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COMPARISION OF THE FETAL WEIGHT ESTIMATION IN UTERO BY CLINICAL METHODS AND ULTRASONOGRAPHY AT TERM PREGNANCY VS EXACT WEIGHT OF THE BABY AFTER DELIVERY

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ABSTRACT: A baby's birth weight plays an important role in determining its survival. Neonatal morbidity may be exacerbated by an unusual birth weight during delivery and afterward. Accurate birth weight measurement is crucial for managing labor and determining delivery method. So the present longitudinal study was done on 120 pregnant women planned for full term delivery either by elective caesarean section or by induction of labor, Mothers with live singleton fetus were included in the study to estimate fetal weight in utero by clinical methods and ultrasonography at term pregnancy vs exact weight of the baby after delivery. The study revealed that in most cases, clinical birth weight measurements are as accurate as ultra-sonographic estimates, except in the case of low-birth-weight infants. In order to provide a better prognosis and further assess the fetal well-being, additional sonographic estimation is recommended when the clinical approach indicates a weight less than 2,500 g.

KEY WORDS: Pregnancy, Fetal weight, labor.

1. INTRODUCTION:

When and where to deliver a fetus is decided by its weight, which is crucial for the obstetrician to maximize the health of both mother and fetus. A high birth weight increases the likelihood of complications for new-borns during labor and puerperium. Through the use of standard growth curves for different populations, birth weight has been predicted at various gestational ages.[1]It is extremely important to know the weight of the fetus during labor and delivery. A baby's birth weight plays an important role in determining its survival. Neonatal morbidity may be exacerbated by an unusual birth weight during delivery and afterward. Large fetuses can be delivered vaginally with complications such as shoulder dystocia, brachial plexus injury, bone damage, and intrapartum asphyxia. As for the mother, complications such as birth canal and pelvic floor injuries, postpartum hemorrhage, and

surgical caesarean delivery are more common. Accurate birth weight measurement is crucial for managing labor and determining delivery method. Besides managing diabetes, facilitating vaginal delivery after cesarean section (VBAC) and managing breech births, it is imperative to estimate fetal weight.[2]Pregnancies with various unique complications, however, require greater knowledge to optimize the outcome. There have been a variety of methods used worldwide to estimate fetal weight. So the present study was done to estimate fetal weight in utero by clinical methods and ultrasonography at term pregnancy vs exact weight of the baby after delivery.

AIM AND OBJECTIVES:

Comparing the fetal weight estimation in utero by clinical methods and ultrasonography at term pregnancy vs exact weight of the baby after delivery.

2. MATERIALS AND METHODS:

The study was conducted at Department of Obstetrics Gynaecology, Vinayaka Mission's Medical College and Hospital, Karaikal for one year (1stJuly 2021 to 30thJune 2022). The study was endorsed by the Institutional Ethical Committee. It was a longitudinal analysisincluding120 pregnant women at term, (i.e.,>37 weeks of gestation). All pregnant women planned for full term delivery either by elective caesarean section or by induction of labour, Mothers with live singleton fetus were included in the study. All measurements were taken within one week of delivery. If pregnancy was carried over beyond this time interval the assessments were repeated. Multiple gestations, Patient with polyhydramnios or oligohydramnios, Abnormal lie, Preterm labour, Foetal malformations, Antepartum haemorrhage, Eclampsia, Obese patients(>90kgs), Uterine/ ovarian mass complicating pregnancy were excluded from the study.

OBSERVATIONS AND RESULTS:

Table: 1 - Distribution of study variables in the study population.

Variable	Mean ± SD	Median	Mode	Min	Max
Age	**26.92 ± 3.82**	**27.00**	**28.00**	**19.00**	**39.00**
GA	**38.43 ± 0.90**	**38.30**	**38.00**	**36.60**	**40.20**
EFW Johnson's Formula in Kgs	**3.13 ± 0.57**	**3.10**	**3.00**	**2.10**	**4.70**
EFW Hadlock's Formula in Kgs	**2.92 ± 0.52**	**2.90**	**2.70**	**1.90**	**4.30**
Actual birth weight in kgs	**2.90 ± 0.53**	**2.85**	**2.90**	**1.83**	**4.30**

