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A COMPARATIVE STUDY OF CLINICAL AND ULTRASONOGRAPHY ASSESSMENT OF FETAL WEIGHT IN TERM PREGNANCY

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ABSTRACT: Birth weight is an important parameter regarding baby's survival, physical growth and mental development. Prior knowledge is decisive in determining the mode of delivery. An ideal method to estimate should be accurate and easy to perform and interpret, accurate, cost effective, easily accessible needing minimal expertise and without discomfort to the patient. Clinical estimates have been done since long though not without limitations. Newer formulae (Clinical and sonographic) have its benefits and **LIMITATIONS:** but in terms of accuracy ultrasonography seems to have better prediction of fetal weight.

KEYWORDS: Effective fetal weight, Hadlock's formula, Johnson's formula, Birth weight.

INTRODUCTION: Birth weight is an important parameter with regards to a new born survival, physical growth and mental development. Prior knowledge of fetal weight is important in determining:

1. Mode of delivery.
2. Decision of labour induction/elective caesarean.
3. IUGR.
4. Delivery of preterm fetus.

Low birth weight babies are associated with an increase risk of perinatal morbidity and mortality like asphyxia, pulmonary haemorrhage, hypoglycaemia, infections, fetal distress and intrauterine fetal death. Macrosomic babies are prone to subdural hematomas, cephalhematomas, shoulder dystocia, fractures and nerve palsies. These babies also pose a threat to the mother causing perineal tears, lacerations, post partum hemorrhage, prolonged labor, infections, obstructed labor and rupture of uterus.

An ideal method for estimation of fetal weight especially in a developing country like ours should be accurate, easy to perform, cost effective, easy to interpret, easily accessible needing minimum infrastructure and safe to both mother and baby.

OBJECTIVES: Compare the results obtained of the fetal weight by Johnson's formula and Hadlock's formula and determine efficacy of each method.

MATERIAL AND METHODS: 500 antenatal cases attending the department of OBGYN, Central Hospital NF Railways Maligaon, Assam were enrolled for the study. Patients with congenital malformation, polyhydramnios, oligohydramnios and those with pelvic tumours were excluded from the study.

All cases were subjected to a thorough history taking and clinical examination. An estimate of possible fetal weight was made using Johnson's and Hadlock's formulas. The actual weight was taken following delivery of the baby.

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Birth weight by Johnson's Formula:

1. (SFH in cm - 13)*155, if fetal part is not engaged.
2. (SFH in cm - 12)*155, if fetal part is at zero station.
3. (SFH in cm - 11)*155, if fetal part is at plus station.

Birth weight by Hadlock's formula:

Log10 EFW (Effective fetal weight) in grams.

RESULTS: The ages of the patients ranged from 17 to 40 years. Majority of the patients were in the 21-25years age group.

Majority of these were nulliparas, 234, remaining were multiparas.

Majority of them had vaginal deliveries (59.2%). Instrumental and caesarean deliveries constituted 21.2% and 19.6% respectively.

Male babies constituted 244 and the mean birth weight was 2911grams, while female babies were 256 with an average birth weight of 2625grams.

There were 24 cases in weight category up to 2000grams, 130 cases in weight category 2001-2500grams, 203 cases in 2501-3000grams, 121 cases in 3001-3500grams and 21 cases in 3501-4000grams.

Category (gms)	Bhandhary Amritha & et al (2004)		Present study	
	Johnson's	USG	Johnson's	USG
<2000	415.5	362.57	321.3	200
2001-2500	339.69	256.2	309.08	164.18
2501-3000	299.48	217.42	304.94	163.65
3001-3500	300	219.37	389.46	174.03
>3501	108	440	167.7	182.50
Table 1: Average error in different weight categories				

The mean average error using Johnson's formula was maximum in the 3001-3500grams weight category and least in the 3501-4000grams weight category. With Hadlock's formula, the maximum error was in the less than 2000grams category and least in the 2501-3000grams category. The range of error was more with Johnson's formula compared to Hadlock's.

Method	<2000	2001-2500	2501-3000	3001-3500	>3501
Johnson's USG	Tiwari & Sood (1989)				
	430	740	500	1000	700
	620	550	300	400	400
Johnson's USG	Bhandhary Amritha & et al (2004)				
	1135	770	815	675	175
	702	774	653	634	474
Johnson's USG	Present study				
	890	1000	1140	1125	363
	500	540	618	700	450
Table 2: Maximum Errors					

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Method	Tiwari & Sood (1989)		Sharma & Bhardwaj (2002)		Present study	
	Over-estimation	Under-estimation	Over-estimation	Under-estimation	Over-estimation	Under-estimation
Johnson's USG	38 %	62 %	44.9 %	48.6 %	47.4 %	50.5 %
	54 %	46 %	65.1 %	32.4 %	36.4 %	57 %
Table 3: Over and Under Estimations						

With Johnson's formula, there was an underestimation in 50.5% cases and overestimation in 47.4% cases. With Hadlock's, there was an underestimation and overestimation of 57% and 36.4% cases respectively. Both methods had a tendency to overestimate in weight category less than 2000gms and underestimate weight category above 3000gms.

