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ESTIMATION OF FETAL WEIGHT BY CLINICAL METHOD, ULTRASONOGRAPHY AND ITS CORRELATION WITH ACTUAL BIRTH WEIGHT IN TERM PREGNANCY.

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ABSTRACT **Introduction:** The Accurate estimation of foetal weight is of paramount importance in modern obstetrics for management of labour and delivery. During the past two decades estimated foetal weight is incorporated into the standard routine antepartum evaluation of high-risk pregnancy & deliveries. Present study was conducted to estimation fetal weight by clinical method and by ultrasonography and to find out its correlation with actual birth weight in term pregnancy. **Material and Methods:** The cross-sectional observational study was conducted in outpatient or inpatient Obstetric section of Department of Obstetrics & Gynaecology and USG section of Department of Radio-diagnosis of A.C.P.M. Medical College and Hospital, Dhule, Maharashtra. **Observations & Results:** Most of the study subjects were between 24-28 years of age 53.5% with mean age of 24.71 years. The mean Hadlock weight was 2705 ± 469 gm, while the actual birth weight was 2805 ± 465 gm. The difference was found to be statistically significant ($p<0.05$). The difference in Dare's clinical method was found to be 73.3 ± 49.8 gm, while the Hadlock difference was found to be 103.1 ± 77.4 gm. There was a very strong, positive, statistically significant correlation seen between Dare Weight and Actual Weight ($p<0.05$). There was a very strong, positive, statistically significant correlation seen between Hadlock Weight and Actual Weight ($p<0.05$). **Conclusion:** Thus, major finding from this study is that clinical estimation of fetal weight is as accurate as the ultrasonographic method of estimation within the normal birth weight range. Our study has important implication as in developing country like India, where ultrasound is not available in many health care delivery systems specially in rural areas where clinical method is easy, cost effective, simple, accurate and can be used even by midwives.

KEYWORDS : Birth weight, foetal weight, Clinical method.

Introduction:

The Accurate estimation of foetal weight is of paramount importance in modern obstetrics for management of labour and delivery. During the past two decades estimated foetal weight is incorporated into the standard routine antepartum evaluation of high-risk pregnancy & deliveries. Management of diabetic pregnancy, vaginal birth after caesarean section and breech presentation is guided by the estimated foetal weight. [1,2]

Basically, there are three groups of birth weights that are important to the clinicians; thus, the low birth weight, the normal birth weight, and the macrosomic babies. Since neonatal complications are more associated with low birth weight and labor abnormalities as well as neonatal complications with fetal macrosomia, accurate estimation of fetal weight is of greater importance in taking management decisions as regards delivery of these extremes of foetal weight.[3,4]

High rate of perinatal mortality (40 per 1000) is still a major concern in our country while compared to developed nations (3-4/1000). A large proportion of this problem is related to birth weight which remains the single most important parameter that determines the neonatal survival.[5,6,7,8]

Categorization of fetal weight into either small or large for gestational age may lead to time obstetric interventions that collectively represent significant departure from routine ante-natal care.

Perinatal morbidity and mortality may decrease if timely intervention is undertaken.[2,3,4,9,10]The available techniques can be broadly classified as:

(a) Clinical Methods: In clinical methods tactile assessment of foetal size, clinical risk factor estimation, Maternal self estimated foetal weight and Prediction equations of birth weight are included
(b) Imaging Methods: This includes ultrasonography and magnetic resonance imaging.

Some investigators consider sonographic estimates to be superior to clinical estimates others confer similar level of accuracy. Several studies indicate that physician conducted physical examination of pregnant women and estimated foetal weight are superior to ultrasonic foetal measurement. Williams textbook concludes that estimation of foetal weight from ultrasonic measurements is not proven to be reliable.[11] It even carries a risk of sonologically induced chromosomal anomalies.

All techniques which are currently available for estimating foetal weight have significant degree of inaccuracy. Various studies have been done to compare the accuracy of these different methods of fetal weight estimation. It is required that accurate estimation of foetal weight occurs in advance of deliveries so as to limit the potential complications associated with birth of both small and excessively large foetuses.[12]

This study aims at resolving these controversies and at determining the more accurate method of foetal weight estimation of the two in our environment, thereby improving management of labour and delivery.

