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Estimation of fetal weight by clinical methods and ultrasonography and correlating its accuracy with actual birth weight in term pregnancies

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Abstract

Aim: The aim of the study was to estimate fetal weight by clinical methods and ultrasound and to compare it with actual birth weight. **Materials:** This was a prospective study conducted over a period of 6 months in a tertiary care centre. All term singleton pregnancies with cephalic presentation, intact membranes and with ultrasound sonography test (USG) examination done within a week of delivery were included in the study. Pregnancies with intrauterine fetal demise, multiple gestations, poly and oligohydramnios, pelvic or abdominal masses, and current maternal weight more than 80 kg were excluded from the study. Fetal weight was assessed by Insler's formula, Johnson's formula and by Hadlock's formula using ultrasonographic measurements of biparietal diameter, abdominal circumference, and femur length. The estimated fetal weights (EFW) obtained by all the three formulae were compared with the ABW and each other using paired t-test and Karl Pearson's correlation coefficient. P ≤ 0.05 was considered significant. **Results:** Total of 200 mothers were included in the study. The estimated mean fetal weight by ultrasound was 3.0 ± 0.5 kg, while the mean birth weight was 2.9 ± 0.80 kg. There was no significant difference between the mean fetal weight estimated by Ultrasound scan and the mean birth weight. There was a positive correlation between ultrasound estimated fetal weight and actual birth weight with Pearson's coefficient of 0.75(P value = 0.04). The Mean error in the estimation of birth weight was 50 g. The mean absolute error in the estimation of birth weight was 212g. **Conclusion:** Ultrasound shows significantly better accuracy than clinical methods In fetal weight estimation.

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Introduction

Antenatal assessment of fetal birth weight before delivery is required in planning the management, optimal route of delivery and the level of hospital where the delivery should be conducted. Fetal Birth weight is the single most important determinant of newborn survival. Both low and excessive fetal weights at delivery are associated with an increased risk of newborn complications during labor and puerperium. There are a large number of clinical methods and ultrasonographic formulae available in literature for predicting fetal birth weight with varying degrees of accuracy. Increasing attention is being paid to the accuracy of using various ultrasound measurements in estimating fetal weight. It is routine obstetric practice to estimate fetal weight by measuring the symphysio-fundal height at each antenatal visit and to refer on for a sonographic estimation if it varies from the normal range for the gestation. Early expectation that ultrasonography might provide an objective standard for identifying

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foetuses of abnormal size for gestational age was recently undermined by prospective studies that showed sonographic estimates of foetal weight to be no better than clinical palpation for predicting foetal weight.

Aim And Objectives

1.To determine which method of fetal weight estimation (clinical or sonographic) is more accurate.

2.Estimation of Fetal Weight by Clinical Methods and Ultrasound and Correlating its Accuracy with Actual Birth Weight in Term Pregnancies.

Methods And Material

Prospective study conducted over a period of 6 months. A total of 200 mothers were included in the study after a written informed consent was sought.

Inclusion criteria

Pregnant patients above 18 years of age attending ANC OPD. Patients with singleton viable pregnancy in cephalic presentation at term. Patients coming in early stages of labour.

Exclusion criteria

Pregnant patient with fetal congenital anomalies. Patients with multiple pregnancies. Malpresentation. Patients with pelvic mass. Intra-uterine death.

Polyhydroamnios/oligohydroamnios.

Fetal weight was assessed by –

1. **Insler's formula**: fetal weight in grams = AG in centimeters × symphysis fundal height in centimeters.

2. **Johnson's formula**: fetal weight in grams = (symphysio-fundal height in centimeters – n) × 155 n denotes the station of head n = 13 when presenting part is above ischial spines n = 12 when presenting part is at ischial spines n = 11 when presenting part is below ischial spines

3. **Hadlock's formula** using ultrasonographic measurements of biparietal diameter,head circumference, abdominal circumference, and femur length.

The estimated fetal weights (efw) obtained by all the three formulae were compared with the ABW and each other using paired t-test and Karl Pearson's correlation coefficient. $P \leq 0.05$ was considered significant.