In table 1, the distribution of study variables in the study population was given. The results showed that the mean age of the study population was recorded as 26.92 ± 3.82 with the median value of 27 and the mode value of 28. The age distribution range was recorded as 19

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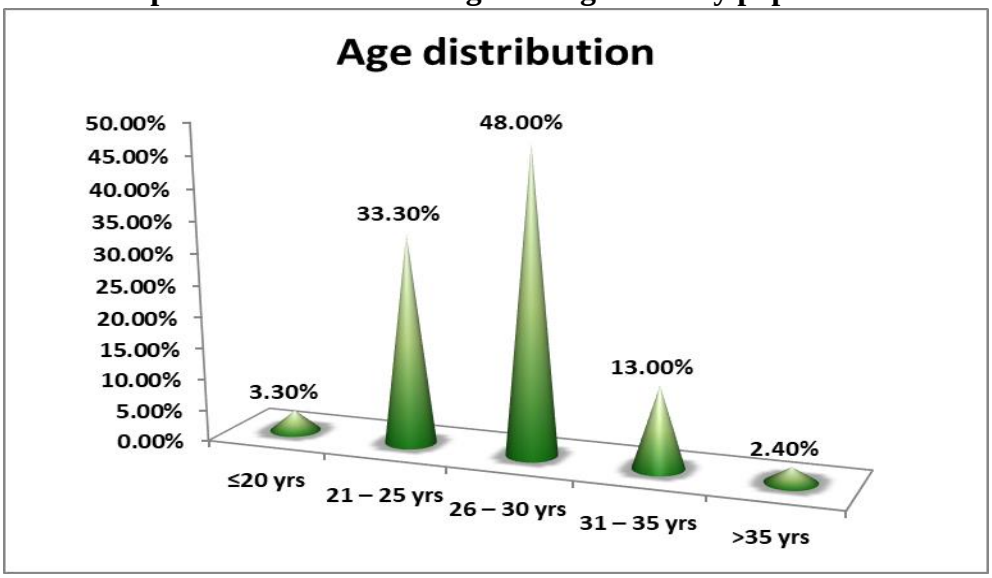
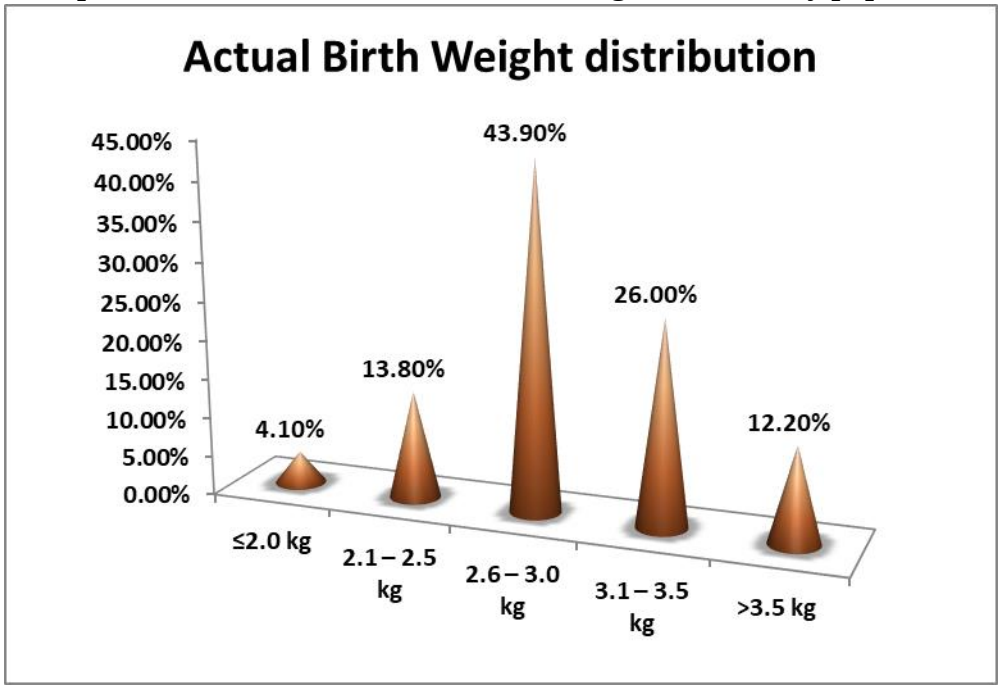
to 39. Similarly, the gestation age (GA) of the study population was 38.43 ± 0.90. The median and mode value of the gestation age was recorded as 38.3 and 38 respectively. The minimum value of GA was 36.6 and the maximum value was 40.2. The expected foetal weight (EFW) was calculated with both Johnson's formula and Hadlock's formula. The EFW with Johnson's formula was calculated as 3.13 ± 0.57 and with Hadlock's formula was recorded as 2.92 ± 0.52. Whereas the mean actual birth weight of the study population was noted as 2.90 ± 0.53.

