Original Article

# A Comparative Study of Estimation of Fetal Weight in Term Pregnancy by USG and Clinical Methods with Actual Birth Weight in Tertiary Care Center

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## Abstract

**Background:** The ability to estimate fetal weight at term is important for good obstetric management, as low birth weight and macrosomia are linked to maternal and neonatal morbidity. Clinical methods (Johnson's formula) and ultrasonographic methods (Hadlock's formula) are widely used, but the comparative accuracy is different in different populations. The objective is to examine the accuracy of clinical estimation (Johnson's formula) of fetal weight in comparison to ultrasonographic estimation (Hadlock's formula) of fetal weight in comparison to actual birth weight, and to examine the correlation between both methods **Material and Methods:** The study is a prospective comparative study done on 100 primigravida women with singleton term pregnancy (37-42 wks) with vertex presentation in the hospital setting. Fetal weight was estimated clinically using Johnson's formula using symphysio-fundal height and fetal station. The ultrasonographic estimation was performed within 7 days before delivery by Hadlock's formula with fetal biometric parameters (BPD, HC, AC, FL). The actual birth weight was measured and taken as the gold standard immediately after delivery. Pearson correlation and percentage error assessment were used for statistical analysis. **Results:** The mean actual birth weight was 2880.96 ± 416.89 g. The mean value in clinical estimation was higher (3019.81 ± 376.18 g), suggesting a trend towards overestimation while the ultrasonographic estimation (2880.8 ± 341.74 g) was closer to the actual birth weight. The ultrasonography was more accurate with 74% within 10% of the estimate versus 68% for clinical estimation. The percentage of estimates >20% was significantly lower with ultrasonography (2% vs. 8%). Both methods were well correlated with actual birth weight with ultrasonography showing a higher r value (r = 0.819) than clinical estimation (r = 0.761); both of these were significant ($p < 0.0001$). **Conclusion:** The ultrasonographic estimation by Hadlock's formula is more accurate and reliable than the clinical estimation by Johnson's formula. However, clinical techniques are useful and important, especially in low resource areas, and can be useful adjuncts in fetal weight assessment.

**Keywords:** Fetal weight estimation, Johnson's formula, Hadlock formula, ultrasonography, birth weight.

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## Introduction

A key aspect of obstetric practice is the estimation of fetal weight in term pregnancy which has a direct impact on antenatal surveillance, intrapartum decision making, mode of delivery and neonatal preparedness.[1,2] Accurate estimation of fetal weight allows obstetricians to detect fetuses at risk of low birth weight and fetal macrosomia, both of which are linked to important maternal and neonatal morbidity and mortality.[3] Low birth weight is associated with the risks of hypothermia, hypoglycemia, respiratory distress, neonatal sepsis, and long-term neurodevelopmental impairment while fetal macrosomia is associated with longer labor, shoulder dystocia, birth injury, postpartum hemorrhage and increased operative deliveries.[4] Hence, it is important to have an accurate estimation of fetal weight in the antenatal period for proper obstetric planning and optimization of fetomaternal outcomes.

Because the true birth weight is only known after birth, indirect methods of fetal weight estimation have been used, the most important of which are clinical examination and ultrasonography (USG).[5] Several maternal and fetal factors, such as gestational age, maternal body mass index, amniotic fluid volume, fetal presentation and operator expertise, affect the accuracy of each method.[6] Clinical estimation is an important bedside tool as it is simple, inexpensive, non-invasive and readily available, especially in resource-limited areas where ultrasonography may be limited.[7] Johnson's formula, which is

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based on the symphysio-fundal height and considers the station of the presenting part, and Dare's formula which is based on the fundal height and abdominal circumference are common clinical methods for estimating fetal weight. These techniques give reasonably accurate estimates when conditions are standardized but are influenced by inter-observer variability, uterine fibroids, polyhydramnios, oligohydramnios and maternal obesity.[8,9] Clinical methods have been reported to be satisfactory for average birth weight, but underestimate macrosomic fetuses and overestimate growth-restricted fetuses.[10]

