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Title: FETAL WEIGHT ESTIMATION AT FULL TERM, CLINICAL METHOD VERSUS ULTRASOUND

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Abstract

Aim and objectives: Hence this study is being taken up for clinical as well as USG estimation of birth weight close to delivery date and to find their accuracy when compared to actual birth weight of the neonates.

Materials and method: This Prospective cross-sectional comparative study was conducted at Dr. D. Y. Patil Medical College, Hospital and Research Centre, Pimpri Pune from September 2020 to September 2022. Singleton pregnancy with vertex presentation at term (37-40 weeks) who had gestational age confirmed by dates and early trimester ultrasound scan.

Results: Among study population, 86.4% had a liquor between 8-15 cm. There were 4.5% participants each with liquor less than 8 cms, between 16-20 cms and above 20 cm. Weight estimation by the two methods had no statistically significant difference. However, clinical method was found to be slightly more accurate for estimating the antenatal foetal weight.

Conclusion: Clinical and fetal weight estimation is one of the easiest and cheapest method which can be applied in any setup like in rural areas, where facilities for ultrasound machine may not be available. So, clinical method does have the advantage over the other.

Keywords: Birth weight, Fetal weight estimation, USG,

Introduction

It has long been known that birth weight has a significant role in predicting infant mortality and morbidity in the first year of life[1] and that birth weight has a greater impact on death than gestational age. The management of labour and delivery depends on an accurate pre-delivery examination and calculation of foetal weight, which enables the obstetricians to decide on the kind, time, and route of delivery.[2]

Estimated fetal birth weight will help an obstetrician to make a decision about timing and mode of delivery at an appropriate period of gestation. Estimated fetal weight often decides the mode of delivery; vaginal, instrumental, or cesarean. It also helps to select a patient for trial of labor after cesarean section and patients suspected of having a macrosomic fetus to prevent unforeseen complications like rupture uterus and shoulder dystocia.[3-5]

Prenatal foetal weight estimate, a crucial component of standard obstetric treatment, aids doctors in selecting the best course of action. Clinical foetal weight estimation has been criticised for being less reliable due to observer variance. It is standard practise in obstetrics to utilise ultrasound to estimate the foetal weight before birth. Some researchers praised ultrasound as a good imaging tool for assessing how "big" the foetus is and for rejecting "small for date" babies.[6] Sonographic fetal weight could be estimated by measuring fetal parameters such as the Biparietal diameter (BPD),

Abdominal Circumference (AC), Femur Length (FL), and Head Circumference (HC) and by a combination of several of these fetal parameters.[7]

Ultrasonographic estimation is made by the machine from these parameters using a formula incorporated in the software and this has gained much popularity in the modern age. But this facility may not be available to pregnant women who are residing in rural and remote areas and those who cannot afford it due to financial reasons. In such cases the clinical estimation of fetal weight is the only available method for identification of low birth weight, macrosomia, and anticipation of obstetric complications, thereby decreasing perinatal morbidity and mortality.[8]

Clinical estimation of fetal birth weight is commonly done by "Johnson formula" or "Dare's formula" which can be done very easily even by junior doctors and antenatal nursing staff. It was suggested that the benefit of sonographically estimated foetal weight over clinical methods stems from the fact that sonographic foetal weight estimation is based on objective intra-uterine linear and/or planar measurement of foetal parameters, which eliminates the subjectivity involved with clinical methods. However, several studies consider sonographic foetal weight prediction to be difficult and time-consuming, and they also claim that the modality is negatively impacted by maternal traits including age and weight, anteriorly positioned placentae, oligohydramnios, and racial features. Numerous factors can impact how accurately an ultrasonographic weight estimate is made. At the weight's extremes, studies have revealed a limited level of predictability (low birth weight and macrosomia). On the reliability of ultrasound-based foetal weight measurement at term, there are contradicting results.[9]

In cases like gestational diabetes, breech birth, and borderline pelvis, ultrasound measurement of foetal weight can also play a crucial role in choosing the best delivery method. This will make it easier for patients and medical professionals to decide on the best delivery method.However, superiority of one method over another remains controversial especially at the later stage of pregnancy. Hence this study is being taken up for clinical as well as USG estimation of birth weight close to delivery date and to find their accuracy when compared to actual birth weight of the neonates.