Graph: 1- Distribution of age among the study population:



The age distribution of the study population was given in graph 1. Out of the 123 patients included in the study 59 patients (48%) belong to the category of 26-30 years, followed by 41 patients (33.3%) in the category of 21-25 years and 16 patients (13%) in the category of 31-35 years. In the remaining 7 patients, 4 patients (3.3%) belong to ≤ 20 years and 3 patients (2.4%) belong to > 35 years.

Graph: 2- Distribution of Actual Birth Weight in the study population



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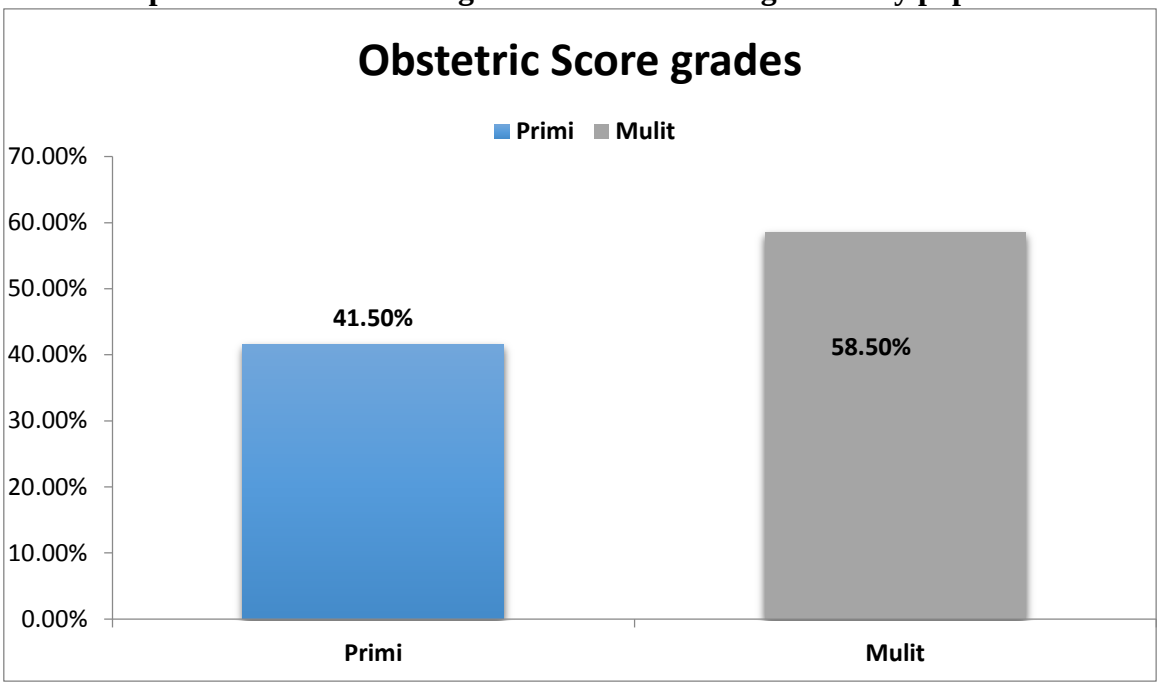
The distribution of actual birth weight in the study population was given in table 3 and graph 2. Around 54 cases (43.9%) were found to fall under the category of 2.6 – 3.0 kg, followed by 32 cases (26%) under the category of 3.1 – 3.5 kg, 17 cases (13.8%) under the category of 2.1 – 2.5 kg, 15 cases (12.2%) under the category of > 3.5 kg, and 5 cases (4.1%) under the category of ≤ 2.0 kg.