Fetal weight estimation by ultrasonography is performed using fetal biometric parameters such as biparietal diameter, head circumference, abdominal circumference and femur length.[11] Hadlock's equation is the most widely used of the available predictive equations due to its ease of reproducibility and relatively low prediction error.[12] Previous studies have shown good correlation between ultrasound estimated fetal weight and actual birth weight especially if ultrasound is done within a week of delivery.[13] Indian studies have also shown that Hadlock's formula is more accurate than other clinical formulas like Johnson's and Dare's formula in term pregnancies.[14,15] The limitations of ultrasonographic estimation, however, include fetal position, decreased amniotic fluid, late gestational cranial moulding, operator dependence and time interval between examination and delivery.[16] Consequently, although ultrasonography is generally considered superior, its accuracy is not absolute.

Although many studies have been conducted, there is still a significant difference in the accuracy of these methods, due to the differences in maternal anthropometry, population characteristics, examiner skills, and the time of fetal weight estimation. Additionally, there are few region-specific comparative data that directly compare Johnson's clinical formula with Hadlock's ultrasonographic formula to actual birth weight. Hence, the present study was conducted to compare the accuracy of fetal weight estimation using the clinical method (Johnson's formula) and the ultrasonographic method (Hadlock's formula) with actual birth weight in term pregnancies. The study also aimed to determine the correlation between clinical and ultrasonographic fetal weight estimates and their agreement with the measured birth weight following delivery.

## Materials and Methods

The study was an institution based prospective comparative study conducted in the Department of Obstetrics and Gynaecology, Government RDBP Jaipuria Hospital, Jaipur for 5–6 months following approval from the Institutional Ethics Committee. After written informed consent, primigravida women with singleton pregnancies between 37-42 weeks of gestation, cephalic presentation and a reliable first trimester dating scan, were consecutively recruited. Women with multiple gestation, malpresentation, major congenital anomalies, uncertain expected date of delivery, pregnancy associated with pelvic masses, ruptured membranes, intrauterine fetal demise, or polyhydramnios/oligohydramnios were excluded from the study.

The sample size was determined by comparing two means according to the methodology described by Fatima S et al,[16] for a significance level (α) of 0.05, a power of 80%, an expected difference between the two means of 0.25 kg, standard deviations of 431.1 g and 485.8 g for Johnson's and ultrasonographic methods, respectively, and a correlation coefficient of 0.87. The calculated pooled standard deviation was 0.459 kg, which gave an initial sample size of 53 participants. The minimum required sample size after adjusting for the paired study design was 84. One hundred consecutive eligible women were then recruited to increase the statistical power and precision of the study.

After enrolment, demographic and obstetric data were obtained on a structured proforma and detailed general, systemic and obstetric examination was done for all the enrolled. The symphysio-fundal height in centimeters was measured clinically and fetal weight was calculated using Johnson's formula: fetal weight (g) = (Symphysio-fundal height − X) × 155, where X was set at 13 when the presenting part was above the ischial spines, 12 at the level of the ischial spines (0 station), and 11 when the presenting part was below the ischial spines. Later, ultrasonographic fetal weight estimation was performed within 7 days before delivery based on the standard fetal biometric parameters: biparietal diameter (BPD), head circumference (HC), abdominal circumference (AC), and femur length (FL). The estimated fetal weight was determined using Hadlock's formula, which includes the above mentioned biometric measurements.

Immediately after delivery, each newborn was weighed on a calibrated electronic weighing scale and the birth weight obtained was taken as the standard for comparison to the clinical and ultrasonographic estimates. To minimize the estimation error due to fetal growth, the time interval between fetal weight estimation and delivery was less than 7 days for all the participants.

The data were then inputted in Microsoft Excel 2021 and analyzed by IBM SPSS Statistics for Windows 26.0 (IBM Corp., Armonk, NY, USA). The continuous variables were presented as mean and standard deviation. Pearson's correlation was used to assess the correlation between estimated fetal weight (Johnson's formula), ultrasonographic fetal weight (Hadlock's formula) and actual birth weight. Linear regression analysis was used to assess the ability of each estimation method to predict the actual birth weight. A two-tailed p-value <0.05 was considered statistically significant.