Materials and method

This Prospective cross-sectional comparative study was conducted at Dr. D. Y. Patil Medical College, Hospital and Research Centre, Pimpri Pune from September 2020 to September 2022.

Sample Size

Considering the Correlation coefficient value of clinical and ultrasonographic fetal weight estimation with the actual birth weight of the baby, the calculated sample size using the Computer Programme For Epidemiologists (PEPI) is 75 by the formula:

SAMPLE SIZE (n) = $\underline{P\,(1\text{-}P) * Z^2}$

Two-tailed level of significance= 0.05

Power chosen = 80%

Difference between means =0.1kg

Standard deviation in A (Clinical) =0.361

Standard Deviation in population B (Ultrasound scan) = 0.058

Common correlation coefficient value = 0.817

However, 100 consecutive patients were considered for increasing the power of study.

All data obtained during the study period was entered into excel sheet specifically designed for the study.

Inclusion Criteria

Singleton pregnancy with vertex presentation at term (37-40 weeks) who had gestational age confirmed by dates and early trimester ultrasound scan.

Exclusion criteria

- Polyhydramnios, oligohydramnios
- Antepartum hemorrhage
- Congenital anomalies of fetus
- Obese (Body mass index >30 kilogram/meter^2).
- Pelvic mass including fibroid
- Malpresentation
- IUGR

A total of 100 mothers participated in the study. Systematic random sampling was used to make the selection. The time between the foetal weight's clinical and ultrasound assessment and the infants' birth was three days. Before giving birth, mothers were asked for their age, the date of their last period, the gestational age, and their parity. Using an adult weighing scale, the maternal weight was calculated and recorded. Then, in the labour room, in-utero clinical assessments of foetal weight were performed using a flexible measuring tape that was calibrated in centimetres.

The uterine fundus' highest point and the middle of the top border of the symphysis pubis were used to determine the fundal height. At the umbilicus, the abdominal circumference was gauged. The clinical foetal weights in grammes were calculated using the Dare formula, which is the fundamental height times the abdominal circumference in centimetres. The patients received ultrasonographic estimates of foetal weight after the clinical evaluations. The abdominal sector 3.5 MHz transducer on the real-time ultrasound equipment was employed.

Hadlock developed the method for calculating foetal weight using the biparietal diameter (BPD), head circumference (HC), abdominal circumference (AC), and femoral length measurements (FL). Estimates from the ultrasound and clinical tests were recorded in an excel spreadsheet. The babies' birth weights were recorded as soon as they were delivered. All information gathered throughout the research period was recorded into an excel sheet created especially for the investigation. Data are gathered from the study population utilising a prepared proforma that satisfies the research's goals while also taking into account the inclusion and exclusion criteria.

Dare's method is used for my study, which is as follows:

Birth weight (Grams) = Fundal height (cm) × Abdominal girth (cm). Obstetric ultrasonography was then taken into consideration for comparison after recording the clinically determined foetal weight. As a result, the members of the study team were blinded to the specifics of the sonographic foetal weight. The patient's data detailing clinical measures were not accessible to the sonologist. As a result, the clinical foetal weight estimation information were hidden from the sonologist. Dares' formula, however, was more effective in clinically estimating foetal weight.

Ultrasonographic Method

Hadlock's formula is a formula for estimating fetal weight that is devised by Hadlock on the basis of biparietal diameter (BPD), head circumference (HC),abdominal circumference (AC), and femoral length (FL).The formula is as follows:

Hadlock 3: Log10BW=1.335–0.000034 (ACxFL) +0.00316 x (BPD) + 0.0045 (AC) + 0.01623 (FL).

The ultrasound machine used is real-time with abdominal sector 3.5MHz transducer.

Statistical analysis

SPSS version 25.0 analyzed the Excel data when it was loaded. Quantitative (numerical variables) data was given as mean and standard deviation, whereas qualitative (categorical variables) data was provided as frequency and percentage. The student t-test was used to compare the two groups' mean values, while the chi-square test analyzed their frequency differences. If $p < 0.05$, it was statistically significant.