Graph: 3- Obstetric Score grades obtained among the study population



The obstetric score grades calculated among the study population was depicted in table 5 and graph 4. Out of the 123 patients included in the study, 51 cases (41.5%) were primiparous, and the remaining 72 cases (58.5%) were multiparous.

Table: 1- Association of Age distribution with Obstetric Score grades among the study population.

Age	Obstetric Score grades				Total
	Primi	%	Multi	%	
≤20 yrs.	4	3.3%	0	0.0%	4 (3.3%)
21 – 25 yrs.	28	22.8%	13	10.6%	41 (33.3%)
26 – 30 yrs.	16	13.0%	43	35.0%	59 (48.0%)
31 – 35 yrs.	2	1.6%	14	11.4%	16 (13.0%)
>35 yrs.	1	0.8%	2	1.6%	3 (2.4%)
Total	51	41.5%	72	58.5%	123 (100%)
Chi square test value		28.420	P value	0.0001 (p<0.05) Sig	

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The comparison of age distribution in the study population with the obtained Obstetric score grades revealed that there was a significant association between the age distribution and Obstetric Score grades with the chi square value of 28.420 and the P-value of 0.0001.

Table: 2- Association of Actual birth weight among the study population with Obstetric Score grades.

Birth Weight	Obstetric Score grades				Total
	Primi	%	Multi	%	
≤2.0 kg	3	2.4%	2	1.6%	5 (4.1%)
2.1 – 2.5 kg	8	6.5%	9	7.3%	17 (13.8%)
2.6 – 3.0 kg	18	14.6%	36	29.3%	54 (43.9%)
3.1 – 3.5 kg	15	12.2%	17	13.8%	32 (26.0%)
>3.5 kg	7	5.7%	8	6.5%	15 (12.2%)
Total	51	41.5%	72	58.5%	123 (100%)
Chi square test value		2.951	P value	0.566 (p>0.05) Not Sig	

The association analysis between actual birth weight and the obtained Obstetric Score grades showed that the association was non-significant as the chi square value of 2.951 and the P-value of 0.566 (p>0.05) suggests that there is no significant relation.

Table: 3- Comparison of estimated low birth weight values obtained by Various Methods.

Actual Birth Weight	Johnson's Formula (n=123)	Hadlocks's Formula (n=123)
Less than 2 kg	(0) 0.0%	(6) 4.9%
2.1 to 2.5 kg	(18) 14.6%	(23) 18.7%
Fisher's Exact test	P value	0.069 Not Sig

The association between estimated low birth weight values obtained by two different methods was found to be non-significant as the fisher's exact test suggest with the p-value of 0.069.

Table: 4- Comparison of actual birth weight within 10% by two different methods.

Method	Estimates within 10% of Actual birth Weight	>10%	Total
Johnson' Formula	(13) 10.6%	(110) 89.4%	(123) 100%

Hadlock's Formula	**(102) 82.9%**	**(21) 17.1%**	**(123) 100%**
Chi Square test value	**129.344**	**P value**	**0.0001 Sig**

The comparison of actual birth weight estimates by two different methods used were given in table 11 and graph 8. Johsnson's Formula suggest that out of the 123 cases included in the study, only 13 cases (10.6%) will have actual birth weight within 10% and the remaining 110 cases (89.4%) will have actual birth weight > 10%. Contrastingly, Hadlock's formula suggest that around 102 cases (82.9%) will have actual birth weight within 10% and only 21 cases (17.1%) will have >10% actual birth weight.

Graph: 4- Comparison of actual birth weight within 10% assessment by two different methods.

