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Original Research Paper

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ESTIMATION OF FETAL WEIGHT: COMPARATIVE STUDY BETWEEN CLINICAL METHODS AND ULTRASOUND EXAMINATION

Dr. Jayshree Chimrani*	DNB Resident, Dept of Obstetrics & Gynecology, Jaipur Golden Hospital , Delhi, India. *Corresponding Author
Dr. Abha Sood	Head Of The Department Of Obstetrics & Gynaecology, Jaipur Golden Hospital, Delhi, India.
Dr. Shefali Sharma	DNB Resident, Dept of Obstetrics & Gynecology, Jaipur Golden Hospital , Delhi, India.
Dr. Shobhini Baghel	DNB Resident, Dept Of Obstetrics & Gynecology, Jaipur Golden Hospital , Delhi, India.

ABSTRACT

Introduction: Estimation of fetal weight is important for antenatal and intrapartum clinical decision-making. Accurate estimates are essential, since abnormal fetal growth may be associated with perinatal and maternal risk. This study aimed to compare the accuracy of the three most commonly used techniques, abdominal palpation and ultrasound, carried out near to and at term by comparing to the weight at birth.

Methods: Present study included 100 singleton pregnancies who were recruited from a tertiary care institute of North India (JAIPUR GOLDEN HOSPITAL DELHI) . Anthropometric measurements were taken such as symphysio- fundal height, abdominal circumference etc. Ultrasound estimation was also done. Comparison of the estimation methods were done to see the accuracy of above methods.

Results: Primigravida were 50% with 77% participants with gestational age of 38 weeks or more. Mean actual weight was 2.92 kg followed by Johnson (2.89 kg) and Ultrasound methods (2.85 kg). Correlation coefficient was highest for ultrasound (r=0.943) with actual weight. Error was lowest with ultrasound (145 grams) followed by Johnson's (207 grams).

Conclusion: Ultrasound is easy to use and newer advancements have made fetal weight estimation accurate. Ultrasound training is also essential to make the fetal weight estimation with minimum error.

KEYWORDS : fetal weight estimation, ultrasound, clinical examination, anthropometry

INTRODUCTION

Estimating foetal weight during pregnancy is an important component of prenatal and postpartum management.[1] As the pregnancy progresses, foetal weight estimation becomes even more crucial for delivery preparation, as perinatal problems are more common in cases when the birth weight is at either end of the extremes. During routine check-ups, foetal weight estimate helps in antenatal care in it and can influence decisions concerning labour induction time and method of delivery. Accurate estimations are important because aberrant foetal growth may be linked to perinatal and maternal risk. Longer labour and numerous delivery traumas, such as shoulder dystocia, brachial plexus injuries, and intrapartum hypoxia, are related with the delivery of a macrosomic foetus, as well higher maternal risks such as birth canal injuries and postpartum haemorrhage.[2–4] On the other hand, it is critical to detect a growth-restricted foetus or to provide fetus a safe intrauterine environment and time of birth in order to reduce perinatal risks such as intrauterine foetal death and neonatal morbidity.[5]

Obstetricians should adopt the examination methods that are more reliable in determining foetal weight to give the best perinatal care. In addition, the approach should be easy to apply, valid, and dependable. Ultrasound and clinical examination are the two most often used procedures for estimating fetal weight. Ultrasound is currently chosen due to its ease of use, objectivity, and precision.

In places where ultrasound is unavailable or sparingly used, foetal weights are calculated using abdominal palpation of fetal body parts using Leopold's techniques, measuring fundal height and maternal abdominal circumference (Insler's and Bernstein's calculation), and utilising Johnson's approach. Johnson's approach and Insler's and Bernstein's formula are both formulas that estimate fetal weight using clinical maternal measures that are easily accessible.[6–10] Despite the fact that all of these approaches have been thoroughly examined, there is still discussion in the current literature about their accuracy, as well as which method is the most dependable and legitimate.

This study aimed to compare the accuracy of the three most commonly used techniques, abdominal palpation and ultrasound, carried out near to and at term. Also, the accuracy of Johnson's method, Insler's formula and ultrasonographic method for estimating fetal weight were assessed by comparing to the actual weight.

MATERIAL AND METHODS

The present study was conducted among 100 pregnant patients who were registered at our centre. The present study was conducted in collaboration of Obstetrics and Gynaecology and Department of Radiodiagnosis. The period of study was January to June, 2021. The study included participants from out patient department as well as from in patient admitted for delivery. The mothers were explained about the purpose of the study and consent was taken.

