Prediction Of Fetal Weight In Term Pregnancy – Comparison Of Clinical Methods And USG

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Abstract -

Objective : To make a comparative evaluation of estimation of fetal weight in term pregnancy by using a) Hadlock's formula using ultrasonography b) Johnson's formula and c) Dare's formula - abdominal girth (AG) X symphysiofundal height (SFH). **Methods :** The fetal weight in-utero was calculated by using the above methods in 600 pregnant women at term. The results were correlated with the actual birth weight. Comparative analysis of the accuracy of the various methods was done. **Results:** Average error and Maximum error in fetal weight estimation were least with AG X SFH method. Almost 86% of cases came within 10% error of actual birth weight by both AG X SFH method and Hadlock's formula using ultrasonography. Standard deviation of prediction error was least with Hadlock's ultrasound method, closely followed by Dare's (AG X SFH) method. **Conclusion:** Though ultrasound predicts the fetal weight more accurately, Dare's method (AG X SFH) should be used in day to day practice, especially in places where ultrasound is not available.

Key words : Abdominal girth, Actual birth weight, Comparative studies, Estimated fetal weight, Symphysiofundal height.

Introduction : Estimating the weight of the fetus in utero has utmost importance as it helps the obstetrician to decide when to deliver and also to decide on the mode and place of delivery in order to optimize the feto-maternal outcome. Extremes of birth weight are associated with an increased risk of newborn complications during labor and puerperium. Strategies for intrapartum care may be influenced strongly by prospective estimation of fetal weight.[1] Recently, estimated foetal weight has been incorporated into the standard routine antepartum evaluation of high-risk pregnancies and deliveries.[2] For instance, management of diabetic pregnancy, vaginal birth after a previous caesarean section, and intrapartum management of foetuses presenting by the breech will be greatly influenced by estimated foetal weight. Estimation of fetal weight is being done clinically, which has been criticized as less accurate because of observer variations. But Sherman et al,[2] Baum et al[3] and Titapant et al[4] all have found clinical estimation quite reliable. Ultrasound estimation of fetal weight using different formulas has gained much popularity.

Sonographic estimates may not always be available in low resource settings. In such instances, it is essential to study the reliability of clinical estimation of fetal weight in assisting decision making. Various clinical formulas like Johnson's formula and Dawn's formula have been used for fetal weight estimation. Dare et al[5] used the product of symphysio-fundal height and abdominal girth (SFHxAG) measurements in centimeters in obtaining fairly predictable fetal weight estimation.

The aim of this study was to assess the fetal weight in term pregnancies by various methods: Dare's formula (AGxSFH), Johnson's formula and Ultrasound using Hadlock's formula and to do the comparative evaluation of the methods after knowing the actual birth weight of the newborns.

Material and Methods : This study was conducted in DVVPF's Medical College and Hospital, Ahmednagar from 1st July 2016 to 30th June 2017. It was comparative type of study covering 600 pregnant females at term (i.e. >37 weeks of gestation). If the delivery did not occur within a week of the estimations, the estimations were repeated and those were taken into consideration.

Inclusion Criteria : Pregnant women admitted for confinement in Antenatal ward at term.

Exclusion Criteria : Multiple gestation, Malpresentation

(except Breech), Poly/ Oligohydramnios, IUD, Known cases of Uterine malformations, Fibroid or adnexal mass, Congenital Anomalies in fetus.

After obtaining proper written informed consent, all the eligible patients were enrolled in the study.

Parameters studied :

1. Average error (gms) in different birthweight categories,

2. Standard deviation of prediction error with each method

The selected patients were asked to empty their bladder and the symphysiofundal height (SFH) and abdominal girth (AG) in relaxed uterus was measured using a standard measuring tape and the measurements were rounded to nearest centimeters. The fundal height was measured from the midpoint of the upper border of pubic symphysis to the highest point of uterine fundus markedafter centralizing the uterus. Abdominal girth was measured by encircling the tape at the level of umbilicus, without applying excessive pressure to tighten the tape around the abdomen. The measurements were performed with the patient lying flat on the back with legs in extension. Pelvic examination was performed to evaluate the degree of descent of fetal head. The fetus was considered to be at minus station when the lowermost portion of the fetal head was above the ischial spines, at zero station when vertex was at the level of spines and at a plus station when below the level. All the measurements and information were recorded on individual datasheet and extrapolated on excel sheet.

The study consisted of estimation of fetal weight using the following three methods.

1. Hadlock's formula using ultrasound : Sonography machine calculated the fetal weight after measuring head circumference (HC), abdominal circumference (AC) and femur length (FL) in centimeters.

2. Johnson's formula- Weight in grams : (Mcdonald's measurement of symphysio fundal height in centimeters - x) X155. Station of the head was noted.

x= 13, when presenting part was not engaged. x=12, when presenting part was at 0 station. x=11, when presenting part was at +1 station.

3. Dare's formula : Abdominal girth (centimeters) X symphysio fundal height (centimeters) (AG XSFH).

The fetal weights estimated by the above three methods were compared with the actual weight of the baby after birth. A comparative analysis of the three methods was done.

