



## A Comparative Study of Fetal Weight Estimation at Term by Clinical Method and Ultrasonography

Authors

**Dr Sachin Singh Yadav<sup>1</sup>, Dr Prachi Singh<sup>2</sup>, Dr Shweta Yadav<sup>3</sup>**

<sup>1</sup>Associate Professor, Department of Community Medicine, Teerthanker Mahaveer Medical College, Moradabad (UP)

<sup>2</sup>Assistant Professor, Department of Obstetrics & Gynaecology, Teerthanker Mahaveer Medical College, Moradabad (UP)

<sup>3</sup>Professor & Head, Department of Obstetrics & Gynaecology, Government Medical College, Shivpuri (MP)  
Corresponding Author

**Dr Prachi Singh**

G 203, Faculty Block, TMU, Moradabad (UP), India

Mobile no:-8218770640, Email: [singh.prachi.dr@gmail.com](mailto:singh.prachi.dr@gmail.com)

### Abstract

**Background:** Fetal weight estimation is an important factor for decisions about the delivery mode and the timing of labor induction specially at term birth weight is a major determinant of infant mortality in first year of life and mortality rate is more sensitive to birth weight than gestational age.

**Objectives:** Assessment of fetal weight at term pregnancy by Clinical method and Ultrasonography (USG) and compare the accuracy of each with the birth weight.

**Study design:**-A prospective study was conducted in the Department of Obstetrics and Gynaecology & Department of Radiology, in TMMC & RC Moradabad, over a period of 12 months.

**Material & Methods:** 100 pregnant women between gestational ages 37 to 40 weeks who were admitted in the ward for delivery were included in the study. After taking Informed consent detailed history and clinical examination was done as per pretested proforma. The actual birth weight was compared with the in-utero fetal weight estimated by symphysiofundal height (SFH) measurement using Johnsons Formula and ultrasonographic Hadlock's formula.

**Results:** In our study the fetal weight estimation by clinical method and ultrasound was comparable to the actual birth weight. Estimated fetal weight (EFW) by Ultrasound offers no advantage over clinician's EFW when performed during late pregnancy or labour. An EFW should be recorded in the assessment of all patients who are at term and again when they are in labour, with full awareness of the limitations of the methods for making such estimates. The estimation of fetal weight by SFH measurement is useful alternative, where USG is not available or affordable. This simple method of fetal weight estimation is useful particularly in remote areas where there is shortage of experienced medical personnel and to decide the mode of delivery and place of delivery.

**Keywords:** SFH, Johnsons Formula, Hadlock's Formula, Estimated Fetal Weight (EFW), Actual Birth Weight.

## Introduction

It has been long established that birth weight is a major determinant of infant mortality in first year of life<sup>1</sup> and mortality rate is more sensitive to birth weight than gestational age<sup>2</sup>. An accurate pre-delivery assessment and estimation of fetal weight is important in the management of labour and delivery, permitting the obstetricians to make decision about instrumental vaginal delivery, trial of labour after caesarean section for patients suspected of having a macrosomic fetus to prevent shoulder dystocia and traumatic injury<sup>3-5</sup>. Due to existence of inter observer variations clinical assessment of fetal weight is considered to be less accurate.. Ultrasonographic estimation of fetal weight using different formulae has gained much popularity in the modern age. But this facility may not be available to the pregnant women who are residing in rural remote areas or may not be affordable for poor patients. In such cases the clinical estimation of fetal weight is an important factor for identification of low birth weight, macrosomias and anticipation of obstetric complications, thereby decreasing perinatal morbidity and mortality.<sup>6-9</sup>

## Materials & Methods

A prospective study was conducted in the Department of Obstetrics and Gynaecology & Department of Radiology, TMMC & RC Moradabad, over a period of 12 months from 1<sup>st</sup> Jan 2017 to 31<sup>st</sup> Dec 2017. 100 pregnant women who were admitted in the ward for delivery were included in the study

### Inclusion Criteria

Term (37 weeks -40 weeks), live, Singleton pregnancy, with Cephalic presentation After taking informed consent all the patients included in the study were subjected to a detailed history taking, general examination and systemic examination to assess the patient's condition. The fetal weight was estimated within a week prior to the delivery. If the delivery did not occur within a week of the estimated time, the estimations were repeated and these were taken

into consideration.