Results

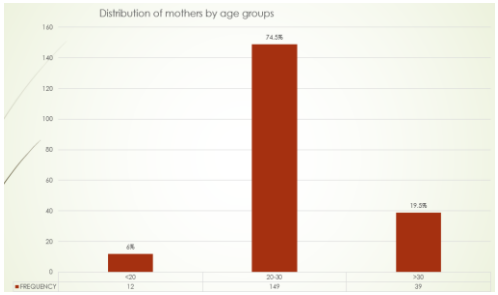


Figure 1: Distribution of mothers age by age group

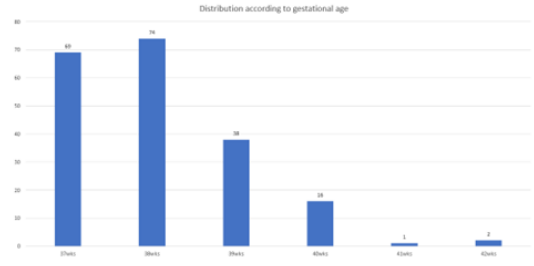
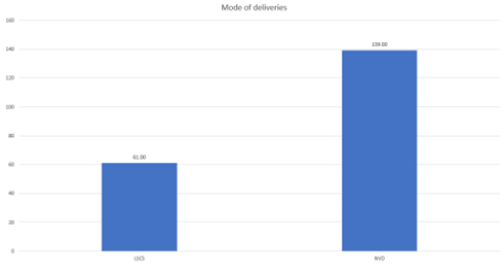


Figure 2: Distribution according to gestational



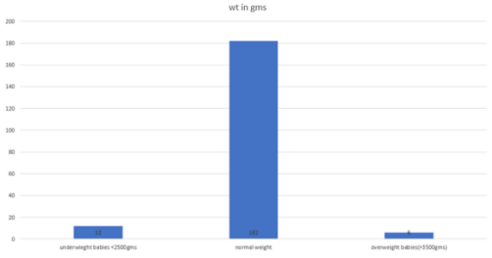


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Figure 3: Mode of deliveries **Figure 4: wt in gms**

Table 1: Comparision of inslers and actual birth weight by paired t-test

Procedure	Mean	Mean difference	Standard deviation	Standard error mean	P value
Inslers formula	8236.948	38.5	293.4598	20.7507	0.02
Actual birth weight	2872.450		302.3617	21.3802	

Table 2: Comparison of johnson's formula and ABW by paired t-test

Procedure	Mean	Mean difference	Standard deviation	Standard error mean	P value
Johnsons formula	3139.525	267.07	391.2586	27.6662	0.03
Actual birth weight	2872.450		302.3617	21.3802	

Table 3: Compaison of Hadlock"s formula and ABW by paired t-test

Procedure	Mean	Mean difference	Standard deviation	Standard error mean	P value
Hadlock's formula	2895.400	22.95	336.1527	23.7696	0.01
Actual birth weight	2872.450		302.3617	21.3802	

Table 4: Comparison of INSLERS and Hadlock's formula by paired t-test

Procedure	Mean	Mean difference	Standard deviation	Standard error mean
Inslers formula	2836.948	58.46	293.4598	20.7507
Hadlock's formula	2895.400		336.1527	23.7696

Table 5: Comparison of johnson's formula and Hadlock's formula by paired t-test

Procedure	Mean	Mean difference	Standard deviation	Standard error mean
Johnsons formula	3139.525	244.125	391.2586	27.6662
Hadlock's formula	2895.400		336.1527	23.7696

Table 6

Person Correlations					
		INSLERS FORMULA	**JHONSONS FORMULA**	**USG BY HADLOCK FORMULA**	**ACTULA BIRTH WEIGHT**
INSELERS FORMULA	Pearson Correlation	1	.885**	.775**	.688**
	Sig.(2-tailed)		.000	.000	.000

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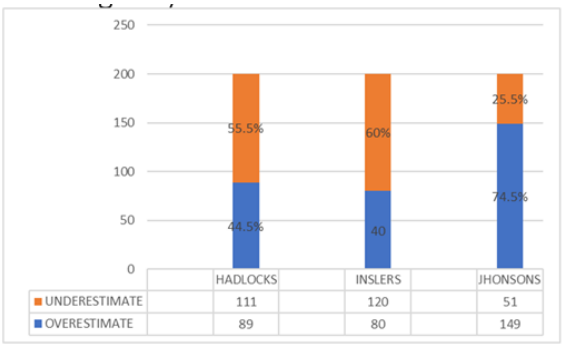
	N	200	200	200	200
JHONSONS FORMULA	Pearson Correlation	.885**	1	.648**	.583**
	Sig.(2-tailed)	.000		.000	.000
	N	200	200	200	200
USG BY HADLOCK FORMULA	Pearson Correlation	.775**	.648**	1	.837**
	Sig.(2-tailed)	.000	.000		.000
	N	200	200		200
ACTUAL BIRTH WEIGHT	Pearson Correlation	.688**	.583**	.837**	1
	Sig.(2-tailed)	.000	.000	.000	
	N	200	200	200	200