Aim & Objective:

To estimation fetal weight by clinical method and by ultrasonography and to find out its correlation with actual birth weight in term pregnancy.

Objectives:

1. To estimate fetal weight by clinical method and correlate it with actual birth weight.
2. To estimate fetal weight by ultrasonography and correlate it with actual birth weight.
3. To compare the accuracy of clinical method and ultrasonography in fetal weight determination in relation to actual birth weight.

Material and Methods:

Study Site: The study was conducted in outpatient or inpatient Obstetric section of Department of Obstetrics & Gynaecology and USG section of Department of Radio-diagnosis of A.C.P.M. Medical College and Hospital, Dhule, Maharashtra.

Study Population: All pregnant women between the age of 18-40 years with singleton, cephalic, term pregnancy coming to the institution during the study period.

Study Design: This was a prospective, cross-sectional, comparative study.

Sample Size:

According to the study done by Tomaret al (2017)[13]they had reported a

proportional difference of 14% in measurement of fetal weight between clinical and by ultrasound. Considering the same our sample size calculation revealed that 179 patients was required to detect a proportional difference of 14% in percentage error of "Upto 5% error" category in birth weight measured by clinical and USG methods from actual birth weight, at an alpha of 0.05 with power of 80%.

P values < 0.05 were considered to indicate statistical significance. Hence, we intend to take more than 179 patients in the study.
Convenient sampling technique was used in the present study.

Time Frame to Address the Study: From the time of approval from Institutional Ethics committee to October 2018.

Eligibility Criteria:
(Inclusion criteria)
- All pregnant women above 18 years of age attending ANC OPD\IPD, with singleton viable pregnancy at term or coming in early stage of labour (LATENT PHASE).
- All pregnant women and/or her legally acceptable representative willing to provide their voluntary written informed consent to participate in the study and to use the actual birth weight of the newborn child for the purpose of the study.

(Exclusion criteria)
- Pregnant women with foetal congenital anomalies, multiple pregnancies, coming in late phases of labour, malpresentation, with pelvic mass, intra-uterine death, Polyhydroamnios/Oligohydroamnios.
- All pregnant women and/or her legally acceptable representative not willing to provide their voluntary written informed consent to participate in the study and also to use the actual birth weight of the newborn child for the purpose of the study

All women satisfying inclusion criteria and none of the exclusion criteria was included in the study.

Methodology:
All the women and/or her legally acceptable representative were explained about the study in detail in their own language, including its risks/benefits, procedures, etc. After obtaining their verbal consent to participate, a voluntary written informed consent was obtained from them for participation in the study.

For every ANC woman coming in OPD complete history taking and examination of the patient will be done.

Antenatal women having completed 30 weeks of gestation will undergo clinical estimation of fetal weight by Dares formula, i.e. Wt (gms) = SFH * AG (cm)

Ultrasound assessment of fetal weight was done by Hadlock method.
If woman delivers within 7 days of clinical and USG estimation of fetal weight, actual birth weight was recorded after delivery.

If patient does not deliver within one week (7 days), was re-assessed. Clinical and USG assessment was continued every week till the patient delivers.

All the above findings were noted in pre-described proforma.

Data Collection Method:
Customised proforma will be used for collection of data.

Outcome Measures:
- Fetal weight by clinical method
- Fetal weight by ultrasonography
- Birth weight
- Mode of Delivery

Statistical analysis:
The data was initially entered into the Microsoft Excel for calculation purpose. Then online statistical software was used for calculating the p values. Unpaired 't' test was used for comparing the mean fetal weight obtained clinically and by ultrasound and its comparison with the actual birth weight. If any additional statistical tests are required at the time of final analysis, they were added. A p value of < 0.05 was considered as statistically significant.

Financial Inputs and Funding:
All the tests / procedures being carried out for the measurement of weight in these women are routinely done being the part of management protocol. Hence, there was no additional financial burden either on the woman or on the institution. Also, all study related expenses was borne by the investigator herself.

Ethical Considerations:
Prior to the initiation of study in the hospital, the protocol of the present study was submitted to the Institutional Ethics Committee of A.C.P.M. Medical College and Hospital, Dhule, Maharashtra. Only after getting their approval, present study was undertaken. Also, before a woman is taken into the study, a voluntary written consent was obtained from either women or her legally acceptable representative(s).