## Results

One hundred term primigravida women were studied. The majority of participants were aged 21–25 years (31.0%), followed by 26–30 years (26.0%), 18–20 years (22.0%), and 31–35 years (21.0%). Most women delivered at 39 weeks of gestation (28.0%), followed by 40 weeks (25.0%), 37 weeks (24.0%), and 38 weeks (23.0%). The majority of the deliveries (66.0%) were by normal vaginal delivery with 27.0% of deliveries delivered by lower segment cesarean section and 7.0% delivered by instrumental delivery. The study population included 56.0% females and 44.0% males newborns. [Table 1]

**Table 1: Baseline Characteristics of the Study Participants (N = 100)**

| Variable | Category | n (%) |
|---|---|---|
| Age (years) | 18–20 | 22 (22.0) |
| | 21–25 | 31 (31.0) |
| | 26–30 | 26 (26.0) |
| | 31–35 | 21 (21.0) |
| Gestational age (weeks) | 37 | 24 (24.0) |
| | 38 | 23 (23.0) |
| | 39 | 28 (28.0) |
| | 40 | 25 (25.0) |
| Mode of delivery | Normal vaginal delivery | 66 (66.0) |
| | Lower segment cesarean section | 27 (27.0) |
| | Instrumental delivery | 7 (7.0) |
| Gender of newborn | Male | 44 (44.0) |
| | Female | 56 (56.0) |

The majority of neonates had an actual birth weight between 2501 and 3000 g (44.0%), followed by 3001–3500 g (33.0%) and <2500 g (17.0%). The mean estimated weight by clinical estimation using Johnson's formula was higher than the actual birth weight (3019.81 ± 376.18 g vs. 2880.96 ± 416.89 g), while the mean estimated weight by ultrasonographic estimation using Hadlock's formula was almost similar to the actual birth weight (2880.80 ± 341.74 g vs. 2880.96 ± 416.89 g). An ultrasonography distribution of birth weight also showed a closer approximation to the birth weight categories observed than the clinical method. [Table 2]

**Table 2: Comparison of Actual Birth Weight with Clinical and Ultrasonographic Estimated Birth Weight (N = 100)**

| Birth weight (g) | Actual Birth Weight n (%) | Johnson's Formula n (%) | Hadlock Formula n (%) |
|---|---|---|---|
| <2500 | 17 (17.0) | 10 (10.0) | 14 (14.0) |
| 2501–3000 | 44 (44.0) | 33 (33.0) | 51 (51.0) |
| 3001–3500 | 33 (33.0) | 47 (47.0) | 32 (32.0) |
| 3501–4000 | 4 (4.0) | 9 (9.0) | 1 (1.0) |
| >4000 | 2 (2.0) | 1 (1.0) | 2 (2.0) |
| Mean ± SD (g) | 2880.96 ± 416.89 | 3019.81 ± 376.18 | 2880.80 ± 341.74 |
| Minimum | 1915 | 2124 | 2223 |
| Maximum | 4244 | 4108 | 4032 |

The accuracy of the ultrasonographic estimation was higher than the accuracy of the clinical estimation, with 74.0% of the fetal weight estimates being within 10% of the actual birth weight, and 68.0% of the fetal weight estimates from the Johnson's formula being within 10% of the actual birth weight. There was a similar percentage of estimates with an error of 10–20% (24.0%) for both methods and a lower percentage of estimates with an error >20% (2.0%) with Hadlock's formula compared with Johnson's formula (8.0%), suggesting that ultrasonographic estimation was more precise. [Table 3]

**Table 3: Percentage Error in Birth Weight Estimation by Clinical and Ultrasonographic Methods**

| Percentage error | Johnson's Formula n (%) | Hadlock Formula n (%) |
|---|---|---|
| <10% | 68 (68.0) | 74 (74.0) |
| 10–20% | 24 (24.0) | 24 (24.0) |
| >20% | 8 (8.0) | 2 (2.0) |

