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Original Research Article.

A Comparative Study between Johnson Formula and Hadlock Formula For Estimating Fetal Weight in Term Gestation

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ABSTRACT

Background: Ultrasound study forms a very important tool in present day obstetrics. Accurate assessment of weight by ultrasound examinations is mandatory for obstetric management particularly at term.

Methods: A Prospective observational study done on 100 pregnant women who had gravid between 37 to 42 weeks who fulfilled the inclusion criteria was conducted in Department of Obstetrics and Gynecology-Government Medical College, Pali, Rajasthan. EFW was measured at term by sonological formula i.e. Hadlock formula and Johnson's formula and compared with the actual birth weight. Statistical analysis was done using Z test.

Results: The mean birth weight of Hadlock formula is closest to the mean of actual birth weight when compared to that of Johnson's formula. P value obtained for both the formulae were <0.01, highly significant. The mean error of the Hadlock formula 188gms , Mean error of Johnson 202.148gms. Percentile error of <20% is 77% in Hadlock formula compared to 79% in Johnson's formula.

Conclusion: Mean birth weight of hadlock formula was closest to the mean of actual birth weight when compared to Johnson's formula. Least mean error was noted in the birth wt between 2.5-3.5 Kg. Johnson's formula overestimated the weight in SGA fetuses and Hadlock formula underestimated the weight in LGA fetus.

Key Words: Fetal Weight, Hadlock Formula, Johnson's Formula, Pregnancy.

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INTRODUCTION

Accurate estimation of foetal weight is of paramount importance in the management of labour and delivery. During the last decade, estimated foetal weight has been incorporated into the standard routine antepartum evaluation of high-risk pregnancies and deliveries. 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.[1,2]

Also, when dealing with anticipated preterm delivery, perinatal counseling on likelihood of survival, the intervention undertaken to postpone preterm delivery, optimal route of delivery, or the level of hospital where delivery should occur may be based wholly or in part on the estimation of expected birth-weight. Categorization of foetal weight into either small or large for gestational age may lead to timed obstetric interventions that collectively represent significant departure from routine antenatal care.[3-5] High rate of perinatal mortality (39-130 per 1,000 total births) is still a major cause for concern in developing countries such as Nigeria.[7] A large portion of this problem is related to birth-weight which remains the single most important parameter that determines neonatal survival.[6-9]

Standard growth curves for different population groups have been devised in order to predict birth weight at different gestational ages. However, these do not prove useful in pregnancies with various unique complications where the knowledge is more needed to optimize the outcome. So different methods of estimating fetal weight have been tried in different parts of the world in search of the best method. Broadly they are classified as:

1. Clinical Methods: Worldwide, this method is used extensively because it is both convenient and virtually costless, however it is subject to wide range of predictive errors.
2. Risk factor assessment: Quantitative assessment of clinical risk factors can be valuable in predicting deviations in fetal size.[10]
3. Maternal self-estimation: A third method of estimating fetal weight is maternal self-estimation. Perhaps a surprise in some studies maternal self-estimation of fetal weight in multiparous women were as accurate as clinical estimates in predicting fetal weight and abnormally large fetuses at term.[11]
4. Obstetric ultrasonography: This is the most modern method for assessing fetal weight *in utero*.

However, controversies abound as to which method is most useful and widely applicable for predicting fetal weight. Contrary to the widely held belief several studies have shown that ultrasonographic estimates of fetal weight are no better than clinical palpation in predicting fetal weight. Associated with this is the question of its availability in resource poor settings. However, clinical methods have limitations of their own subject to interindividual variation depending on the experience of the observer in addition to errors inherent to the technique.

In developing countries, ultrasonography may be unavailable or may not be affordable by patients. That is why measurement of fundal height using inexpensive and easily available nonelastic tapes has been recommended as a means of assessing birth weight in low-resource countries. The present study was aim to estimation of fetal birth weight clinically and sonographically and compare them with actual birth weight after delivery of fetus.

MATERIALS & METHODS

A Prospective observational study done on 100 pregnant women who had gravid between 37 to 42 weeks who fulfilled the inclusion criteria was conducted in Department of Obstetrics and Gynecology-Government Medical College, Pali, Rajasthan.

Inclusion Criteria

- Patients with confirmed gestational age i.e. 37-42 weeks Willing to participate in the study
- High risk pregnancies
- Patient with dating scan or with reliable date.

Exclusion Criteria

- Preterm
- Multiple gestations
- Congenital fetal anomaly

Procedure

Apparatus used in the set-up for ultrasonography was real time ultrasound scan, equipment Philip HD 7 with a transducer frequency of 3.5Mhz.

Biparietal Diameter (BPD) was measured on the frozen image from the outer edge of the proximal skull to the inner edge of the distal skull table, with electronic calipers placed on a line perpendicular to mid line echo.

Head circumference (HC) was measured at the same section as above using ellipse method by tracing the head circumference along the outer skull table.

