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Comparison between Foetal Weight Estimation through Ultrasonographic Method versus Clinical Method

Dr. Kiran Babry*, Dr. Zaiba Sher, Dr. Ayesha Mukhtar

Department of Obstetrics and Gynaecology, PAEC General Hospital, H-11/4 Islamabad, Pakistan.

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A B S T R A C T

Objectives: To compare foetal weight estimated through ultrasonographic method versus clinical method and mean difference of estimated foetal weight measured by either method from actual birth weight. **Study design:** Comparative cross-sectional study. **Place and Duration of the study:** Pakistan Atomic Energy Commission/General Hospital, Islamabad from March-2025 to August-2025. **Methodology:** A total of 251 pregnant women at term gestation were included. Estimated foetal weight was measured by clinical and ultrasonographic methods and were compared with actual birth weight of the baby. To compare estimated foetal weight by two methods from actual birth weight and mean difference of estimated foetal weight, measured by two methods, from actual weight paired t-test was used. **Results:** In this study, 251 pregnant women at term gestation were included. Mean age was 28.35 ± 6.69 years. Mean week of gestation was 38.55 ± 1.49 weeks. Mean BMI was 22.34 ± 3.16 kg/m2. Mean estimated foetal weight was 3419.57 ± 130.58 grams with clinical and 3241.58 ± 115.62 grams with ultrasonographic method. Mean actual birth weight was 3246.01 ± 130.18 grams. Mean difference between actual birth weight and estimated foetal weight by clinical method was 173.55 ± 119.97 while by ultrasonographic method, it was 4.43 ± 86.10, ($p < 0.001$). **Conclusion:** Ultrasonographic method is significantly more accurate compared to the clinical method to correctly estimate weight of the foetus in-utero.

Keywords: Birth Weight, Foetal Weight, Ultrasonography.

Corresponding Author: Dr. Kiran Babry
Email: kirandarain@gmail.com

INTRODUCTION

Estimating the weight of the foetus is a standard practice in antenatal care, since it can have major impact on the pregnancy outcomes. [1, 2] It is also essential for managing the pregnancies that are considered to be high risk and for monitoring the growth and development of the foetus. [3] According to a global epidemiological data on the subject of child mortality, Pakistan has the second highest infant mortality rate in the entire world with a rate of forty two deaths for every one thousand live born infants. [4] An infant is considered to have foetal growth restriction, if its birth weight is below the 10th percentile while those with weights higher than 90th percentile are considered to be large for their gestational age. Problems can occur in childbirth, postpartum period and early infancy, whether the birth weight of baby is low or high. [5, 6]

Neonatal weight at birth is one of the most significant factor that plays a role in whether or not the baby will survive. In developing countries, the primary causes of death among newborn babies are having weight lower than the normal ranges and premature birth. [7] For this purpose, accurately estimating the weight of a foetus in-utero during the antenatal period is essential to foresee fetomaternal outcome and for determination of high risk pregnancies. For this purpose, some centres use various formulae (like Dare's and Johnson's) which are modes of clinically measuring the estimated foetal weight (EFW) while other centres utilize ultrasound for this purpose by using Hadlock's formula. [8]

However, when it comes to choice of method that is more accurate to estimate foetal weight, previous studies report controversial results.

In this instance, a study concluded that clinical method was more accurate than the ultrasonographic method for estimating foetal weight and reported that mean clinically determined EFW was much lower and near the actual birth weight (ABW) compared to that measured by ultrasound, thereby exhibiting clinical method to be more accurate mode of measuring EFW compared to the ultrasonography. [9] Contrary to this, a study found that the mean of the difference between ultrasonographic EFW and ABW was much less compared to clinically assessed EFW and ABW making ultrasonographic method more accurate. [10] Owing to such opposing evidence, present this study was conducted to compare foetal weight estimation through ultrasonographic method versus clinical method to find most accurate method of measuring EFW.

METHODOLOGY

This comparative cross sectional study was conducted at Pakistan Atomic Energy Commission General Hospital, Islamabad from April-2025 to June-2025, once ethical approval was obtained from research evaluation unit of CPSP (Ref. No.: CPSP/REU/OBG-2021-048-11402). Calculation of the appropriate sample size was done by using WHO sample size calculator by assuming 95% confidence level, 1% precision, anticipated population mean of 56.12 and anticipated population standard deviation of 80.785. [10] This yielded a sample size of 251 which was selected by using non-probability consecutive sampling technique.