Results

Table 1: Distribution of participants based on age:

		Frequency	Percent
Age (in years)	<20	9	8.2%
	20-25	45	40.9%
	26-30	39	35.5%
	>31	17	15.5%
Educational status	Educated	60	54.5%
	Illiterate	50	45.5%
Socioeconomic status	Lower	26	23.6%
	Middle	30	27.3%
	Upper	54	49.1%
Location	Rural	40	36.4%
	Urban	70	63.6%
Gravida status	Multigravida	95	86.4%
	Primigravida	15	13.6%

Table 1 shows the distribution of participants based on age. Majority (40.9%) were between age of 20-25 years. 49.1% participants belonged to upper class, 27.3% were from middle class, and 23.6% were from lower class. 63.6% were from urban area and 36.4% from rural area. 95 (86.4%) were multigravida whereas 15(13.6%) were primigravida.

Table 2: Distribution of participants based on Hemoglobin level:

Hemoglobin (gm/dL)	Frequency	Percent
Normal (>11)	56	50.9
Mild (9-10.9)	38	34.5
Moderate (7-8.9)	16	13.63
Severe (<7)	0	0
Total	110	100.0

Table 2 shows the distribution of participants based on hemoglobin level. Most (50.9%) of them had normal level of hemoglobin above 11gm/dL.

Table 3: Distribution of participants based on Liquor amnii:

Liquor amnii (in cm)	Frequency	Percent
<8	5	4.5
8-15	95	86.4
16-20	5	4.5
>20	5	4.5
Total	110	100.0

Table 3 shows the distribution of participants based on liquor amnii. 95(86.4%) had a liquor between 8-15cm. there were 5(4.5%) participants each with liquor less than 8cm, between 16-20cm and above 20cm.

Table 4: Mean comparison of clinical and actual birthweight of baby:

Baby weight	Mean	Std. Deviation	Mean difference	p-value
Clinical	2758.96	587.38	6.66	0.932*
Actual	2752.30	575.87		
USG	2788.25	595.32	35.95	0.649*
Actual	2752.30	575.87		

*Independent t-test; P<0.05 is significant

Table 4 shows the mean comparison of clinical and actual baby weight. The mean clinical baby weight was 2758.96±587.377 and mean actual baby weight was 2752.30±575.865. There was no statistically significant difference between the clinical and actual baby weight.

The mean USG baby weight was 2788.25±595.324 and mean actual baby weight was 2752.30±575.865. There was no statistically significant difference between the clinical and actual baby weight.

Discussion

Estimation of the fetal weight before delivery can play a significant role in both prenatal, intrapartum as well as postnatal care. It becomes even more crucial as the mother approaches the date of delivery as it provides important information for proper planning during birth.[10,11]

In the present study, majority of the mothers are in the age group of 20-25 years, with 40.9% of the participants. And two extremes of age showing 15.5% and 8.2% in 31 years and above and 20 years and below age group respectively.[12] The distribution of cases according to age group in our study is similar to a study by Alfred Kwesi et al (shown in table below). In a study by Chiara Di Gravio et al., it was found that younger age mother generally have low birth weight babies. It increases the chances of neonatal mortality and morbidity as well.[13] In terms of higher age, in a study by Shanshan Wang et al., the fetal birth weight increases upto 34 years of maternal age with increased

incidence of macrosomic babies.[14] Therefore, there is significant evidence of adverse pregnancy outcome in both ends of the spectrums of age of mother.

The distribution of the mothers with respect to education in the current study shows that 45.5% were illiterate and 54.5% of them were educated. The positive role of the educational status of the mother is well known. A study by Timothy B. Gage et al. has inferred by logistic regression test that the mortality reduces when the mother is educated and the trend is seen with an increase in education level as well.[15] This is further substantiated by a study by Din et al. which documents that as the maternal education increases, there is not only a decrease in the infant mortality but also an increase of the weight of the newborn.[16]

The distribution of the socioeconomic status of a person also has a considerable effect on the fetal weight. In the current study, 23.6% of the mothers belonged to the lower socioeconomic class while 27.3% were from the middle socioeconomic class and 49.1% from the upper socioeconomic class. In a study conducted by Alfred Kwesi et al. shown women with poor socioeconomic status have low birth weight babies[17]. This maybe due to mother having a lower nutritional intake during pregnancy in lower socioeconomic strata which effects on birth weight of the baby.