Abdominal circumference (AC) was measured at the level of umbilical vein as it enters liver. Stomach bubble was also taken as landmark. It was measured using ellipse method.

Femur Length (FL) was measured from greater trochanter to external condyle, excluding femoral head.

Then standard tables stored in the equipment calculated the EDD. Also looked for cardiac activity, number of fetuses, congenital anomalies and placental localization and amniotic fluid index.

All the ultrasonic examinations were performed by single operator who had specific training in ultrasonography.

Hadlock formula:

Log10EFW = 1.3596-0.00386(ACXFL) + 0.0064(HC) + 0.00061(BPDXAC) + 0.0425(AC) + 0.174(FL)

The actual birth weight of baby recorded within 5 minutes of delivery on a mechanical scale with accuracy of ± 50 gm (Annexure I, Photograph No. 2 & 3) and the actual weight of neonate was compared to ultrasound predicted birth weight and clinical predicted birth weight.

RESULTS

Present study showed that the majority of subjects (87%) were seen in 20-30 years of age group. The mean age of patients was 24.48yrs (table 1). Majority of the birth weight were distributed between 2.5-3.5kg P value for both Hadlock formula and Johnson's formula were 0.5 i.e.>0.05 not significant (table 2). The mean birth weight of Hadlock formula is closest to the mean of actual birth weight (table 3). Mean error of Hadlock formula is least i.e. 188.449gms (table 4).

In present study Hadlock formula is found better for SGA babies and average size babies whereas hadlock is better for LGA babies. Hadlock underestimates the wt >3.5 kg (table 5). Average error is least between 3.1-3.5kg in both the groups (table 6).

Table 1: Age distribution of the subject studied

Age in years	Cases	%
18-20	9	9%
20-25	59	59%
25-30	28	28%
30-35	4	4%
Total	100	100%

Table 2: Distribution of estimated birth weight and actual birth weight.

EFW in kg	Hadlock Formula	%	Johnson's formula	%	Birth weight	%
1.5-2	-	-	-		1	1%
2-2.5	3	3%	2	2%	12	12%
2.5-3	27	27%	31	31%	44	44%
3-3.5	46	46%	40	40%	32	32%
3.5-4	23	23%	21	21%	8	8%
>4	1	1%	5	5%	3	3%

Table 3: Comparison of Mean weight of two formulae

	Mean birth weight in gms	S.D in gms
Hadlock formula	3213.85	371.472
Johnson's formula	3227.548	401.17
Birth weight	3025.4	445.172

Table 4: Comparison of mean error of two formulae.

	Mean error in gms	S.D	P-value
Hadlocks formula	188.449	405.512	<0.01
Johnson formula	202.148	403.884	<0.01

Table 5: Distribution of birth weight according to Hadlock and Johnson's formulae.

Actual birth weight in (gms)	Hadlock formula	Johnson's formula
1500-2000gms	2316	2685
2001-2500	2949	2937
2501-3000	3160	3141.7
3001-3500	3306	3317
3501-4000	3570	3632.8
>4000	3390	3968

Table 6: Average error in various fetal weight groups by different methods

Birth weight	Hadlock formula	Johnson's formula
<2000gm	449.33	818.33
2001-2500	545.8	533.56
2501-3000	327.67	300.1
3001-3500	23.4	33.51
>3500	327.5	150.23

DISCUSSION

Present study showed that the majority of subjects (87%) were seen in 20-30 years of age group. The mean age of patients was 24.48yrs. As it is the most fertile period more no of cases are seen. In the present study age group of subjects are comparable to Tiwari and sood[12], Bhandary et al.[13] Age of the subject had no effect in estimating the fetal weight.

Majority of subjects was 76.5% of birth weight are between 2.5-3.5 Kg. Present study is comparable to Bhandary et al[13] study. Only 3 cases are less than 2 Kg, 5 cases are >4Kg.

Measurement of SFH is affected in extremes of birth weight, maternal obesity, abdominal wall oedema, liquor volume, lie of the fetus. SFH are in the range of 27cms – 40cms. This is comparable to Watchree et al[14] study in which SFH was 27-44cms.

Present study showed that the mean birth weight of hadlock is closest to the mean of actual birth weight in comparison with the Johnson's formula. But there is no significant difference between mean of Hadlock and Johnson formulae. The mean of Hadlock is 3213.85 ±371.472 grams which is comparable to Ayoola et[15] study with mean birth weight of 3238±452grams. The mean weight of Johnson is 3227.548 ±401.1 gms which is comparable to Watchree et al[14] study i.e. 3318.16±351.72 gms. This indicates that both formulae are highly significant in obtaining the mean birth weight but not when taken individually.

The overall variation from actual birth weight is studied by finding the mean difference between actual birth weight and expected birth weight using two formulae. The mean error of the Hadlock formula is least because Hadlock formula uses four parameters and Johnson's formula uses only one parameter (SFH) for estimating fetal weight. The mean error of Johnson formula is 202.148gms which is in correlation with that of Watchree et al[14] and Bhandary et al[13] study. But in a study of Tiwari and Sood[12] mean error is more than that of our study. The mean error of the Hadlock formula is 188gms which is less than that of Bhandary et al[13] and Ayoola et al[15] study.