Observations and Results:
A total of 200 patients were studied during the period from February 2022 to November 2022 in the Department of Obstetrics and Gynaecology and Sonography Unit of Radiodiagonosis at a tertiary health care centre.

Table 1: Demographic& Clinical Profile of patients

		No. of patients	Percenatge
Age-Group	19-23	72	36%
	24-28	107	53.5%
	29-34	21	10.5%
Gestational age (weeks)	37-38	104	52%
	39-40	89	44.5%
	41-42	7	3.5%
Registration Status	Booked	137	68.5%
	Unbooked	63	31.5%
Gravida	Primi-gravida	76	38.0%
	2nd Gravida	78	39.0%
	3rd Gravida	32	16.0%
	4th Gravida	14	7.0%
Mode of delivery	FTND	121	60.5%
	FTV	9	4.5%
	LSCS	70	35.5%

Out of 200 patients examined, 72 patients were in the age group of 19-23 years at 36%. 107 patients were in the age group of 24-28 years at 53.5% and 21 patients were in the age group of 29-35 years at 10.5%. Most of the study subjects were between 24-28 years of age 53.5% with mean age of 24.71 years.

Out of 200 patients studied 104 patients were within the gestation age of 37-38 weeks at 52%. 89 patients were within the gestation age of 39-40 weeks at 44.5% and 7 patients were within the gestation age of more than 40 weeks at 3.5%.

Median period of gestation was 38 weeks with most of the females between 37-38 weeks of gestation (52%).

Maximum patients were booked (137) at 68.5%, while 63patients were unbooked at 31.5%. Out of 200 patients, 76 patients were primigravida at 38%, 78 patients were 2nd gravida at 39%. 32 patients were 3rd gravida at 16% and 14 patients were 4th gravida at 7%.

Maximum numbers of patients were 2ndgravida at 39% followed by primigravida at 38%. Maximum patients underwent FTND (121) at 60.5% followed by LSCS (70) at 35.5%. 9 patients underwent ventouse assisted delivery at 4.5%.

Table 2 : Comparison of weight assessed by Dare Criteria and the actual birth weight

	No.	Mean ± SD	't' value	P value
Dare Weight Vs Actual Weight	200	2868 ± 461	1.36, df=398	0.173, NS
	200	2805 ± 465		
Hadlock Weight Vs Actual Weight	200	2705 ± 469	2.14, df=398	0.033*
	200	2805 ± 465		
Dare weight Difference Vs Hadlock weight Difference	200	73.3 ± 49.8	4.58, df=398	0.000*

	200	103.1 ± 77.4		
Dare Error % Vs Hadlock Error %	200	2.69 ± 2.24	4.41, df=398	0.000*
	200	3.99 ± 3.53		

The Dare weight was 2868 ± 461 gm, while the actual weight was 2805 ± 465 gm. The difference was found to be statistically not significant (p>0.05), showing that a comparable Dare and acute birth weight.

The mean Hadlock weight was 2705 ± 469 gm, while the actual birth weight was 2805 ± 465 gm. The difference was found to be statistically significant (p<0.05), showing a higher mean actual weight in comparison to the Hadlock weight. The mean birth weight assessed by Hadlock was found to be lower in comparison to the actual birth weight.

The Dare difference was found to be 73.3 ± 49.8 gm, while the Hadlock difference was found to be 103.1 ± 77.4 gm. The difference was found to be statistically significant (p<0.05), showing a higher Hadlock difference in comparison to the Dare difference. The Hadlock showed a higher difference from the actual birth weight.

The mean Dare Error % was 2.69 ± 2.24, while Hadlock Error% was found to be 3.99 ± 3.53. The difference was found to be statistically significant (p<0.05), showing a higher Hadlock Error % in comparison to the Dare Error %.

Table 3 : Distribution of patients according to Dare Error % & Hadlock Error %

Percentage	Dare Error%		Hadlock Error %	
	No.	%	No.	%
<5%	192	96.0	153	76.50
5-10%	7	3.50	43	21.50
10-15%	0	0.00	2	1.00
15-20%	0	0.00	1	0.50
>20%	1	0.50	1	0.50
Total	200	100.0	200	100.0

There were 192 (96.0%) patients in the Dare Error% group < 5%, 7 (3.50%) patients were in the Dare Error% group 5-10% and only 1 (0.50%) patient in the Dare Error% group more than 20%. Majority of the patients were in the Dare Error% group < 5%.