There was a high positive correlation between both clinical and ultrasonographic methods and the actual birth weight. But it was more correlated with Hadlock's ultrasonographic estimation ($r = 0.819$, $p < 0.0001$) than Johnson's clinical estimation ($r = 0.761$, $p < 0.0001$). There was also a high positive correlation between the two estimation methods ($r = 0.667$, $p < 0.0001$). [Table 4]

**Table 4: Correlation Between Actual Birth Weight and Estimated Birth Weight**

| Variables | Pearson's correlation (r) | p-value |
|---|---|---|
| Actual birth weight vs Johnson's estimate | 0.761 | <0.0001 |
| Actual birth weight vs Hadlock's estimate | 0.819 | <0.0001 |
| Johnson's estimate vs Hadlock's estimate | 0.667 | <0.0001 |

## Discussion

At term, the estimation of fetal weight is important for proper obstetric management, for decisions on the mode and timing of delivery and to reduce maternal and neonatal complications. Most of the women in the present study were in the age group 21–30 years (57%) and most of the deliveries were at 39–40 weeks of gestation. The majority of births were by normal delivery (66%) and the female newborns accounted for 56% of the study population. These findings are similar with those of Durgaprasad et al., Kumari R et al., and Mahindra et

al., who also found that majority of term delivery women were in their twenties.[15,17,18] Likewise, Veena SR et al. and Pavithra K et al. found that most deliveries were in the 38-40 weeks of gestation which is similar to the present findings.[8,19] The majority of deliveries were vaginal in the current study, which was higher than the vaginal deliveries reported by Durgaprasad et al., Kumari R et al., and Yadav et al., possibly because of different institutional practices and risk profile of the patients.[15,17,20] The demographic profile of the present cohort was representative of uncomplicated term pregnancies and was similar to the previous Indian studies.

The present study showed that the fetal weight estimated by ultrasonography according to Hadlock's formula was more accurate than the one estimated by clinical method according to Johnson's formula. The estimated mean birth weight based on ultrasonography (2880.80 ± 341.74 g) was almost the same as the actual mean birth weight (2880.96 ± 416.89 g), while Johnson's formula gave an overestimation of the birth weight (3019.81 ± 376.18 g). In addition, ultrasonography gave a distribution of birth weights that was very similar to the true distribution of the birth weights in the various weight classes, whereas the clinical method tended to overestimate the number of fetuses in the higher weight classes. This is corroborated by Durgaprasad et al. and Kumari R et al. who also found that Johnson's formula had the highest overestimation of birth weight while Hadlock's formula had much lesser mean error.[15,17] Similarly, Das et al. found that the estimation error of ultrasonography was very low and it showed good agreement with actual birth weight.[21] The better performance of ultrasonography may be explained by the use of several fetal biometric parameters which makes it less dependent on the maternal habitus and abdominal examination.

The estimation error also further proved the superiority of ultrasonography. In the current study, 74% of the ultrasonographic estimates were within 10% of the actual birth weight, whereas 68% of the Johnson estimates were within 10% of the actual birth weight, and major errors (>20%) only occurred in 2% of the ultrasonographic estimates compared with 8% of the Johnson estimates. These results are similar to the ones found by Kumari R et al., who found highly significant differences between the percentage errors obtained by Hadlock's formula and Johnson's formula.[15] Durgaprasad et al. reported mean difference significantly lower with ultrasonography and Das et al. reported ultrasonographic estimation was more accurate in all categories of errors.[17,21] The lower error rates reported with ultrasonography are clinically relevant as they will affect the rate of misclassification of fetal size, thus reducing the number of unnecessary operative interventions and increasing the detection of fetuses with growth restriction or macrosomia. However, Johnson's formula was satisfactory for most pregnancies and remains useful when ultrasonography is not available or accessible.