Inclusion Criteria

a. Singleton term pregnancy in cephalic presentation
b. Gestational age of 36 weeks and above

Exclusion Criteria

a. All pregnancies of less than 36 week gestation
b. Non-cephalic singleton pregnancies
c. Multiple pregnancies
d. Fetal anomalies, intrauterine fetal death

Study procedure

A structured questionnaire was prepared and details of the patients was taken. A detailed menstrual and obstetric history

was taken to ascertain the gestational age which was calculated by Naegele's rule or by first trimester ultrasonographic report. Fetal weight estimation was done by Insler's formula. After emptying the bladder, the patient made to lie in supine with legs flat on the bed i.e. extended both at hip and knee. The abdominal girth was measured at the umbilicus and expressed in cms. After correction of dextrorotation, McDonald's measurement of the of the height of the fundus from the upper edge of the symphysis pubis following the curvature of the abdomen was taken with a centimeter tape the upper hand was placed firmly on top of the fundus, with the measuring tape pressing between the index and middle finger readings were taken from perpendicular intersection of the of the tape with the fingers. The measurement was made using the tape reverse side up so as tom forestall any bias.

Abdominal girth or AG x symphysis fundal height or SFH (Insler's formula) and EFW (weight in grams) = AG (cms) x SFH (cms)

Fetal Weight Estimation By Simplified Johnson's Formula

As mentioned in the previous method McDonald's measurement of the Symphysis fundal height is done, which is the distance from height of fundus to the upper edge of the pubic symphysis. Station of presenting part was assessed by abdominal examination. Fetal weight was estimated by as follows:

Fetal weight in grams= (McDonald's measurement - X) x 155, where X is equal to 13, 12, or 11 when presenting part is at minus, zero or plus station respectively.

Fetal weight estimation by Hadlock's formula using ultrasonography

Sonographic examination was done in all patients using 3.5 MHz convex assay and linear assay transverse (transverse Sumen's sonoline SL grey scale model with M & B mode for simultaneous imaging and calculating fetal heart).After biparietal diameter (BPD), abdominal circumference (AC) and femur length (FL) were measured in centimeters, the sonography machine calculated fetal by Hadlock's formula. BPD diameter is measured using real time scanner; linear array Dynamic imaging equipment yields the most accurate results of BPD measurement.

Great care was taken to ensure that the image was not inclined side to side or front to back. Excessive pressure with the transducer was avoided as it would distort the shape of the abdomen. The radiologist had no prior knowledge of the clinical estimate of the fetal weight. All the three estimates were documented into a chart. After delivery, the new born babies were weighed within 30mins of delivery on an electronic weighing scale and documented as well.

Statistical Analysis

The data was entered in Microsoft excel spreadsheet and analysed using SPSS software version 20.0 for Windows. Comparison between two groups with continuous data was done using independent t-test. Statistical significance was considered when p-value was less than 0.05.

RESULTS

The study was conducted among 100 antenatal patients who had singleton pregnancies. Half of the subjects were primigravidae (50%) whereas second and third gravidae constituted 27% and 19% respectively (Table 1). More than one third of subjects (36%) had gestational age of 39 weeks and only 6% subjects with 36 weeks gestational age.

Table 1: Distribution of gestational status and age of subjects

Variable	Category	Frequency (%)
Gestational status	Primigravida	50 (50%)
	Second gravida	27 (27%)
	Third gravida	19 (19%)
	Fourth gravida	4 (4%)
Gestational age (in weeks)	36 weeks	6 (6%)
	37 weeks	17 (17%)
	38 weeks	29 (29%)
	39 weeks	36 (36%)
	40 weeks	12 (12%)

Table 2 shows the descriptive summary of different weight estimation methods. Mean weight was 2.99 kg using Insler's method whereas mean actual weight was 2.92 kg. The mean error of ultrasound weight with respect to actual weight was lowest and Insler's method had highest error.