Females of reproductive age whose age was 16-45 years, presented with a singleton pregnancy with vertex presentation and had term gestation were included. Pregnant women with polyhydramnios, oligohydramnios, multiple gestation, pregnancy with fibroid or adnexal mass, congenital anomalies of foetus on anomaly scan and those who were obese (body mass index > 30kg/m^2) were excluded. Obtaining of informed consent in written form was made prerequisite before inclusion in the study.

Baseline characteristics including age, week of gestation and body mass index (BMI) were documented. In all these patients, clinical EFW assessment was performed using Dare's formula. This weight was not told to the patient as well as consultant obstetrician who was planned to perform ultrasonographic weight estimation. Each patient then had foetal weight estimation by ultrasonographic (USG) method (using Hadlock's formula). After this, antenatal card was maintained till delivery of baby and mothers were given advice regarding antenatal visits and care. At time of delivery, ABW of the baby was assessed using standard weighing scale and mean difference of estimated weight by the two methods from the actual weight was calculated.

Data was analysed using Statistical Package for Social Sciences (SPSS) version 22. The quantitative variables (age, BMI, week of gestation, clinical and ultrasonographic EFW, ABW) was expressed as mean ± standard deviation (SD). The quantitative variables were represented as frequency and percentages. To compare EFW by two methods and mean difference from ABW of two methods, paired t-test was used. Data was stratified by maternal age, BMI and week of gestation to deal with effect modifiers. Post-stratification, independent t-test was used. A p-value of ≤ 0.05 was considered statistically significant.

RESULTS

In this study, 251 pregnant women were included. Mean age was 28.35 ± 6.69 years. Mean week of gestation was 38.55 ± 1.49 weeks. Mean BMI was 22.34 ± 3.16 kg/m2. Patient demographics are further elaborated in Table 1.

Table 1: Patients demographics (n = 251).

Demographic variable	Mean ± SD; n (%)
Mean age	28.35 ± 6.69 years
< 30 years	135 (53.80%)
≥ 30 years	116 (46.20%)
Mean week of gestation	38.55 ± 1.49 weeks
< 40 weeks	168 (66.90%)
≥ 40 weeks	83 (33.10%)
Mean BMI	22.34 ± 3.16 kg/m2
< 25 kg/m2	177 (70.50%)
≥ 25 kg/m2	74 (29.50%)

Abbreviations: SD = Standard Deviation, n = number of patients, BMI = Body mass index

Mean EFW measured by clinical method was 3419.57 ± 130.58 grams while mean EFW measured by USG method was 3241.58 ± 115.62 grams, ($p < 0.001$). Mean ABW was 3246.01 ± 130.18 grams. Comparison of EFW between two methods and of each method with ABW is given in Table 2.

Mean difference between ABW and EFW by clinical method was 173.55 ± 119.97 while mean difference between ABW and EFW by USG method was 4.43 ± 86.10, ($p < 0.001$). Comparison of mean difference of EFW by two methods and ABW is given in Table 3.

Stratification of mean difference between actual birth weight and estimated foetal weight by two method by maternal age, BMI and week of gestation is given in Table 4.

Table 2: Comparison of estimated foetal weight between two methods and of each method with actual birth weight (n = 251).

	Estimated foetal weight	Actual birth weight	p-value [a]
Clinical method	3419.57 ± 130.58 grams	3246.01 ± 130.18 grams	< 0.001†
USG method	3241.58 ± 115.62 grams	3246.01 ± 130.18 grams	0.416†
p-value [b]	< 0.001†	---	---

Abbreviation: USG = Ultrasonography. † = paired t-test, a = estimated versus actual weight, b = clinical versus USG method

Table 3: Comparison of mean difference of estimated foetal weight by two methods and actual birth weight (n = 251).

Mean difference of estimated foetal weight by clinical method from actual birth weight	Mean difference of estimated foetal weight by USG method from actual birth weight	p-value
173.55 ± 119.97	4.43 ± 86.10	< 0.001 †

Abbreviation: USG = Ultrasonography. † = paired t-test

Table 4: Stratification of mean difference between actual birth weight and estimated foetal weight by two methods by confounding variables (n =294).