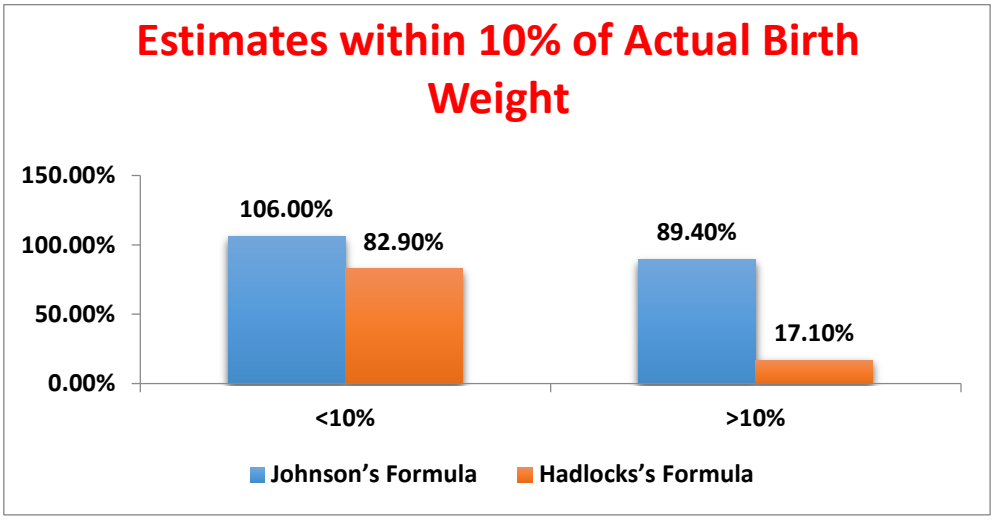

Table: 5- Estimates of actual birth weight within 10% by Johnson's Formula.

Actual Birth Weight	**Johnson's Formula**		**Total**
	Estimates within 10% of Actual birth Weight	**>10%**	
≤2.0 kg	**0 (0.0%)**	**5 (4.1%)**	**5 (4.1%)**
2.1 – 2.5 kg	**5 (4.1%)**	**12 (9.8%)**	**17 (13.8%)**
2.6 – 3.0 kg	**6 (4.9%)**	**48 (39.0%)**	**54 (43.9%)**
3.1 – 3.5 kg	**2 (1.6%)**	**30 (24.4%)**	**32 (26.0%)**
>3.5 kg	**0 (0.0%)**	**15 (12.2%)**	**15 (12.2%)**
Total	**13 (10.6%)**	**110 (89.4%)**	**123 (100%)**
Chi Square test value	**9.398**	**P value**	**0.052 Not Sig**

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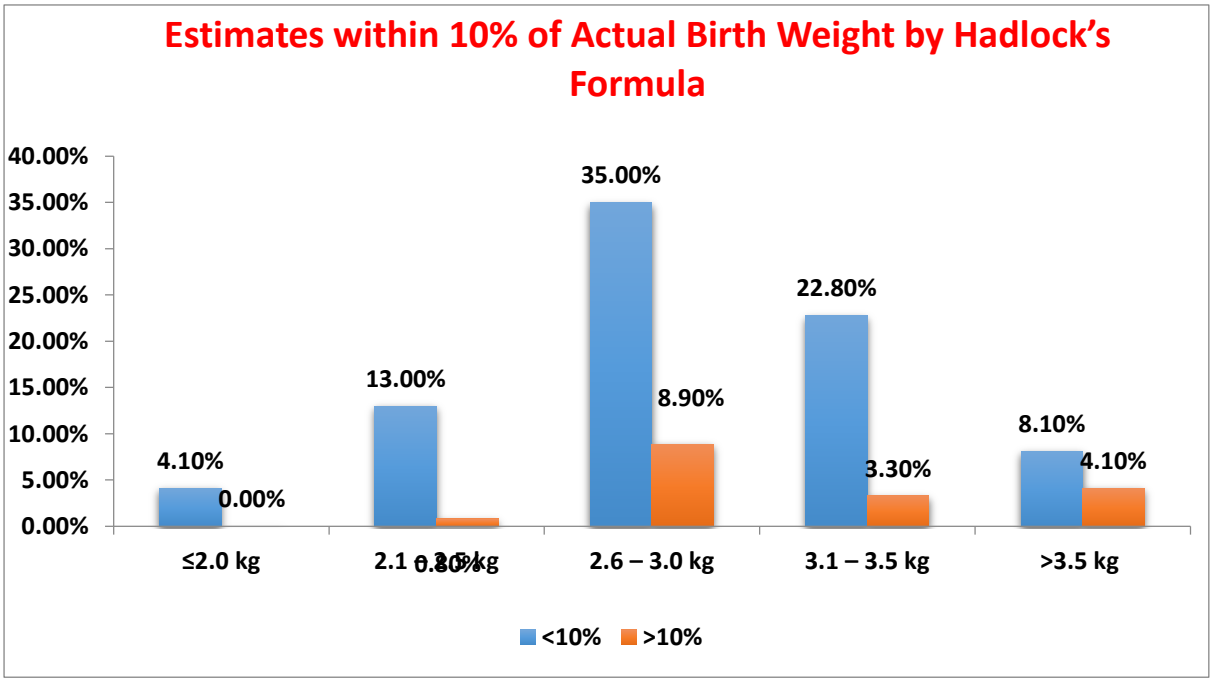
On estimation of actual birth weight by Johnson's Formula, out of the 123 cases, only 5 cases belong to ≤2.0kg (>10% of the estimated actual birth weight). In the 2.1 – 2.5 kg category, 5 cases (4.1%) belong to the estimates within 10% and 12 cases (9.8%) belong to the estimates above 10% of the actual birth weight. Out of the 54 cases in the 2.6 – 3.0 kg category, only 6 cases (4.9%) were found to be under the estimates within 10% of the actual birth weight, whereas the remaining 48 cases (39%) were found to be at the estimates above 10% of the actual birth weight. In the 3.1 – 3.5 kg category, only 2 cases belong to the with 10% group and 30 cases belong to the estimates above 10% of actual birth weight. The remaining 15 cases in the >3.5kg category belong to the estimates above 10% of the actual birth weight. The estimation of actual birth weight using Johnson's Formula was found to be non-significant with the P-value of 0.052 and the chi square test value of 9.398.