Method	Tiwari & Sood	Sharma & Bhardwaj	Present study
Johnson's USG	130.86	66.90	99.2
	99.32	63.24	64
Table 4: Average Error per Kg. Birth weight (gms)			

The average error in birth weight using Johnson's formula was 99.2gms and 64gms for Hadlock's. Using Johnson's formula, 46.4% cases came upto 10% of actual birth weight compared to 87% with Hadlock's. 73% cases with Johnson's formula come within 15% of actual birth weight compared to 94.2% cases with Hadlock's. Overall Hadlock's formula was found to be significant at 99% confidence limits compared to 90% confidence limits of Johnson's, thus highlighting the superiority of Hadlock's formula.

DISCUSSION: Assessment of fetal weight in utero leads to an improved prospective management of high risk pregnancies and considerable reduction in perinatal morbidity and mortality. Both Johnson's and Hadlock's formulas are not without limitations. In the Johnson's formula, correction was made for station of the head and obesity; but factors like liquor volume, site of placenta, deflexed head and moulding of the head remained. Since these factors cannot be ascertained by Johnson's formula, it was ignored.

In ultrasonography, the fetal weight is derived from fetal and is based on the assumptions of a constant reproducible relationship between selected fetal parameters and fetal volume. USG assumes a constant density of the fetus across a range of volume and among both healthy and compromised fetus.

The efficacy of ultrasound depends on how the formula describes the relationship between these variables and fetal weight and how the formula deals with altered shape as sometimes seen with IUGR. The accuracy of the given model in predicting the birth weight decreases further as the population deviates further from that used to generate such a mode.

Most of the USG formulas are derived from a relatively small proportion of population of uneven weight distribution with a variable interval between measurement and delivery and do not account for changes in relative density due to lung expansion.

Due to these errors together with the potential error of measurement of fetal parameters, USG also exhibit a range of error between estimated weight and actual weight.

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Birth Weight, Maternal Age and Parity: In the present study, age ranged from 17-40 years. There were 234 primigravidas and 266 multiparas. The relationship between birth weight, para and maternal age was not highlighted in the study as these parameters do not have a direct bearing on the study design.

Birth Weight and Sex Difference: Male fetus weighs more than the female fetus. In the present study, we had 244 male babies and 256 female babies. The mean birth was 2911grams for male babies and 2625gms for female babies. The difference in weight was 286grams and is comparable with other studies (Kaur and Kaur 2002).¹

The average error in the present study was found to be larger with Johnson's formula in all weight categories except more than 3501grams category, which is comparable to other studies. (Bhandary et al 2004).²

Under- and Over Estimation: In the present study, Johnson's formula had an almost equal frequency of over and under estimations. Hadlock's formula had a tendency to underestimate. Johnson's had a tendency to overestimate in weight category less than 2000grams and underestimate in weight more than 3000grams. Similar results were reported by Tiwari and Sood, 1989.³ and Sharma and Bhardwaj, 2002.⁴

In the present study USG had a tendency to overestimate in the weight category less than 2000grams and underestimate in more than 3000gms category. The results were comparable in 2001-2500gms category. Tiwari and Sood 1989 reported similar results.

Percentage Error per Method: The results of the present study using both formulas are comparable to Tiwari and Sood, 1989 and also to that of Bhandary Amritha et al, 2004. Mhaskar et al.⁵ found a high correlation between estimated and actual weight using Johnson's formula.

% Error	Tiwari & Sood (1989)	Bhandhary Amritha & et al (2004)	Present Study
Upto 5	52	27.5	48
Upto 10	85	62.0	87
Upto 15	92	85.5	94.2
Upto 20	96	92.5	95.4
Upto 25	97	96.5	98
Table 5: Percentage Error per method (USG)			

% Error	Tiwari & Sood (1989)	Bhandhary Amritha & et al (2004)	Present Study
Upto 5	22	17	24
Upto 10	55	41	46.4
Upto 15	78	63.5	73.6
Upto 20	88	79.5	85.8
Upto 25	95	89.5	92
Table 6: Percentage Error per method (Johnson's formula)			

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Average error per Kg birth weight: The results of the study was found to be comparable to Tiwari and Sood, 1989.

CONCLUSION: The results of the present study highlights the superiority of Hadlock's over Johnson's formula in prediction of fetal weight.

USG is safe, non- invasive and gives a lot of information. Doppler USG, 3D, 4D USG have additional benefits. On the other hand, it is costly, requires skill and expertise for correct interpreting.

In a country like ours, where even basic amenities are not available to all; it is difficult to imagine USG facilities reaching the remote areas and a trained sonologist. In such scenario, alternatives have to be sought after.

The measuring tape is cheap, light an easy to use Johnson's formula is easy to calculate and use. It is suggested that all pregnant women should be assessed. SFH measurement and Johnson's formula can be included in the teaching modules and training programs for doctors as well as for other field staffs working at the grassroots levels for better delivery of obstetric care/services.

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