Age stratification			
Mean difference of estimated foetal weight from actual birth weight	< 30 years (n = 135)	≥ 30 years (n = 116)	p-value
Clinical method	179.02 ± 124.90	167.18 ± 114.17	0.437*
USG method	0.43 ± 89.12	9.07 ± 82.59	0.429*
Week of gestation stratification			
Mean difference of estimated foetal weight from actual birth weight	< 40 weeks (n = 168)	≥ 40 weeks (n = 83)	p-value
Clinical method	181.95 ± 121.27	156.55 ± 116.15	0.115*
USG method	0.52 ± 84.64	12.33 ± 88.98	0.307*
BMI stratification			
Mean difference of estimated foetal weight from actual birth weight	< 25 kg/m2 (n = 177)	≥ 25 kg/m2 (n = 74)	p-value
Clinical method	178.87 ± 124.22	160.85 ± 108.89	0.279*
USG method	2.07 ± 87.64	10.05 ± 82.61	0.505*

* Independent t-test

DISCUSSION

Foetal weight is amongst one of the most important predictor of the outcome of pregnancy as well as the health of the newborn. [11, 12] Accurate estimation of foetal weight may help in determining whether the weight of the foetus is low or high as compared to the normal foetal weight which can have significant impact on the pregnancy outcomes [13, 14], therefore, method that can produce accurate and reproducible results should be adopted for foetal weight estimation. Present study, thus focused on determining which method among the clinical and ultrasonographic foetal weight estimation is more accurate. In present study, the clinical method which was used for estimating the weight of in-utero foetus was Dare's formula. This method is well known to be highly accurate method for this purpose and has been used by various studies in the past. [15, 16]

Ultrasonographic method which was employed for estimation of the weight of foetus was based on the Hadlock's formula. It is amongst the most accurate ultrasonographic method for achieving the goal of calculating estimated weight of the foetus. [17, 18]

Upon analysis of the performance of the methods to correctly estimate the foetal weight, it was observed that there was significant difference between foetal weight estimated through clinical method and the ABW of the infant ($p < 0.001$) while this difference was not significant when estimated weight, measured by USG method, was compared with ABW ($p = 0.416$) indicating that USG method is much more accurate way for estimation of the weight of the foetus. In the similar way, mean difference between EFW and ABW was significantly higher with clinical rather than the USG method ($p < 0.001$) again signifying the higher accuracy of USG method in this regard.

Similar to this, a study was conducted by Nasir *et al*. [19] in which similar comparison was performed. In this study, they reported that mean estimated foetal weight measured by ultrasound method was much more closer to the actual weight of the new born as compared to the estimated weight assessed by clinical method and concluded that ultrasonographic foetal weight estimation was more accurate as compared to clinical method with mean difference by ultrasound significantly less than by clinical method ($p < 0.001$). In another study, by Durgaprasad *et al*. [10], similar superiority of ultrasonographic weight estimation of foetus over the clinical method was exhibited.

Contrarily, this similar comparison of clinical and ultrasonographic estimation of the foetal weight was performed by Ingale *et al.* [9] in which opposite findings were observed, exhibiting much smaller mean difference of with clinical method as compared to ultrasound method from the actual weight of the newborn. Similarly, in another study, in which this comparison of ultrasonographic and clinical weight estimation of the in-utero foetus was performed by Pavithra *et al.* [20], it was observed that there was no difference in the two techniques when compared with the ABW and thus it was concluded that both the techniques were equally effective for accurate estimation of in-utero foetal weight. The exact reason for this difference is not known precisely. One possibility is the difference in the level of expertise of a person performing the ultrasonographic assessment of the foetal weight which may have contributed to such differences in the results of previous and current study.

Based on the results of present study, it is evident that better technique to accurately measure the estimated weight of the foetus in-utero is the ultrasonographic method and should be used preferentially for this purpose. There were no limitations of present study.

CONCLUSION

In conclusion, ultrasonographic method is significantly more accurate compared to the clinical method to correctly estimate weight of the foetus in-utero.

ETHICAL APPROVAL

Obtained from the ethical committee of Pakistan Atomic Energy Commission/General Hospital, Islamabad (Ref No: PGHI-IRB(DME)-RCD-06-084)

PATIENTS' CONSENT

Informed consent in writing was taken from all participants.

COMPETING INTEREST

None.

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