Results : Out of 600 women studied, 33% were primigravida. The cases were distributed as per the birth weight of the babies into five groups as shown in Table1. Maximum distribution of cases was in 2500- 3000 grams fetal weight group.

**Table I:- Distribution of the cases according to the birth weight**

Sr. No.	Groups	No. of Cases	Percentage (%)
1	< 2000 gms	18	3.00
2	2000-2500 gms	142	23.67
3	2500-3000 gms	270	45.00
4	3000- 3500 gms	146	24.33
5	3500 gms and above	24	4.00
Total		600	100

There were 10 patients with breech presentation, for which only Dare's formula and USG estimate was taken into consideration. So, total 590 patients with cephalic presentation were studied for comparison in all the groups.

Average error in various fetal weight groups by the three methods is given in Table II. The average error in the weight groups less than 2000 grams group was least with USG- Hadlock's formula. Dare's formula showed least error when estimation involved groups of 2000-2500 and 2500-3000grams, closely followed by Hadlocks ultrasound method. Average error in the above 3000grams groups was least with Johnson's formula. The number of under and over estimations in all the fetal weight groups for all the methods were calculated. Below 2500 grams, Dare's and Johnson's formula overestimated birth weight. In the above 3500 grams fetal weight group, all methods had a tendency to underestimate the fetal weight.

Table II:- Average error in various fetal weight groups by various methods

Methods	Birth Weight (in grams)					
	<2000n=18	2000-2500 n =138	2500-3000 n=265	3000-3500 n=145	3500 and above n=24	All cases n=590
	Average error					
USG	161.67	148.91	175.2	145.24	361.58	168.86
Johnson's	730.56	386.01	203.26	108.28	127.08	235.65
Dare's	463.83	139.94	107.47	196.39	462.5	162.23
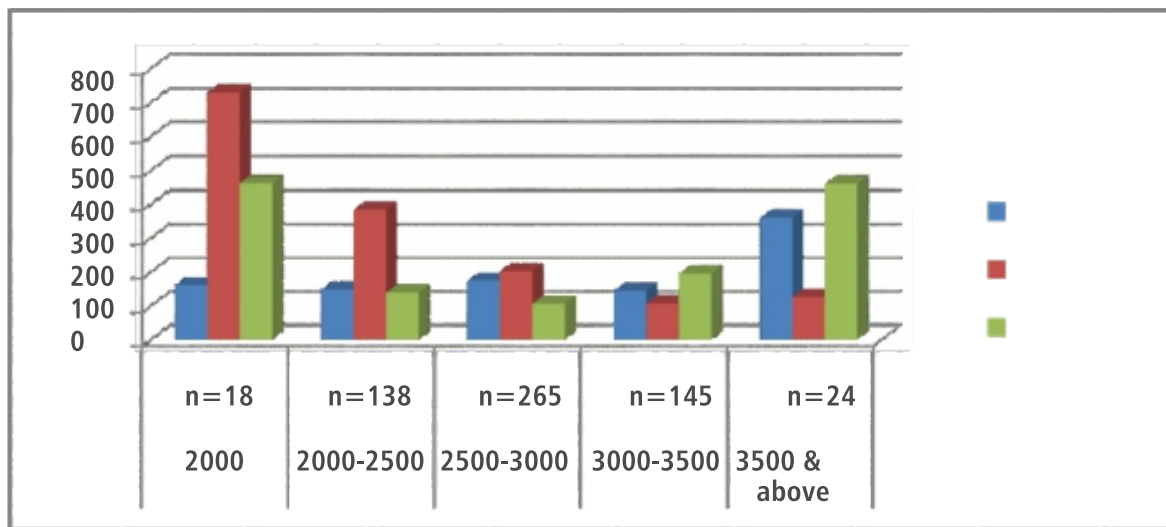
Maximum error in all fetal weight groups by the three methods is given in Table III. On an average, maximum error was most marked with Hadlock's formula closely followed by Johnson's and least with Dare's. Dare's formula showed maximum error when birth weight crossed 3500 grams. In Johnson's formula, it was seen in less than 2000grams fetal weight group and in Hadlock's method, it was seen in 2500-3000 grams fetal weight group.

Table III:- Maximum error in various fetal weight groups by various methods

Methods	Birth Weight (in grams)					
	<2000n=18	2000-2500 n =138	2500-3000 n=265	3000-3500 n=145	3500 and above n=24	All cases n=590
	Maximum error					
USG	290	440	790	650	750	584
Johnson's	925	660	415	485	425	582
Dare's	630	330	287	550	716	502.6

Percentage error of the method was calculated using the formula-

Percentage error $= x/y$ x100 x$=$error in grams

y$=$actual birth weight in grams

As seen in Table IV, 86% of cases came within 10% of birth weight by both Dare's and Hadlock's ultrasound method. As compared to that, only 66.7% came within 10% of birth weight by Johnson's formula.

