

Comparative study of methods of fetal weight estimation



INTRODUCTION:

Knowledge of fetal weight in utero is important for the obstetrician to decide whether or not to deliver the fetus and also to decide the mode of delivery. Both low birth weight and excessive fetal weight at delivery are associated with increased risk of newborn complications during labor and the puerperium. Various clinical formulae like Johnson's formula and Dawn's formula have come into usage for fetal weight estimation. Another formula is the product of symphysiofundal height with abdominal girth in centimeters which gives a fairly good estimate of fetal weight.

METHODS:

It is a prospective observational study of 200 women at term pregnancy at a hospital. Patients within 15 days from their Expected Date of Delivery were included in the study. The formulas used in this study are:

- JOHNSON'S FORMULA
- SYMPHYSIOfUNDAL HEIGHT X ABDOMINAL GIRTH (AG X SFH)
- DAWN'S FORMULA
- HADLOCK'S FORMULA USING ULTRASOUND.

RESULTS:

There have been differing results about accuracy of various methods of estimating fetal weight. This study showed that AG X SFH was the best indicator among all other methods assessed followed by Hadlock's formula by ultrasonographic method.

CONCLUSION:

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Fundal height assessment is an inexpensive method for screening for fetal growth restriction. SFH measurement continues to be used in many countries on large scale because of its low cost, ease of use, and need for little training as the setup for ultrasonographic evaluation is not readily available in rural setups.

KEYWORDS: Fetal Weight, At Term Pregnancy, Symphysiofundal Height, Ultrasonography, Newborn Complications

INTRODUCTION

Knowledge of fetal weight in utero is important for the obstetrician to decide whether or not to deliver the fetus and also to decide the mode of delivery. Both low birth weight and excessive fetal weight at delivery are associated with an increased risk of newborn complications during labor and the puerperium. The perinatal complications associated with low birth weight are attributable to preterm delivery, intrauterine growth restriction (IUGR), or both. For excessively large fetuses, the potential complications associated with delivery include shoulder dystocia, brachial plexus injuries, bony injuries, and intrapartum asphyxia. The maternal risks associated with the delivery of an excessively large fetus include birth canal and pelvic floor injuries and postpartum hemorrhage. The occurrence of cephalopelvic disproportion is more prevalent with increasing fetal size and contributes to both an increased rate of operative vaginal delivery and cesarean delivery for macrosomic fetuses compared with fetuses of normal weight. Estimation of fetal weight being done clinically has received much criticism for less accuracy due to observer variation.

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AIMS AND OBJECTIVES

The aim of this study was to assess the fetal weight in term pregnancies by various methods- abdominal girth (cms) X symphysiofundal height (cms) AG X SFH, Johnson's formula, Dawn's formula and Hadlock's formula using ultrasound, and to compare the methods after knowing the actual weight of the baby after birth.

MATERIALS AND METHODS

It is a prospective observational study of 200 women at term pregnancy at Dhiraj General Hospital, Vadodara from 1st June 2010 to 31st May 2011. Patients within 15 days from their Expected Date of Delivery were included in the study.

Cases of MULTIPLE PREGNANCIES, OLIGO/POLYHYDRAMNIOS, MALPRESENTATIONS AND FIBROID OR ADNEXAL MASSES were excluded

THE METHODS

- JOHNSON'S FORMULA
- SYMPHYSIOfUNDAL HEIGHT X ABDOMINAL GIRTH.
- DAWN'S FORMULA
- HADLOCK'S FORMULA USING ULTRASOUND.

JOHNSON'S FORMULA:

WEIGHT IN GRAMS = (SYMPHYSIOfUNDAL HEIGHT - x) X 155.

Here symphysiofundal height is taken after correcting the dextrorotation, from the upper border of symphysis to the height of the fundus.

station of the head was noted:

x = 12 when head was at or above the level of the ischial spines

x = 11 when head was below the level of ischial spines.

AG X SFH:

Weight in grams = abdominal girth (AG) x symphysiofundal height (SFH) (AG X SFH)

Abdominal girth was measured at the level of umbilicus and symphysiofundal height as described earlier.

DAWN'S FORMULA:

WEIGHT IN GRAMS =

Longitudinal diameter of the uterus x(transverse diameter of the uterus) ² x

1. 44

2

HADLOCK'S FORMULA:

After head circumference, abdominal circumference and femur length were measured in centimeters, the sonography machine calculated the fetal weight.

Fetal weight estimated by the above four methods was compared with the actual weight of the baby after birth. A comparative analysis of the four methods was done.

OBSERVATION AND RESULTS

TABLE I: WEIGHT WISE DISTRIBUTION

Groups	No. of cases	Percentage
Less than 2000	14	7
2001-2500	60	30
2501-3000	93	46.5
3001-3500	30	15
More than 3500	3	1.5
Total	200	100

TABLE II : AVERAGE ERROR IN CALCULATION OF FETAL WEIGHT IN VARIOUS GROUPS

Birth

Weight(Gms)

	200	250	300		All
<200	1-	1-	1-	>	case
0	250	300	350	3500	s
	0	0	0		
n=	N=	N=	N=	N=	N=
14	60	93	30	3	200

Methods

Average

error in gms

AG X SFH	301. 2	218. 2	213. 4	207	182	224. 3
DAWN'S	365. 5	376	381. 9	407. 5	790. 6	464. 3
JOHNSON'S	415. 4	339. 6	299. 4	300	108	292. 5
HADLOCK'S	362.	256.	217.	219.	440	299.