Table 2: Descriptive statistics of difference weight estimation methods

Method of weight estimation	Minimum	Maximum	Mean	Std. Deviation	Mean error of weight (in gms)
Insler's	2.21	3.88	2.99	0.39	237.1±158.8
Johnson	2.32	3.88	2.89	0.30	207.4±152.5
USG weight	2.01	3.80	2.85	0.37	145.2±114.5
Actual weight	2.07	3.74	2.92	0.37	-

Table 3 shows the comparison of actual weight with different methods of weight estimation. There was no significant difference between the actual weight and the weight estimation by different methods. Actual weight was closest to Johnson weight estimation whereas maximum difference was observed with ultrasonographic method.

Table 3: Comparative analysis of actual weight and different methods of weight estimation

Comparison of different methods with actual weight	Weight in Kgs	P-value*
Insler method Actual weight	2.99±0.38 2.92±0.37	0.197
Johnson Actual weight	2.89±0.29 2.92±0.37	0.474
USG weight Actual weight	2.84±0.36 2.92±0.37	0.138

*Independent sample t-test

Table 4 shows the correlation of actual weight with different methods. Correlation coefficient was highest for ultrasonographic weight (r=0.943), followed by Johnson method (r=0.873) and Insler's method (r=0.859). The correlation was significant for all three methods.

Table 4: Correlation of actual weight and different methods of weight estimation

	Correlation coefficient, r	P-value
Insler's method	0.859	<0.001
Johnson method	0.873	<0.001
Ultrasonographic method	0.943	<0.001

DISCUSSION

The foetal weight estimate is the single most important factor in determining the Obstetrics management. If applied to all pregnancies, accurate fetal weight prediction in relation to gestational age can help identify incorrect dates, intrauterine growth restriction, and thus reduce the number of preterm perinatal deaths. Ultrasound is a painless, non-invasive, and simple technique that provides information such as

biophysical profile, gestational age, lie, position, and presentation, as well as determining the growth, timing, and route of delivery, and detecting any abnormalities such as fetal growth abnormalities or genital problems. Ultrasound is considered to be more precise for determining fetal growth, whereas normal clinical examination and above 4000g range are considered to be less precise. However, some studies have found that both clinical examination and ultrasonography have a similar level of accuracy, but ultrasound is proven to be more accurate than clinical methods.[11]

In the present study, half of the participants were primigravida and 77% of subjects had gestational age of 38 weeks or more. The mean actual weight was 2.92 kgs whereas the nearest weight estimation was done by Johnson's method and ultrasound estimation with mean weights of 2.89 and 2.85 kg respectively. On comparison of actual mean weight with other estimation methods, there was no significant difference found which implies that all methods have similar values to the actual weight of the baby. Study by Durgaprasad et al revealed that Hadlock's formula and symphysio-fundal height estimation were closest in measuring the actual weight.[11] Regarding the error produced by different estimation methods, ultrasound method had least error (145 grams) followed by Johnson's method (207 grams) and Insler's method (237 grams). Tiwari and Sood et al reported similar findings with lowest error shown by Hadlock's ultrasound method.[12]

In the present study, correlation coefficient was calculated of actual weight with different estimation methods. Ultrasound method had highest correlation coefficient (r=0.943) with Insler's method as lowest coefficient. This implies that actual weight correlates very closely with ultrasonographic weight followed by other estimation methods. In other study from Vishakhapatnam, similar findings were reported with correlation coefficient of 0.701 between actual weight and Hadlock's ultrasound method.[11]

As a result, our findings are consistent with those of many other research, indicating that ultrasonography technology, despite ongoing disputes and controversies, plays a substantial role in foetal weight estimation and remains a credible source for foetal weight diagnosis. According to the findings of the current study, if ultrasound technology and experience are available, the focus should be on providing ultrasound training for foetal weight estimation, as the majority of recent studies agree that ultrasound is the most accurate method. It's also worth noting that the accuracy of foetal weight estimation using ultrasonography in recent research was higher than in studies conducted in the 1990s or even earlier. Ultrasound is now more accurate, with the improvement in USG machine , software and better trained ultrasonologists.

CONCLUSION

In comparison to Insler's and Hadlock's formulas, Johnson's formula was found to be closer to mean actual weight in fetal weight estimation. In terms of producing the least amount of error and having a high correlation coefficient, the ultrasound method was superior. Finally, the study found that sonographic examination is more accurate than clinical examination in assessing fetal growth and estimating fetal weight. Future studies are needed to develop new formulae to predict fetal weight more accurately and to determine the threshold at which combining clinical fetal weight estimates with sonographic estimates improves ultrasound reliability.

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