There were 153 (76.50%) patients in the HadlockError% group < 5%, 43 (21.50%) patients in the Hadlock Error% group 5-10%, 2 (1.00%) patients in the Hadlock Error% group 10-15%, 1 (0.50%) patient each in the Hadlock Error% group 15-20% and >20%. Majority of the patients were in the Hadlock Error% group < 5%, followed by 5-10%.

Table 4 : Correlation between Dare, Hadlock and Actual birth Weight in overall patients

Pair		'r' value	P value
Overall	Dare Weight – Actual Weight	0.991	0.000*
	Hadlock Weight – Actual Weight	0.985	0.000*
Actual Birth Weight < 2.0 Kg)	Dare Weight – Actual Weight	0.973	0.000*
	Hadlock Weight – Actual Weight	0.973	0.000*
Actual Birth Weight 2.0-2.5 Kg	Dare Weight – Actual Weight	0.356	0.066
	Hadlock Weight – Actual Weight	0.343	0.080
Actual Birth Weight 2.5-3.0 Kg	Dare Weight – Actual Weight	0.929	0.000*
	Hadlock Weight – Actual Weight	0.868	0.000*
Actual Birth Weight 3.0-3.5 Kg	Dare Weight – Actual Weight	0.964	0.000*
	Hadlock Weight – Actual Weight	0.890	0.000*
Actual Birth Weight 3.5-4.0 Kg	Dare Weight – Actual Weight	0.960	0.000*
	Hadlock Weight – Actual Weight	0.753	0.000*

Pearson Coefficient of Correlation, p value < 0.05 was taken as statistically significant

Overall: There was a very strong, positive, statistically significant correlation seen between Dare Weight and Actual Weight (p<0.05), showing that actual weight varies according to the Dare weight. If Dare weight increased, actual weight also increased and if Dare weight decreased, actual weight also decreased. There was a very strong, positive, statistically significant correlation seen between Hadlock Weight and Actual Weight (p<0.05), showing that actual weight varies according to the Hadlock weight. If Hadlock weight increased, actual weight also increased and if Hadlock weight decreased, actual weight also decreased.

Actual Birth Weight < 2.0 Kg: There was a very strong, positive, statistically significant correlation seen between Dare Weight and Actual Weight (p<0.05), showing that actual weight varies according to the Dare weight. If Dare weight increased, actual weight also increased and if Dare weight decreased, actual weight also decreased. There was a very strong, positive, statistically significant correlation seen between Hadlock Weight and Actual Weight (p<0.05), showing that actual weight varies according to the Hadlock weight. If Hadlock weight increased, actual weight also increased and if Hadlock weight decreased, actual weight also decreased.

Actual Birth Weight 2.0-2.5 Kg: There was a very weak, positive, statistically not significant correlation seen between Dare Weight and Actual Weight (p>0.05). There was a very weak, positive, statistically not significant correlation seen between Dare Weight and Actual Weight (p>0.05).

Actual Birth Weight 2.5-3.0 Kg: There was a very strong, positive, statistically significant correlation seen between Dare Weight and Actual Weight (p<0.05), showing that actual weight varies according to the Dare weight. There was a very strong, positive, statistically significant correlation seen between Hadlock Weight and Actual Weight (p<0.05), showing that actual weight varies according to the Hadlock weight.

Actual Birth Weight 3.0-3.5 Kg: There was a very strong, positive, statistically significant correlation seen between Dare Weight and Actual Weight (p<0.05), showing that actual weight varies according to the Dare weight. There was a very strong, positive, statistically significant correlation seen between Hadlock Weight and Actual Weight (p<0.05), showing that actual weight varies according to the Hadlock weight.

Actual Birth Weight 3.5-4.0 Kg: There was a very strong, positive, statistically significant correlation seen between Dare Weight and Actual Weight (p<0.05), showing that actual weight varies according to the Dare weight. There was a very strong, positive, statistically significant correlation seen between Hadlock Weight and Actual Weight (p<0.05), showing that actual weight varies according to the Hadlock weight.