The fetal weights are overestimated between 1.5-2.5kg birth weight. Overestimation is more in Johnson's formula because that is influenced by the maternal obesity and liquor volume. Between 2.5 – 3.5 Kg estimation is en par with actual birth weight. Again birth weight > 3.5 Kg there is underestimation of the weight. According to present study for SGA babies Hadlock formula is better and for LGA babies Johnson's formula is a better formula. Measurement of subcutaneous tissue by ultrasound is the better method for LGA babies. We also studied the effect of fetal weight in the mode of delivery. As there were other factors involved, such as fetal distress, liquor volume, previous LSCS EFW alone did not affect the mode of delivery.45% delivered vaginally and 55% underwent LSCS.As ours is a tertiary hospital % of LSCS is more. All fetuses tend to gain some weight in utero from the day of scan till date of delivery. In one study sonographic fetal weight estimates were corrected by 12.4 gms per day for female fetuses and 13 gms per day for male fetuses for the period that elapsed

between the performance of the obstetric ultrasonographic examination and delivery. However in present study such a correction is not made.

According to Sumit Babutaa et al (2013)[16] found that the overall trend in both trimesters (in every respective week) shows that the mean measurement of all four parameters was lower than Western normo- grams.

As present study is done in the institution different scans are done by different radiologists. Hence there could be inter observer errors.

CONCLUSION

It can be concluded that among various standard formulae used Hadlock method was found to be a good predictor of birth weight. Thus it was found that different populations needed different formulae for reliably estimation of fetal birth weight.

REFERENCES

1. Sherman DJ, Arieli S, Tovbin J, Siegel G, Caspi E, Bukovsky IA. A comparison of clinical and ultrasound estimation of fetal weight. Obstet Gynaecol 1998;91:212-7.

2. Chauhan SP, Hendrix NW, Magann EF, Morrison JC, Jenney SP, Devoe LD. Limitations of clinical and sonographic estimates of birth weight: experience with 1034 parturients. Obstet Gynecol 1998;91:72-7.

3. Nzeh DA, Oyawoye O, Adetoro OO. Ultrasound estimation of birth weight in late pregnancy among African women. West African J Ultrasound 2000;1:9- 14.

4. Hanretty KP, Neilson JP, Fleming EE. Re-evaluation of clinical estimation of fetal weight: a comparison with ultrasound. J Obstet Gynaecol 1990;10:199- 201.

5. Hendrix NW, Grady CS, Chauhan SP. Clinical versus sonographic estimates of birth weight in term of parturients. A randomized clinical trial. J Reprod Med 2000;45:317-22.

6. Raman S, Urquhart R, Yusof M. Clinical versus ultrasound estimation of fetal weight. Aust N Z J Obstet Gynaecol 1992;32:196-9.

7. Watson WJ, Soisson AP, Harlass FE. Estimated weight of the term fetus. Accuracy of ultrasound vs. clinical examination. J Reprod Med 1988;33:369- 71.

8. Diejomaoh FME. Perinatal and maternal mortality. In: Agboola A, editor. Textbook of obstetrics and gynaecology for medical student, v. 2. Lagos: University Services Educational Publishers, 1988:304- 14.

9. Airede AI. Birth weight of Nigerian newborn infants—a review. West Afr J Med 1995;14:116-20.

10. Boyd ME, Usher RH, McLean FH. Fetal macrosomia: Prediction, risks and proposed management. Am J Obstet Gynecol 1983 Jun;61(6):715-22.

11. Naumi G, Collodo Khoury F, Bombard A, Julliar K, Weiner Z. Clinical and sonographic estimation of fetal weight performed during labor by residents. Am J Obstet Gynecol 2005 May;192(5):1407-09.

12. Tiwari R, Sood M. Comparative study of various methods of fetal weight estimation at term pregnancy. J Obstet Gynecol Ind 1989:39:279-86.

13. Bhandary Amritha A, Pinto Patric J, Shettv Ashwin P. Comparative Study of Various Methods of Fetal Weight Estimation at term pregnancy. J Obstet Gynecol of India. July 2004: 54(4) 336-339.

14. Watchree Numprasert. A study in Johnson's formula :Fundal height measurement for estimation of birth weight.AU J.T. Jul 2004; 8(1):15-20.

15. O.O.Ayoola et al. Accuracy of various ultrasound formula in predicting fetal weight in anigerian population. J of Chinese clinical medicine:2008:1:vol.3,No.1: 12-17.

16. Sumit Babutaa, Sangita Chauhan, Rohin Garg, Meenu Bagarhatta. Assessment of fetal gestational age in different trimesters from ultrasonographic measurements of various fetal biometric parameters. Journal of the Anatomical Society of India 62 (2013) 40–46.

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