Majority of the mother in the present study belonged to the urban area, which is, 63.6%, while 36.4% belonged to the rural area. There have been multiple studies that have proven that mothers who belong to the rural areas had more chances of having a low birth weight baby as compared to urban setup. A logistic regression analysis in terms of odds ratio in a study by Meresa Gebremedhin et al., mothers from the rural areas have 4 times more probability of having a fetus with a low birth weight when compared to the mothers residing in urban cities.[18] There are a number of factors that can be attributed to it. Lack of accessibility to medical facilities, awareness about nutrition and availability of health information are the important factors for poor pregnancy outcome. Distribution of the cases in their study and in our study is shown in table below.

Distribution of cases according to hemoglobin level in our study found majority of the mothers had normal hemoglobin level that is 50.9% of the participants. 35.4% had mild anemia and 13.63% had moderate anemia and none had severe anemia in our study. Similar distribution of cases of haemoglobin level was found by a study by Leila Sekhavat et al. where they have demonstrated a close relation between hemoglobin level and birth weight of the baby.[19]

In the current study, most of the mothers had a normal liquor range of 5-25 centimeters, which was a healthy 86.4%, while 4.5% were on the either sides of the extremes. However, there are no substantial evidence that ascertains a relationship between the amount of amniotic fluid and the fetal weight. In cases of oligohydramnios group, there is 54.1% chance of overestimating actual birth weight was noted in studies by Karahanoglu et al. and Blitz et al.[20,21] In polyhydramnios group clinical method using Dares formula might a false estimation of fetal weight as abdominal circumference and symphysiofundal height are the parameters taken into consideration. A study by Nitin Wadnere et al. concludes the absence of association between them and it has been confirmed by a pair measurement study by P Owen et al. as well.[22,23]

When a comparison was made between the estimation of weight by the Ultrasonography (USG) and the actual weight of the baby, the current study showed a slight deviation between them. The actual average weight of babies were 2752.30 grams while it was estimated to be around 2788.25 grams by USG and 2758.96 grams by clinical method. Though there is no statistically significant difference in the two methods with actual birth weight, but clinical estimation was mathematically more closer to actual birth weight.

In fact, a few studies have proven that the USG method is more accurate in determining fetal weight while some other advocate the clinical method as being equal or even superior in estimation. In a study by Bhandary P et al., USG method has been found to be more accurate in weight estimation.[24] Contrastingly, the study by Khani S et al. proves that the clinical method is more

accurate.[25] There are a number of factors that can potentially influence the result and it ranges from the formula used for the weight determination to the number of days prior to delivery when the estimation was made.

One limitation of the study is the limited sample size which may lead to certain confounding factors influencing the result. Therefore, a more comprehensive research with an increased sample size can be helpful in determining the accuracy of the two methods.

Conclusion

Though clinical and ultrasound fetal weight estimation was found to be similar and were close to actual birth weight. However, clinical and fetal weight estimation is one of the easiest and cheapest method which can be applied in any setup like in rural areas, where facilities for ultrasound machine may not be available. So, clinical method does have the advantage over the other.