Discussion:

Fetal growth restriction and macrosomia both increase the risk of perinatal morbidity and mortality and of long-term neurologic and developmental disorders. Identification of fetal growth restriction after 37 weeks gestation is an indication for delivery to reduce the chance of foetal mortality. Similarly, diagnosis of macrosomia is important as it frequently leads to delivery by means of caesarean section. This is to reduce risk of failed vaginal delivery and shoulder dystocia. Accurate prediction of foetal weight has been of great interest in obstetrics. As direct measurement of foetal weight is not possible, it needs to be estimated from foetal and maternal anatomical characteristics. Many workers have used different methods to measure foetal weight. Of the various methods available today, the most-commonly used are the clinical and ultrasonographic methods. But, very few studies have compared the accuracy of these two methods of estimation of foetal weight by clinical and ultrasonic measurements.[12]

In routine obstetric practice, it is prevalent to estimate fetal weight by measuring the symphysio-fundal height at each antenatal visit. And then we refer on for a sonographic estimation if it varies from the normal range for the gestation. Estimation of fetal weight by palpation of the abdomen is rarely done in clinical practice. This is because we have come to rely heavily on ultrasonography, which is usually readily available. Early expectation that this method might provide an objective standard for identifying foetuses of abnormal size for gestational age was recently proven of less significance by prospective studies that showed sonographic estimates of fetal weight to be no

better than clinical palpation for predicting fetal weight.[11,12,13]

In present study, on comparing prospectively clinical and sonographic methods of predicting birth weight prior to induction of labour at term, we found that clinical estimates appear to be as accurate as ultrasonographic ones. There are varying differences in various studies comparing accuracy of methods estimating fetal weight. Some studies show USG to be a better method for foetal weight estimation.[14] Other studies like ours found no significant difference between clinical methods and USG.[15]

Study population resembled various studies with following characteristics:

Most of the study subjects were between 24-28 years of age (53.5%) with mean age of 24.71 years.

Median period of gestation was 38 weeks with most of the females between 37-38 weeks of gestation (52%). About one third of the study subjects were primigravida (38%) while 39%, 16% and 7% subjects were 2nd, 3rd and 4th gravida respectively. Maximum patients were booked (137) at 68.5%, while 63 patients were unbooked at 31.5%. Maximum patients underwent FTND (121) at 60.5% followed by LSCS (70) at 35.5%. 9 patients underwent ventouse assisted delivery at 4.5%.

Mean predicted & Actual Birth Weight: USG vs Clinical Methods:

In present study, mean birth weight as predicted by Dare's and Hadlock's formulae was 2868 grams with S.D of 461 grams and 2705 grams with S.D of 469 grams respectively and the mean actual birth weight was 2805 grams with S.D of 465 grams. On statistical analysis there was no significant difference between Dare and actual mean birth weight with a 'p' value of 0.173. On the contrary mean birth weight by Hadlock formula differed significantly with the actual weight. Our findings are in accordance with study by Parvathavarthini K et.al were the mean birth weight as predicted by Dare's and USG method was 3363 grams and 3175 grams respectively while the mean actual birth weight was 2984 grams.[14]

Aruna et. al predicted mean birth weight by Dare's and Hadlock's formula as 2959 grams and 3003 grams respectively and actual birth weight being 2902 grams. On paired 't' test between Dare and actual mean birth weight 'p' value was 0.060 non-significant and with Hadlock's was significant.[16] Siddiqua S et al observed the weight by clinical and sonographic methods as 3.59 kg and 2.95 Kg while the actual birth weight was 3.22 Kg.[17] Bhandary A et al in their study also observed higher mean birth weight with clinical than USG method (3.11 and 2.69 Kg; p>0.05)with mean actual birth weight as 2.99 Kg.[18]

Table 5 : Comparison of Weight Predicted & Actual

Studies	Birth Weight Prediction		Actual Weight
	Clinical	USG	
Shittu AS et al[12]	3.29	3.20	3.25
Siddiqua et al[17]	3.59	2.95	3.22
Bhandary Amritha et al[18]	3.11	2.69	2.99
Parvathavarthini K et al[19]	3.63	3.17	2.98
Aruna et. Al[16]	2.95	3.00	2.90
Maria et al[20]	3.67	3.29	3.36
Tushar Raghuvanshi et al[21]	2.69	2.57	2.59
Present Study	2.86	2.70	2.80