Table IV : Percentage error in the various methods

Percentage error	USG	Johnson's	Dare's
Upto 5%	35.42 (209)	28.81 (170)	42.88 (253)
Upto 10%	86.27 (509)	66.78 (394)	86.61 (511)
Upto 15%	98.31 (580)	82.37 (486)	95.42 (563)
Upto 20%	99.66 (588)	89.83 (530)	97.80 (577)
Upto 25%	99.83 (589)	93.39 (551)	98.47 (581)

Table V compares the standard deviation of prediction error by all the methods. It was 101.02 grams by Hadlock's ultrasound method, closely followed by 120.60 grams by Dare's. It was much higher with Johnson's formula. The variance between the three methods was statistically significant ($p < 0.05$).

Table V:-Standard deviation of prediction error

Method	Standard Deviation
USG	101.0257
Johnson's	162.6853
Dare's	120.6023

For remaining 10 patients with breech presentation, Dare's formula was compared with USG estimate. Average errors were compared in different birth weight category. It was 163 grams for USG and 162.3 for Dare's method when all 10 patients were considered (Table—VI)

Table VI:- Average error in different groups in Breech presentation

Methods	Birth Weight (in grams)			
	2000-2500 n=4	2500-3000 N=5	3000-3500 n=1	All cases n=10
	Average Error			
USG	137.5	180	180	163
Dare's	219.5	104.8	220	162.3

Discussion : Equipped with information about the weight of the fetus, the obstetrician managing labor is able to pursue sound obstetric management decreasing perinatal morbidity and mortality. Symphysiofundal height is one of the important parameters taken for estimating fetal weight as in Dare's method, Johnson's formula and the formula developed by Mhaskar et al.[6]

In the present study, the average error in various fetal weight groups by AGXSFH was 162.23 gms which was least when compared to other methods. Bhandari et al[7] also had least average error with Dare's formula. It was 168.86 grams by Hadlock's method and higher for Johnson's method (TableII). Tewari and Sood[8] in their study showed an average error of 364.96 grams, 327.28 grams and 198.6 grams by applying clinical, Johnson's and Warsof's ultrasound method respectively. In our study, the average error in the weight groups less than 2000 grams group was least with USG-Hadlock's formula. Dare's formula showed least error when estimation involved groups of 2000-2500 and 2500-3000grams, closely followed by Hadlocks ultrasound method. Average error in the above 3000grams groups was least with Johnson's formula.

Comparison of average errors in different groups

Method	Our Study	Bhandari et al	Tewari et al
USG	168.86	299.11	198.6
Johnson's	235.65	292.51	327.28
Dare's	162.23	224.37	

In our study, average maximum error was the least by Dare's method. Maximum error in USG was 790, while it was 925 by Johnson's and 716 by Dare's method. In a study by Parvathavarthini K et al,[9] maximum error in USG was 1120, while it was 1485 by Johnson's method and 1172 by Dare's method.

Percentage error was restricted to 10 % in 86.27% of the cases by Hadlock's ultra sound method and 86.67% by Dare's method, compared to 66.78% by Johnson's formula. Tewari and Sood[8] found 92 % of cases within 15% of error by ultrasound method and 74% and 78% by clinical and Johnson's method respectively. Dare et al[5] found a percentage error between the actual and the estimated weight to be 20.1 % by Dare's method.

The standard deviation of prediction error was the least for Hadlock's ultrasound method, viz. 101.02 gms. It was 120.60 gms for Dare's and much higher i.e. 162.68 for the Johnson's formula (Table V). Bhandari et al[8] recorded similar trend in their study. Tewari and Sood[7] recorded that standard deviation of prediction error was 462.11 gms, 338.75gms and 203.02 gms by using clinical, Johnson's and Warsof's ultrasound method respectively. Ultrasound method has the least standard deviation of prediction error in estimating the fetal weight.

Comparison of Standard deviation of prediction error in Groups-

Method	Our study	Bhandari et al	Tewari et al
USG	101.02	258.48	203.02
Johnson's	162.69	309.98	338.75
Dare's	120.60	272.66	

In the study conducted in Nigeria, in the entire study group, the clinical method systematically overestimated actual birth-weight, while the ultrasonic method underestimated it.[10] They regarded the overestimation of foetal weight by the clinical method as a positive factor since it will enhance the sensitivity of health workers at peripheral centers if properly taught to them for earlier referral of mothers with macrosomic foetuses, thus contributing to reduction of obstructed labour and its sequelae.[10,11]

For 10 cases having Breech presentation, average error was calculated by USG and Dare's method. Though sample size of this subgroup was very small in present study, it gives fair applicability of Dare's formula in Breech presentations too, where Johnson's formula can't be used.

Conclusion : Hadlock's ultrasound method has the least standard deviation of prediction error in estimating the fetal weight. Dare's method (AGXSFH) has better predictable results in fetal weight estimation compared to other formulas. The (AGX SFH) clinical formula can be very useful in a developing country like ours, where ultrasound is not available at many health care delivery systems. It can be used even by midwives due to its relative simplicity. From the abovestudies, we can safely conclude that though USG continues to be the most accurate method, clinical methods are inexpensive, simple and giving fair estimation of fetal weight and thus have more clinical applicability in low resource settings.

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