fetal biometry and growth. *Ultrasound in obstetrics & gynecology*. Jun 2019; **53(6)**: 715-23.
9. Milner J, Arezina J. The accuracy of ultrasound estimation of fetal weight in comparison to birth weight: A systematic review. *Ultrasound*. Feb 2018; **26(1)**: 32-41.
10. Plonka M, Bociaga M, Radon-Pokracka M, Nowak M, Huras H. Comparison of eleven commonly used formulae for sonographic estimation of fetal weight in prediction of actual birth weight. *Ginekologia Polska*. 2020; **91(1)**: 17-23.
11. Sabbagha RE, Minogue J, Tamura RK, Hungerford SA. Estimation of birth weight by use of ultrasonographic formulas targeted to large-, appropriate, and small-for-gestational-age fetuses. *American journal of obstetrics and gynecology*. Apr 1989; **160(4)**: 854-62.
12. Insler V, Bernstein D, Rikover M, Segal T. Estimation of fetal weight in utero by simple external palpation. *American journal of obstetrics and gynecology*. May 1967; **98(2)**: 292-3.
13. Aye AA, Agida TE, Babalola AA, Isah AY, Adewole ND. Accuracy of ultrasound estimation of fetal weight at term: A comparison of shepard and hadlock methods. *Annals of African Medicine*. Jan 2022; **21(1)**: 49.
14. Nzeh DA, Oyawoye O, Adetoro OO. Ultrasound estimation of birthweight in late pregnancy among African women. *West African Journal of Ultrasound*. 2000;1(1).
15. Aye AA, Agida TE, Babalola AA, Isah AY, Adewole ND. Accuracy of ultrasound estimation of fetal

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- weight at term: A comparison of shepard and hadlock methods. *Annals of African Medicine*. Jan 2022; **21(1)**: 49.
16. Mohamed MA, Tamboul J, Yousef M, Sulieman A. The accuracy of Ultrasound in Estimation of fetal weight. *Journal of American Science*. 2013; **9(12)**.
 17. Konwar R, Basumatary B, Dutta M, Mahanta P. Accuracy of Fetal Weight Estimation by Ultrasonographic Evaluation in a Northeastern Region of India. *International Journal of Biomaterials*. Dec 2021; 2021.
 18. Gurung SD, Shrestha J, Gauchan E, Subedi A, Shrestha A, Thapa S. Comparison of Actual Birth Weight with the Ultrasonographic and Clinical Estimation of Fetal Birth Weight: A Prospective Study. *Nepalese Journal of Radiology*. Jun 2022; **12(1)**: 8-12.
 19. Lanowski JS, Lanowski G, Schippert C, Drinkut K, Hillemanns P, Staboulidou I. Ultrasound versus clinical examination to estimate fetal weight at term. *Geburtshilfe und Frauenheilkunde*. Mar 2017; **77(03)**: 276-83.
 20. Baum JD, Gussman D, Wirth III JC. Clinical and patient estimation of fetal weight vs. ultrasound estimation. *Obstetrical & gynecological survey*. Sep 2002; **57(9)**: 558-9.
 21. Warshafsky C, Ronzoni S, Quaglietta P, Weiner E, Zaltz A, Barrett J, Melamed N, Aviram A. Comparison of sonographic fetal weight estimation formulas in patients with preterm premature rupture of membranes. *BMC pregnancy and childbirth*. Dec 2021; **21(1)**: 1-8.