References

1. Steer P, Alam MA, Wadsworth J, Welch A. Relation between maternal haemoglobin concentration and birth weight in different ethnic groups. BMJ. 1995; 310(6978):489-91.
2. Chauhan SP et al. Limitations of clinical and sonographic estimates of birth weight: experience with 1,034 parturients. J Obstet Gynecol. 1998;91:72–7.
3. Juozas Kurmanavicius , Tilo Burkhardt, Josef Wisser, Renate Huch. Ultra-sonographic fetal weight estimation: accuracy of formulas and accuracy of examiners by birthweight from 500 to 5000 g. Journal of perinatal medicine, 2004; 32:155–61.
4. Ratanasiri T et al. Comparison of the accuracy of ultrasonic fetal weight estimation by using the various equations. J Med Assoc Thai. 2002; 85:962–7.
5. Jolly MC, Sebire NJ, Harris JP, Regan L, Robinson S. Risk factors for macrosomia and its clinical consequences: a study of 350,311 pregnancies. Obstet Gynecol Reprod Biol. 2003;111(1):9-14.
6. Coomarasamy A, Connock M, Thornton J, Khan KS. Accuracy of ultrasound biometry in the prediction of macrosomia: a systematic quantitative review. BJOG 2005;112(11): 1461-1466.
7. Shamley KT, Landon MB. Accuracy and modifying factors for ultrasonographic determination offetal weight at term. J Obstet Gynecol. 1994;84:926-930.
8. Ben-Haroush A et al. Accuracy of sonographically estimated fetal weight in 840 women with different pregnancy complication sprior to induction of labor. Ultrasound Obstet Gynecol. 2004, 23(2):172–176.
9. Chauhan SP, Magann EF. Screening for fetal growth restriction. Clin Obstet Gynaecol 2006;49:284-94.
10. Chauhan S P, Hendrix N W, Magann E F. Limitations of clinical and sonographic estimates of birth weight: experience with 1034 parturients. Obstet Gynecol. 1998;91:72–77.
11. Goldenberg RL, Cutter GR, Nelson KG, Foster J. Effects of very low birth weights on fetal and neonatal mortality rates in Alabama. Public Health Rep. 1989 Sep-Oct;104(5):488-92.
12. Tela FG, Bezabih AM, Adhanu AK. Effect of pregnancy weight gain on infant birth weight among mothers attending antenatal care from private clinics in Mekelle City, Northern Ethiopia: A facility based follow-up study. PLoS One. 2019 Mar;14(3):e0212424.
13. Di Gravio C, Lawande A, Potdar RD, Sahariah SA, Gandhi M, Brown N, Chopra H, Sane H, Kehoe SH, Marley-Zagar E, Margetts BM, Jackson AA, Fall CHD. The Association of Maternal Age with Fetal Growth and Newborn Measures: The Mumbai Maternal Nutrition Project (MMNP). Reprod Sci. 2019 Jul;26(7):918-927.
14. Wang, S., Yang, L., Shang, L. et al. Changing trends of birth weight with maternal age: a cross-sectional study in Xi'an city of Northwestern China. BMC Pregnancy Childbirth. 2020;20:744.

15. Gage TB, Fang F, O'Neill E, Dirienzo G. Maternal education, birth weight, and infant mortality in the United States. Demography. 2013 Apr;50(2):615-35.
16. Din-Dzietham R, Hertz-Picciotto I. Infant mortality differences between whites and African Americans: The effect of maternal education. American Journal of Public Health. 1998; 88:651–656.
17. Manyeh, A.K., Kukula, V., Odonkor, G. et al. Socioeconomic and demographic determinants of birth weight in southern rural Ghana: evidence from Dodowa Health and Demographic Surveillance System. BMC Pregnancy Childbirth. 2016;16:160.
18. Gebremedhin, M., Ambaw, F. Admassu, E. et al. Maternal associated factors of low birth weight: a hospital based cross-sectional mixed study in Tigray, Northern Ethiopia. BMC Pregnancy Childbirth. 2015;15:222.
19. Leila Sekhavat, RobabDavar, Somaiasadat Hosseinidezoki. Relationship between maternal hemoglobin concentration and neonatal birth weight, Hematology. 2011;16(6):373-376.
20. Matthew J Blitz , Burton Rochelson , Leah B Stork , Stephanie Augustine , Meir Greenberg, Cristina P Sison , Nidhi Vohra . Effect of maternal body mass index and amniotic fluid index on the accuracy of sonographic estimation of fetal weight in late gestation. Am J Perinatol, 2018;35(13):1235-1240.
21. Ertugrul Karahanoglu , Orhan Altinboga, Funda Akpinar, Ismail Burak Gultekin, Safak Ozdemirci, Aysegul Akyol, Serdar Yalvac. The effect of the amniotic fluid index on the accuracy of ultrasonographic-estimated fetal weight Ultrasound Q. 2017;33(2):148-152.
22. Wadnere N, Kosta S, Kumar R. Association between fetal weight and amniotic fluid index in women of Central India. Adv Biomed Res. 2014 Nov;29(3):243.
23. Owen P, Osman I, Farrell T. Is there a relationship between fetal weight and amniotic fluid index? Ultrasound Obstet Gynecol. 2002 Jul;20(1):61-3.
24. Bhandary A, Pinto P J, Shetty A P. Comparative study of various methods of fetal weight estimation at term pregnancy. J ObstetGynecol Ind. 2004;54:336–339.
25. Khani S, Ahmad-Shirvani M, Mohseni-Bandpei M A. Comparison of abdominal palpation, Johnson’s technique and ultrasound in the estimation of fetal weight in Northern Iran. Midwifery. 2011;27:99–103.