Graph: 5- Estimates of actual birth weight within 10% by Hadlock's Formula.



The actual birth weight estimation by Hadlock's Formula results suggest that the 5 cases in the ≤2.0kg category belong to the estimates within 10% of actual birth weight. Out of the 17 cases in the 2.1 – 2.5 kg category, 16 cases (13%) belong to the estimates within 10% of the actual birth weight and only one case belong to the above 10% category. In the case of 2.6 – 3.0 kg category, 43 cases (35%) belong to the estimates within 10% actual birth weight and 11 cases (8.9%) belong to the estimates above 10% actual birth weight. Similarly, in the 3.1 – 3.5 kg category, 28 cases (22.8%) belong to the estimates within 10% actual birth weight and 4 cases (3.3%) belong to the estimates above 10% actual birth weight. In the >3.5 kg category, 10 cases belong to the estimates within 10% actual birth weight and 5 cases belong to the estimates above 10% actual birth weight. The actual birth weight assessment with Hadlock's Formula was non-significant as indicated by the P-value of 0.183 and the chi square test value of 6.222.

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Table: 6- Comparison of Estimates of actual birth weight within 10% between Normal and High Birth weight babies by various methods.

Actual Birth Weight	Estimates within 10% Actual birth weight	
	Johnson's Formula	Hadlocks's formula
2.5 – 3.5 kg (Normal)	(8) 100%	(76) 88.4%
>3.5 kg (High)	(0) 0.0%	(10) 11.6%
Total	8 (100%)	86 (100%)
Chi Square test value	1.041	0.308 Not Significant

The evaluation of association between estimates of actual birth weight within 10% between normal and high birth weight babies obtained by two different methods revealed that the association was non-significant with the P-value of 0.308 and the chi-square value of 1.041. In the Johnson's Formula, a total of 8 cases belong to the estimates within 10% actual birth weight (8 cases belong to normal category). Contrastingly, in the Hadlock's Formula, 86 cases belong to the estimates within 10% actual birth weight category (10 cases belong to high birth weight category and 76 cases belong to normal category).

3. DISCUSSION:

In obstetric practice, ultrasound is an essential tool for estimating fetal weight. When the neonatal setup is available, the obstetrician can decide the route of delivery for preterm and small for gestational age (SGA) babies. In large for gestational age fetuses, accurate fetal weight estimation is also crucial. Using clinical methods and ultrasound at term pregnancy in comparison with the actual weight of the baby after delivery, we compared the fetal weight estimation in utero with that determined by actual weight at birth.