In the present study, the correlation analysis revealed that both methods were significantly correlated with the actual birth weight; however, the correlation was higher for Hadlock's ultrasonographic estimation ($r = 0.819$, $p < 0.0001$) than for Johnson's clinical estimation ($r = 0.761$, $p < 0.0001$). Das et al. have also found ultrasonographic estimates to be more highly correlated with actual birth weight than clinical estimates.[21] and the findings of the current study confirm this. Kumari R et al. and Durgaprasad et al. also showed that Hadlock's formula had better predictive value, thus confirming its reliability for term fetal weight estimation.[15,17] The better correlation and lower variability found with ultrasonography would indicate that it is better suited for clinical situations in which the accurate estimation of fetal weight has a direct impact on obstetric management, such as suspected fetal macrosomia, fetal growth restriction, and planning of operative delivery.

**Strengths and Limitations:** There are a number of strengths of the present study. It used a prospective comparative design with well-defined inclusion and exclusion criteria, resulting in a relatively homogeneous study population of term singleton pregnancies. Direct comparison of the accuracy of clinical estimation by Johnson's formula and ultrasonographic estimation by Hadlock's formula was made against actual birth weight. Standardized fetal weight estimation methods, calibrated weighing scale for birth weight measurement and statistical evaluation by percentage error and correlation analysis increased the reliability of the results. In addition, the inclusion of consecutive eligible participants reduced selection bias and the clinical applicability of the results.

But there are some caveats to be recognized. This study was performed at a single tertiary care center and had a relatively small sample size, so the results may not apply to other population groups. Term primigravida women with singleton cephalic pregnancies only were included and the results cannot be extrapolated to high-risk obstetric populations, multiple gestations and multiparous women, or preterm pregnancies. Furthermore, clinical fetal weight estimation is subjective and ultrasonographic fetal weight estimation is operator-dependent, and the effect of factors such as maternal body mass index, fetal position, placental location and subtle differences in amniotic fluid volume were not assessed separately and may have influenced the accuracy of fetal weight estimation.

## Conclusion

The present study shows that majority of the women were in the age group of 21-30 years, delivered at 37-40 weeks of gestation and had normal vaginal delivery with slight female predominance in newborns in term pregnancies. The majority of neonates had birth weights between 2501-3000 g, with a mean actual birth weight of approximately 2.8 kg. Comparing methods of fetal weight estimation, there was a tendency for greater overestimation of fetal weight with clinical estimation (Johnson's formula) and more variation between weight categories. Conversely, ultrasonographic estimation by Hadlock's formula was close to the actual mean birth weight, had more estimates within acceptable error limits and had a stronger positive correlation with actual birth weight. In conclusion both methods were significantly correlated with actual birth weight, but ultrasonographic estimation was more precise and reliable, which showed its superiority in guiding obstetric decision making and optimizing perinatal management

in term pregnancies.

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## Conflicts of interest
There are no conflicts of interest.