5 2 4 3 1

Average error in all fetal weight groups except in > 3500 gms was least with AG X SFH closely followed by Hadlock's ultrasound method.

Average error in > 3500 gms group was least with Johnson's formula.

TABLE III : NUMBER OF CASES UNDERESTIMATED AND OVERESTIMATED IN VARIOUS FORMULAS

Method	Cases underestimated	Cases overestimated
AG X SFH	140	60
DAWN'S	132	68
JOHNSON'S	64	146
HADLOCK'S	84	116

Number of over and under-estimations in all fetal weight groups was calculated.

AG X SFH and Dawn's formula had a tendency to underestimate. The other 2 methods overestimated.

In > 3500 gms group, all methods underestimated.

TABLE IV : MAXIMUM ERROR IN ALL FETAL WEIGHT GROUPS

Birth

Weight

	2001	2501	3001	>	All
<200	-	-	-		cases
0	2500	3000	3500	3500	n= 4

Method

Maximum

Error in

gms

AG X SFH	530	584	610	734	213	534. 2
Dawn's	567	944	1057	1200	811	915. 8
Johnson's	1135	770	813	675	175	714
Hadlock's	702	774	653	634	474	647. 4

- Most marked with Dawn's and least with AG X SFH.
- By both these methods maximum error was in the 3001- 3500 gms group.

- By Johnson's formula, maximum error was in the < 2000 gms group, whereas with Hadlock's method it was maximum in the 2001- 2500 group.

TABLE V: PERCENTAGE ERROR IN VARIOUS METHODS

Percentage error	AG X SFH	Dawn's	Johnson's	Hadlock's
UPTO 5%	33.5%	15	17	27.5
UPTO 10%	67	32.5	41	62
UPTO 15%	85.5	50	63.5	85.5
UPTO 20%	94	78	79.5	92.5
UPTO 25%	96.5	89	89.5	96.5

- Percentage error was calculated using:

$$x/y \times 100$$

x= error in grams

y= birth weight in grams

- As seen in the table, 85.5% cases came within 15% of actual birth weight by both Hadlock's and AG X SFH methods.
- As compared to only 50% and 63.5% by Dawn's and Johnson's formula, respectively.

TABLE VI: STANDARD DEVIATION OF PREDICTION ERROR

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METHOD STANDARD DEVIATION

AG X SFH 272. 66

Dawn's 441. 56

Johnson's 309. 98

Hadlock's 258. 48

The standard deviation of prediction error was least with Hadlock's formula, closely followed by AG X SFH.

It is much higher with Dawn's and Johnson's formulae.

The variance between the four methods was statistically different. p value < 0. 05.

DISCUSSION

- Birth weight is a key variable affecting fetal and neonatal morbidity, particularly in preterm and small-for-dates babies. In addition, it is of value in the management of breech presentations, diabetes mellitus, trial of labour, macrosomic fetuses and multiple births.
- Clinicians' estimates of birth weight in term pregnancy were as accurate as routine ultrasound estimation in the week before delivery. Furthermore, parous women's estimates of birth weight were more accurate than either clinical or ultrasound estimation.
- There have been differing results about the accuracy of the various methods of estimating fetal weight.

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- This study showed that AG X SFH was the best indicator among all of the other methods assessed followed by Hadlock's formula by ultrasonographic method.
- Other studies have reported limited accuracy of ultrasound EFW at term, particularly in macrosomic fetuses but over all accuracy of this formula is same for all infants.
- Equipped with information about the fetal weight the obstetrician managing labour is able to pursue sound obstetric management, reducing perinatal morbidity and mortality.
- Symphysiofundal height is one of the important clinical parameters taken for fetal weight estimation by AG X SFH, Johnson's formula, Dawn's formula.
- According to my study, Hadlock's ultrasonographic method was the most accurate for estimating fetal weight.
- Of the three clinical methods, AG X SFH has better predictable results than the other 2 methods.
- AG X SFH, a clinical formula can be of great value in a developing country like ours where ultrasound is not available at many health care delivery centres.
- It is easy and simple, can be used even by midwives. With less errors AG X SFH is easier to apply by paramedical workers for the evaluation of fetal weight even in the rural setup as like our area of this study. By this study the results are suggesting that Hadlock's formula has least standard deviation but it requires ultrasonographic evaluation. So after it, AG X SFH is the second most formula for estimation of fetal weight

which is clinically applicable and most reliable method in the absence of sonologic setup.

CONCLUSION

Fundal height assessment is an inexpensive method for screening for fetal growth restriction. ¹ Clinicians are biased in their fundal height measurements by knowledge of gestational age and use of a marked measuring tape. This tendency increases with higher patient BMI and with less provider experience. ² While we have yet to establish reliable tests to predict which pregnancies are at risk of developing IUGR, surveillance of fetal growth in the third trimester of pregnancy continues to be the mainstay for the assessment of fetal well-being. Such surveillance is done by regular fundal height assessment, ultrasound biometry or a combination of both methods. ³ Relative growth of the SF height seems to be independent of fetal sex, maternal obesity and parity. ⁴ There is disagreement in SFH measurement between observers regarding the ability to separate small fundal heights from those that are not small (Bailey 1989). This becomes an issue especially in a clinical setting where the pregnant woman sees more than one clinician during the course of her pregnancy. Despite this, SFH measurement continues to be used in many countries on a large scale simply because of its low cost, ease of use, and need for very little training. ⁵ Ultrasound evaluation of fetal growth, behavior, and measurement of impedance to blood flow in fetal arterial and venous vessels form the cornerstone of evaluation of fetal condition and decision making. ⁶

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