Studies	Methods	
	Clinical	Ultrasonography
Shermanetal[43]	+	+
Titapantetal[45]	+	+
Dawnetal[35]	+	-
Dareetal[41]	+	-
BhandaryAmrithaetal[49]	+	+
A.S.Shittuetal[50]	+	+
Tiwarietal[40]	+	+

HebbarShripad [3]	+	+
Present study	+	+

The Dawn formula for estimating fetal weight was proposed by Dawn et al (1983). Insler's formula was proposed by Dare et al (1990). A clinical and ultra-sonographic method was also used in the current study to estimate fetal weight. Similarly, eligibility and exclusion criteria were similar to BhandaryAmritha et al (2004). We calculated the mean maternal age as 28.1 X 4.3 years in the present study. Results obtained in this study were similar to those obtained in Maria RT et al (26.7% with 7.6), JaparathPrechapanich et al (26.4% with 8.2), and Akinola S. Shittuet to the. (30. 5%).As in Tiwari and Sood, Bhandary et al, the age groups of the study subjects are comparable. Estimating the fetal weight did not depend on the subject's age. The study included 41.5% primigravidas, 26.8% G2P1L1s, and 5.0% G2A1.41.5% were primigravidas, and 58.5% were multigravidas. Anusha et al study has 51.0% primi gravidas, while Bandari et al study has 45% primigravidas. A correlation coefficient of 0.0.975 was found for Hadlock's formula in the present study, which is slightly more accurate than Johnson's formula and statistically significant. As we showed in our study, ultrasound estimation of foetal weight is significantly more accurate than Johnson's formula, with mean percentage errors of 22.66 and 13.83 for each formula, respectively compared with Johnson's formula or ultrasound-formula, Hadlock's. The respective values are -1.97 and 11.76. In both Johnson's formula and Hadlock's formula, correlation coefficients were 0.971 and 0.975, respectively, with actual birth weights. The fetal weight predicted by ultrasound assessment was within 10% of the actual birth weight, applied by two different clinical formulas. Based on Johnson's formula, 10.6% of the estimated birth weights were within 10% of the actual birth weight.

According to Hadlock's Formula, 82.9% of estimates are within 10% of the actual birth weight. According to the present study, Hadlock's formula for estimating fetal weight was slightly more accurate within 10% of actual birth weight than sonographic estimation of fetal weight. Following this was Johnson's formula for estimating fetal weight, whose accuracy was considered negligible, similar to earlier studies.

It has been reported that Johnson's formula, Dare's formula, and ultrasound estimates can accurately predict birth weight within 10% in 61%, 57%, and 65% of the cases. With clinical and sonographic methods, Japarath-Prechapanich et al. also found 66.7% and 65.3% accuracy within 10%, respectively, of actual birth weight. According to Akinola S. Shittu et al., clinical and sonographic methods had accuracies of 70% and 68% within 10% of actual birth weight, respectively. Numerous researchers have demonstrated that the clinical technique is inaccurate below 2,500 grams, so it is recommended to estimate fetal weight in the 2,500-3,000 gram range. It is statistically non-significant to compare low-birthweight babies with large for gestational age babies whose normal birth weight is estimated within 10% of actual birth weight. In contrast to clinical procedures for assessing low birth weight newborns alone, ultrasound accurately estimates low birth weight.

Percentage error of 10% by various methods:

According to Sherman et al. (1998), the rates of estimations within 10% of birth weight in the clinical and USG methods (72% and 69%, respectively) were not statistically significant. Bhandary Amritha et al., also showed that the rates of estimations within 10% of birth weights in the AG x SFH method and USG method (67% and 62%, respectively) were not statistically significant.

4. CONCLUSION:

-When pregnant with a term child, it is essential to evaluate the weight of the baby at birth in order to control labour and delivery

Studies	AGx SFH	USG	Johnson	Dawn's
Shermanetal(1998	72%(by abdominal palpation)	69%	-	-
BhandaryAmrithaetal(2004)	67%	62%	41%	32.5%
Shittuetal(2005)	70%	68%	-	-
Present study	--	82.9%	10.6%	--

-There was a greater correlation between fetal weight and Hadlock's Formula than Johnson's Formula in the study.

-Fetal weight is assessed using ultrasound measurements of the foetus. The advantage of this method is that it measures in-utero foetal dimensions objectively and consistently.

-Hadlock's Formula can be very useful in a health care delivery system offering ultrasonography in a developing country like India.

5. CONCLUSION:

-In most cases, clinical birth weight measurements are as accurate as ultra-sonographic estimates, except in the case of low-birth-weight infants. In order to provide a better prognosis and further assess the foetal well-being, additional sonographic estimation is recommended when the clinical approach indicates a weight less than 2,500 g.

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