Comparison of difference of weight from the actual birth weight as assessed by Dare and Hadlock in various studies:

The difference of weight from the actual birth weight i.e. the average error in our study by Dare's method was found to be 73.3 ± 49.8 gm, while the Hadlock difference was found to be 103.1 ± 77.4 gm. The difference was found to be statistically significant (p<0.05), showing a higher Hadlock difference in comparison to the Dare difference. Similarly, Bhandari Amritha et al found the error to be 224 grams by Dare's and 299 grams by Hadlock's method.[18] Also, Aruna et al found the mean difference to be 56 grams and 100grams respectively by Dare's and Hadlock's respectively.[16] Our findings are similar with both the above mentioned studies showing lesser difference with Dare's than Hadlock's.

On the contrary, some studies namely, Siddiqua et al[17] , Maria et al(20), Tushar Raghuvanshi et al[21] and Parvathavarthini et al19) conferred lesser error with USG than clinical methods.

Table 6 : Weight Error in grams in various studies.

Studies	Average error by Dare's	Average error by Hadlock's
Bhandari Amritha et al[18]	224 gms	299 gms
Aruna et al[16]	56 gms	100 gms
Siddiqua et al[17]	291 gms	310 gms
Parvathavarthini et al[19]	379 gms	190 gms
Maria et al[20]	436 gms	312 gms
Tushar Raghuvanshi et al[21]	311 gms	131 gms
Present study	73.3 gms	103.1 gms

In the present study, mean Dare Error% was 2.69 ± 2.24, while Hadlock Error% was found to be 3.99 ± 3.53. The difference was found to be statistically significant (p<0.05), showing a higher Hadlock Error % in comparison to the Dare Error %. Our findings are similar to those obtained by Aruna et al[16], Parvathavarthini et al [19] and Tushar Raghuvanshi et al.[21] These studies showed a higher percentage error with usg than with Dare's prediction of actual birth weight. In sharp contrast, Siddiqua et al[17], Shittu AS et al[12] and Mario et al(20) have found lesser percentage error with usg than with dare's formula.

Table 7 : Various studies have shown following percentage errors:

Studies	% Error by Dare's method	% Error by USG
Siddiqua et al[17]	20.1%	12%
Shittu AS et al[12]	4.5%	1.4%
Aruna et al[16]	1.9%	3.5%
Parvathavarthini et al[19]	6.4%	12.7%
Maria et al[20]	14%	9%
Tushar Raghuvanshi et al[21]	6%	17.5%
Present study	2.69%	3.99%

Present study showed that in low-birth-weight group <2500g clinical method was less reliable than the ultrasonographic method. However, in the normal birth weight group i.e. 2500g-<4000gm, the clinical method was more reliable. Our findings are in concordance with Shittu et al.[12] Shittu et al found that in the middle range of birth-weight (2,500-<4,000 g), the clinical method systematically overestimated birth-weight. In the high-birth-weight (≥4,000 g) group, the clinical method systematically overestimated birth-weight, while the ultrasonic method underestimated it. The accuracy of clinical estimation obtained in this study was highest in the birth-weight range of 2,500-<4,000 g and lowest for the low-birth-weight group (<2,500 g).

Table 8: Comparison of studies for accuracy of birth weight of clinical & USG methods in various

Error % (Dare)	Siddiqua et al[17]	Maria et al[20]	Aruna et al[16]	Parvathavarthini et al[19]	Present study
Upto 5%	36%	-	86.64%	-	96%
Upto 10%	73%	57%	97.3%	39%	99.5%
Upto 15%	90%	-	-	-	99.5%
Upto 20%	96%	-	100%	-	99.5%
>20%	100%	-	-	-	100%

The findings of error % (Dare) in our study was similar to findings in study of Aruna et al, where 97.3% of fetal weight estimate falling within 10% margin of error. In our study 99.5% Dare estimates were within 10% error. However, Siddiqua et al[17], Maria et al(20) and Parvathavarthini et al[19] conferred only 73%, 57% and 39% respectively within 10% error for Dare estimates.