Sig.(2-tailed) is significant if <0.01

Table 7: Average error and percentage error

Statistic compared	Inslers	Johnson's	Hadlock's
Average error	38.5	267.07	22.5
% error	1.3	9.29	0.78



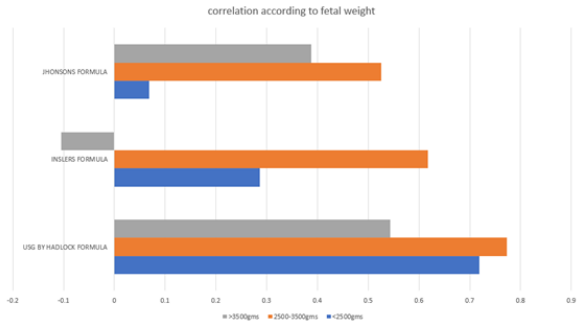


Figure 5 **Figure 6**

Figure 5: Number of cases with over and underestimate of birth weight by different methods

Figure 6: Correlation according to fetal weight

Table 8: Percentage error by different methods at increasing gestational age

	Hadlock's	Insler's	Johnson's
<39wks	2.9	0.3	9.5
40 wks	0.9	2	9.4
>40wks	0.4	6.8	2.1

Discussion

Assessment of fetal weight is a vital and universal part of antenatal care, not only in the management of labor and delivery but often during the management of high risk pregnancies and growth monitoring. It was in 1954 that Johnson used SFH in predicting EFW. 1 in 1990 Dare included his method of combining abdominal girth and SFH. Estimation of fetal weight by ultrasonography has been the acceptable method in most centers. However, in a country

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like ours, ultrasound availability is limited and affordability is an issue and is time consuming. Clinical estimation is easy to perform, can be done by less experienced, measure the growth potential of fetus. Also at times, we have women coming only to deliver, with no prior checkups or scans done anywhere. However Clinical birth weight estimation by johnson's and insler's formulas is now becoming obsolete. Sherman et al. Reported that percentage of fetal weight estimates falling within 10% margin of error for clinical and USG method was 72% and 69%, respectively. Aruna et al. Reported margin of error was 10%, efws by AG × SFH (insler's formula) and USG method were 97.3% and 100%, respectively. According to a study done by anshumala joshi et al.In nepal,the mean percentage error was higher, 13.72± 11.01 % in clinical estimation and 9.58± 7.68 % in ultrasonographic estimation (p=0.001). Considering 10% error as acceptable, clinical estimation had 42.5% within the acceptable error range and ultrasonographic method had 55.7% within the acceptable error range. Charles njoku et al in nigeria reported that the mean absolute percentage errors of both clinical and ultrasound methods were11.1% and 9%, respectively, and the difference was not statistically significant . the accuracy within 10% of actual birth weights was 69.5% and 72% for both clinical estimation of fetal weight and ultrasound, respectively, and the difference was not statistically significant. Study conducted by N nahar et al on bangladesh using the shepard formula showed that the actual BW recorded after delivery of the fetus is more close to uefw than clinically EFW. The study by bhandari et al in karnataka india and regina et al in 2005 in brazil found similar accuracy in the clinical and ultrasonic estimates titapani in 1999 and mehdizadeh in 2000, in an iranian population found similar accuracy between clinical and ultrasonic methods. The studies of hendrix et al and raman et al showed that clinical estimation was more accurate than sonographic methods

Conclusion

Our study demonstrated sonographic estimation of fetal weight is more accurate with less percentage error compared with actual birth weight and more within 10% of actual birth weight.

But estimated birth weights by both clinical and ultrasonograhic method correlated positively with actual birth weight. Among the clinical methods, weight measured with Insler's formula showed more accuracy than Johnson's formula when compared with actual birth weight. And there is no much significant difference between weight estimation by Insler's formula and Hadlock's in term gestation. In late term gestation and in overweight babies, it is recommended to measure fetal weight by Hadlock' formula. However, clinical methods can be reliably used to screen in hospitals where ultrasound has limited availability.

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