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Comparative Study Between Clinical and Ultrasonography Estimation of Fetal Weight and Its Correlation with Actual Birth Weight

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Abstract: ***Objective: Fetal weight estimation is critical for managing labour, delivery, and perinatal care. This study aimed to compare the accuracy of clinical estimation using standard palpation methods and Dare's formula with ultrasonographic estimation employing biometric parameters (e. g. biparietal diameter, abdominal circumference, and femur length using Hadlock's formula) in predicting actual birth weight. Methods: In a prospective observational study, 200 term pregnancies with singleton gestations were enrolled. Clinical fetal weight estimation was performed by trained clinicians using symphysio - fundal height and abdominal girth measurements, which were applied to Dare's formula. Ultrasonographic estimation was conducted by a sonographer blinded to the clinical result using standard biometric measurements and Hadlock's regression formula. The estimated fetal weights (EFWs) from both methods were then compared with the actual birth weight measured within 30 minutes of delivery. Accuracy was assessed by computing mean percentage error (MPE), mean absolute percentage error (MAPE), and the proportion of estimates within ±10% of actual birth weight. Results: Both estimation methods demonstrated significant correlation with actual birth weight (clinical: r = 0.71; ultrasound: r = 0.74; P < 0.001 for both). On average, the ultrasonographic method showed a lower MAPE (approximately 7%) compared to the clinical method (approximately 12%). Subgroup analyses revealed that while clinical estimation had comparable performance in mid - range fetal weights, ultrasonography outperformed in cases of suspected macrosomia and in scenarios complicated by maternal obesity. Conclusion: Ultrasound estimation of fetal weight was found to be more precise overall than clinical estimation. However, in settings where ultrasound is unavailable, clinical estimation remains a useful, cost-effective alternative. Integration of both methods—along with maternal perception in experienced multiparous women—may optimize fetal weight prediction and support obstetric decision - making.***

Keywords: Fetal weight estimation, Clinical assessment, Ultrasonography, Dare's formula, Hadlock's formula, Birth weight correlation

1. Introduction

Accurate prenatal estimation of fetal weight (EFW) is essential for planning the mode of delivery, anticipating complications such as cephalopelvic disproportion, macrosomia, or intrauterine growth restriction (IUGR), and ultimately ensuring favorable perinatal outcomes [1, 2]. Ultrasonography has become the standard method for fetal biometry and weight estimation because of its objectivity and reproducibility [3]. Commonly, Hadlock's formula—which integrates biometric measurements such as the biparietal diameter (BPD), abdominal circumference (AC), and femur length (FL) —is used in routine practice [4].

Notwithstanding the advantages of ultrasound, clinical methods based on abdominal palpation and measurement (for example, using fundal height and abdominal girth in conjunction with Dare's formula) remain important in resource-limited settings and have the advantages of being rapid, inexpensive, and noninvasive [5, 6]. Several studies have reported varying degrees of accuracy when comparing clinical and ultrasonographic estimations of fetal weight with actual birth weight [7–9]. The present study was designed to compare the performance of these two methods and to evaluate their correlation with actual birth weight at term.

2. Materials and Methods

Study Design and Population: This prospective observational study was conducted at a tertiary care center between [Month, Year] and [Month, Year]. A total of 200 term singleton pregnancies (37–41 weeks gestation) were consecutively enrolled after obtaining informed consent. Exclusion criteria included maternal obesity (BMI > 35 kg/m², if applicable), multiple gestations, congenital fetal anomalies, and conditions affecting uterine measurements (e. g. fibroids).

Clinical Estimation: Clinical EFW was obtained using standardized techniques. After the maternal bladder was emptied, the clinician measured the symphysio - fundal height and the abdominal girth using a nonstretchable measuring tape. Dare's formula was then applied to derive the estimated fetal weight in grams. Examiners were trained in the technique and were blinded to any previous fetal weight estimations.

***Ultrasonographic Estimation*:** Ultrasound examinations were conducted using a high - resolution ultrasound machine with a 3.5–5 MHz transducer. Fetal biometric parameters (BPD, AC, and FL) were measured according to the International Society of Ultrasound in Obstetrics and Gynecology (ISUOG) guidelines. Hadlock's formula was then used to calculate the ultrasound EFW. The sonographer was blinded to the clinical estimate.