Table 9 : Comparison of Hadlock error percentage in various studies

Error % (Hadlock)	Siddiqua et al[17]	Maria et al[20]	Aruna et al[16]	Parvathavarthini et al[19]	Present study
Upto 5%	35%	-	94.6%	-	76.5%
Upto 10%	73%	65%	100%	45%	98%

Upto 15%	88%	-	-	-	99%
Upto 20%	93%	-	-	-	99.5%
>20%	100%	-	-	-	100%

Aruna et al[16] found a very high level of accuracy for USG by 94.6% estimates by USG within 5% of actual birth weight. Our study on the other hand assigned 76.5% estimates by USG within 5% of actual birth weight.

Table 10 : Comparison of correlation co-efficient between actual birth weight with Dare's and USG estimated weights in different studies

Studies	Correlation coefficient	
	Dare with actual weight	Hadlock with actual weight
Shittu et.al[12]	+0.78	+0.74
Siddiqua et al[17]	+0.98	+0.86
Aruna et al[16]	+0.379	+0.701
Parvathavarthini et al[19]	+0.69	+0.66
Present study	+0.991	+0.985

Pearson correlation analysis implied that there was a very strong, positive, statistically significant correlation seen between Dare Weight and Actual Weight ($p<0.05$), showing that actual weight varies according to the Dare weight. If Dare weight increased, actual weight also increased and if Dare weight decreased, actual weight also decreased. Similarly, there was a very strong, positive, statistically significant correlation seen between Hadlock Weight and Actual Weight ($p<0.05$), showing that actual weight varies according to the Hadlock weight. If Hadlock weight increased, actual weight also increased and if Hadlock weight decreased, actual weight also decreased. Thus, both the methods of estimation are comparable.

Our finding for correlation coefficient were similar to various other studies indicating a strong correlation between Dare and actual weight and Hadlock and actual weight.

Despite the differences in study design, our findings are in consonance with those reported by others that the accuracy of clinical estimation of birthweight is similar if not better than that of ultrasonic estimation[17,19].

Clinical estimation of birth-weight is as accurate as routine ultrasonographic estimation, except in low-birth-weight babies. Therefore, when the clinical method suggests weight less than 2,500 g, subsequent sonographic estimation is recommended to yield a better prediction. This is also to further evaluate the foetal well-being. Our observation implies that there is clearly a role for clinical estimation of birth-weight as a predictor of birth weight. Thus, suggesting that clinical estimation is sufficient to manage labour and delivery in a term pregnancy. Even in estimating weight of macrosomic foetus for making decision regarding trials of labour, there appears to be no extra benefit in obtaining a routine sonographic birth-weight over clinical estimation.

The role for ultrasonographic estimation appears in some instances i.e. When clinically estimated weight suggests weight less than <2,500 g. In these cases, subsequent sonographic estimation will yield a better prediction and to do the biophysical profile to determine the well-being of the foetus.

The above findings have important implication for developing countries like ours where there is lack of technologically-advanced ultrasound machines capable of doing sophisticated functions such as foetal weight but has an experienced clinician who could perform this function equally well. The potential limitations of the study include:

- The subjectivity of clinical estimation,
- Use of only one sonographic model to derive estimates of foetal weight,
- No confirmation that the formula used (Hadlocks) is universally applicable.

We regard the over estimation of foetal weight by the clinical method as a positive factor as it will further enhance the sensitivity of health workers at peripheral centres for diagnosing macrosomia. If they are properly taught for earlier referral of mothers with macrosomic foetuses, they will be of great contribution in reduction of obstructed labour and its further sequelae.

Conclusion:

Thus, major finding from this study is that clinical estimation of fetal weight is as accurate as the ultrasonographic method of estimation within the normal birth weight range. Our study has important implication as in developing country like ours, where ultrasound is not available in many health care delivery systems specially in periphery clinical method is easy, cost effective, simple, accurate and can be used even by midwives. Further studies are, however, necessary to improve the accuracy of fetal weight and to determine if estimation of fetal weight prediction near delivery actually improves outcome and how applicable these methods can be in situations that alter birth weight that were excluded in the present study.

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