## References
1. Lindström L, Sven Cnattingius, Ove Axelssön, Granfors M. Accuracy and precision of sonographic fetal weight estimation in Sweden. Acta Obstetricia et Gynecologica Scandinavica. 2023 Mar 25;102(6):699–707.
2. Muralisree M, Mirunalini S. Comparative study of fetal weight estimation by clinical and ultrasound methods and its correlation with actual birth weight. Int J Modn Res Revs 2015; 3 (10):948-54.
3. Mengesha HG, Wuneh AD, Weldearegawi B, Selvakumar DL. Low birth weight and macrosomia in Tigray, Northern Ethiopia: who are the mothers at risk? BMC Pediatrics. 2017 Jun 12;17(1):144
4. Bandyopadhyay S. Study of morbidity and mortality profile among low birth weight neonates in sick newborn care unit of a rural medical college and hospital. Pediatric Review: International Journal of Pediatric Research. 2020 Aug 28;7(6):262–70.
5. Alsammani M, Ahmed S. Fetal and maternal outcomes in pregnancies complicated with fetal macrosomia. North American Journal of Medical Sciences. 2012;4(6):283.
6. Milner J, Arezina J. The accuracy of ultrasound estimation of fetal weight in comparison to birth weight: A systematic review. Ultrasound [Internet] 2018 Feb 7;26(1):32–41.
7. Sarris I, Ioannou C, Dighe M, Mitidieri A, Oberto M, Qingqing W, et al. Standardization of fetal ultrasound biometry measurements: improving the quality and consistency of measurements. Ultrasound in Obstetrics & Gynecology. 2011 Nov 25;38(6):681–7.
8. Pavithra K, Annapoorna Y, Priyadarshini K. Estimation of fetal weight by clinical method and its comparison with ultrasonography and its correlation with actual birth weight in term singleton pregnancy. Indian Journal of Obstetrics and Gynecology Research. 2022 Aug 15;9(3):347–51.
9. Cohen G, Hila Shalev-Ram, Schreiber H, Weitzner O, Yair Daykan, Kovo M, et al. Factors Affecting Clinical over and Underestimation of Fetal Weight—A Retrospective Cohort. Journal of clinical medicine. 2022 Nov 15;11(22):6760–0.
10. Ugwu E, Udealor P, Ozumba B, Okeke D, Dim C, Obi S, et al. Accuracy of clinical and ultrasound estimation of fetal weight in predicting actual birth weight in Enugu, Southeastern Nigeria. Nigerian Journal of Clinical Practice. 2014;17(3):270.
11. Wu M, Shao G, Zhang F, Ruan Z, Xu P, Ding H. Estimation of fetal weight by ultrasonic examination. Int J Clin Exp Med. 2015;8(1):540–545.
12. Nitharwal PK, Mittal M, Mathur A, Gupta I. Role of ultrasound in assessment of antenatal fetal weight and correlation of it with postnatal weight. Int J Curr Pharm Rev Res. 2025;17(3):2256–2260.
13. Peregrine E, O'Brien P, Jauniaux E. Clinical and ultrasound estimation of birth weight prior to induction of labor at term. Ultrasound in Obstetrics and Gynecology. 2007;29(3):304–9.
14. Poonam TM, Sansare S, Katwala R, Singh P. A prospective study on comparison of fetal weight estimation by clinical methods and ultrasound and its correlation with true birth weight in term pregnancies. Online J Health Allied Sci. 2021;20(4):4
15. Kumari R, Kumar A, Vijaya. Estimation of fetal weight by clinical methods and ultrasound and correlating its accuracy with actual birth weight in term pregnancies at ANMMCH, Gaya, Bihar. Int J Pharm Clin Res. 2024;16(6):1734–1738.
16. Fatima SA, Devi A, Basha NM, Kabir MA. comparative study on estimation of fetal weight in term pregnancy by clinical methods and USG with actual birth weight in a tertiary care center. International Journal of Health Sciences. 2022 Jul 27; 6(S8):1165–74.
17. Durgaprasad BK, Sharma S, Indira G et.al. Comparative study between clinical methods and ultrasound examination in the estimation of fetal weight. Int J Health Sci Res. 2019; 9(5):79-86.
18. Mahindra T, Singh V, Anuragi D, Akhand G. A prospective study of comparison of fetal weight estimation by clinical method and ultrasound and its correlation with true birth weight in term pregnancies. Eur J Cardiovasc Med. 2023;13(3):2332–2338.
19. Veena S R, Palo LB, Kandasamy R. Estimation of fetal weight at term by clinical and sonographic assessment and its correlation with the birth weight – A prospective cohort study in a tertiary care hospital. Indian Journal of Obstetrics and Gynecology Research. 2024 May 11;11(2):256–63.
20. Yadav R, Barun Kumar Sharma, Ritu Nath Deokota, Rahman H. Assessment of clinical methods and ultrasound in predicting fetal birth weight in term pregnant women. International journal of reproduction, contraception, obstetrics and gynecology. 2016 Aug;5(8):2775-2779.
21. Das S, Biswas S, Nath Das S. A Study on Estimation of Fetal Weight in Term Pregnancy by Clinical Methods and Ultrasonography and Comparison with Actual Birth Weight. Integr Gyn Obstet J. 2025;8(1): 1-6.