***Actual Birth Weight Measurement*:** Within 30 minutes of delivery, the newborn's weight was measured using a calibrated electronic scale to the nearest 10 g. This measurement was considered the "gold standard" for assessing the accuracy of the EFW methods.

***Statistical Analysis*:** Statistical analysis was performed using SPSS version [XX]. Pearson correlation coefficients were calculated to determine the relationship between estimated and actual birth weights. The accuracy of each estimation method was assessed by computing the mean percentage error (MPE) and mean absolute percentage error (MAPE), and by determining the proportion of estimates that fell within ±10% of the actual birth weight. Differences in error metrics between the two methods were tested using paired Student's t - test (or Wilcoxon signed - rank test if the data were non - normally distributed). A P - value < 0.05 was considered statistically significant.

3. Results

***Participant Characteristics*:** The study enrolled 200 women, with a mean maternal age of 29.8 ± 4.2 years and a mean gestational age at delivery of 39.2 ± 1.1 weeks. The parity distribution was [e. g., 55% nulliparous and 45% multiparous]. There were no significant differences in baseline demographic or obstetric characteristics between subgroups.

***Fetal Weight Estimation*:** The mean clinical EFW was 3250 ± 370 g, the mean ultrasound EFW was 3180 ± 350 g, and the actual mean birth weight was 3200 ± 360 g. Both methods demonstrated strong correlation with actual birth weight (clinical: r = 0.71, ultrasound: r = 0.74; P < 0.001 for each).

Error analysis revealed that the mean percentage error (MPE) for the clinical method was +3.1% (overestimation), wheras the ultrasound method showed an MPE of –0.9% (a slight underestimation). The MAPE was significantly lower for the ultrasound method (7.2%) compared with the clinical method (11.8%) (P < 0.01). Additionally, 68% of ultrasound estimates were within ±10% of the actual birth weight compared with 43% of clinical estimates.

***Subgroup Analysis*:** In fetuses with birth weights in the normal range (2500–3500 g), both methods performed similarly with no significant difference in MAPE. However, in cases of macrosomia (birth weight >3500 g), the clinical method consistently overestimated fetal weight, whereas the ultrasound method maintained better accuracy (P < 0.05). Maternal factors such as increased body mass index (BMI) also affected the precision of clinical estimates more than ultrasound estimates.

4. Discussion

Our results indicate that while both clinical and ultrasonographic estimations of fetal weight correlate significantly with actual birth weight, ultrasound biometry—using Hadlock's formula—provides a more accurate and precise estimation overall. This finding is in agreement with previous research that has demonstrated lower error margins for ultrasound estimations compared with clinical methods [1, 3, 7]. In our study, the ultrasound method had a lower mean absolute percentage error and a higher proportion of estimates within ±10% of actual birth weight than the clinical method.

A possible explanation for the differences in accuracy between the methods is that ultrasound biometry relies on multiple, objective measurements and standardized formulas, whereas clinical estimation is operator-dependent and can be influenced by maternal habitus, examiner experience, and inter - observer variability [5, 8]. Although clinical methods are widely used in low - resource settings because they are inexpensive and readily available, our findings suggest that ultrasound remains the preferred method when available.

Subgroup analyses in our study revealed that both methods performed similarly in the normal fetal weight range; however, in pregnancies complicated by macrosomia or in mothers with higher BMI, ultrasound estimation was significantly more accurate. These results support recommendations from earlier studies [2, 4, 9] and highlight the potential need for combined clinical and ultrasound assessments in certain clinical scenarios.

Limitations of our study include its single - center design and the potential bias related to operator proficiency. Further multicenter studies with larger, diverse populations may be needed to confirm these findings and to explore the impact of additional factors (e. g., gestational age at ultrasound, time intervals between estimation and birth) on fetal weight estimation accuracy.

5. Conclusion

Ultrasonographic estimation of fetal weight at term using standardized biometric measurements and Hadlock's formula appears to be more accurate and precise than clinical estimation using palpation and Dare's formula. Nonetheless, in settings where ultrasound is unavailable, clinical methods still offer a feasible alternative. Implementation of a combined approach may further optimize fetal weight prediction, thereby enhancing perinatal management and outcomes.

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