Estimated fetal weight (EFW), in grams was calculated using JOHNSON'S FORMULA i.e. Estimated fetal weight (EFW), in grams = [symphysio fundal height (SFH) in centimeters – X] x 155. SFH measurement was taken by a non elastic centimeter tape by McDonald's method.

X= 13, when presenting part was not engaged

X= 12, when presenting part was engaged at 0 station. X=11, when presenting part was at +1 station

All patients were subjected for ultrasound evaluation and estimated fetal weight as calculated as per Hadlock formula. The sonologist had no prior knowledge of the clinical estimate of fetal weight. Both the estimates were documented on a chart.

Ultrasound Method of Fetal Weight estimation:

**Hadlock formula:** -  $\text{Log}_{10}\text{EFW} = 1.4787 + \{0.001837 \times (\text{BPD})^2\} + \{0.0458(\text{AC})\} + \{0.158(\text{FL})\} - \{0.003343 (\text{AC} \times \text{FL})\}$

Where BPD= Biparietal diameter.AC= Abdominal circumference, FL=Femur length. Newborn babies were weighed within 30 minutes of delivery employing a standard analogue Weigh master (England) scale corrected for zero error. This actual birth weight (ACBW) was noted on the chart and a comparison was made among the three weight estimations/ measurements.

### Statistical Analysis

Accuracy of birth-weight was determined by calculating the percentage error (EFW-ABW) x 100/ABW, the absolute error, i.e. [absolute value (EFW-ABW)] x 100/ ABW, and the ratio by percentage of estimate within 10% of actual birth-weight. Each of these error terms was average for each method of estimation in the entire study group and in the three strata of birth-weights. The mean error represents the sum of the positive (overestimation) and negative (underestimation) from actual birth-weight approximating zero in a method with very low or no systematic error. The difference between both the methods in the mean percentage error (i.e. the size of a systematic error) in each method was assessed by the paired *t*-test.

Data were analyzed using the SPSS (version 11.0), a windows-based statistical programme.

**Results**

In our study the mean age of patients was found to be 25 yrs with minimum age of 19 yrs and maximum age of 36yrs. Out of 100 women 42% were primigravida , 27% second gravida and 31% were multigravida with > 3 conceptions. 54% had no child, 31% had single child, 11% had 2children while only 4% had >2children. 28% had 1abortion and 1% had 2 abortions and 71% had no history of abortions. (Figure I)

In our study out of 46 women with previous history of delivery, 32 had previous normal vaginal delivery and 14 had previous caesareans sections.

The mean Symphysio Fundal Height SFH in 100 cases was 30cm with a minimum and maximum of 23 cm and 39 cm respectively, with standard deviation of 3.2cm. 45% had SFH of 27cm – 30cm , 32% had 31cm -34cm ,14% had 23cm – 26cm and only 9% had >34cm. (table I) with JOHNSON’S FORMULA the mean and median clinical weight was 2747gms and 2635gms

respectively ,with standard deviation of 459.5gms. Minimum and maximum clinical weight was found to be 1705.0gms and 4030gms respectively. (Figure II) The mean weight by USG was 2751.6 gms with a minimum of 1655.0gms and a maximum weight of 4159.0gms respectively with SD 452.3gms. (Figure III).

In our study mean actual birth weight was found to be 2780.6gms and median was 2755.0gms with SD 449.1gms. Minimum and maximum weight was 1764.0gms and 3990.0gms respectively. (Figure IV).

Fetal weight by both clinical and USG were comparable, with p – value non significant for detection of both low and high birth weight.

As depicted in table II when the weight is within normal range 62 were correctly estimated and 9 were incorrectly estimated. On USG 63 were correctly estimated and 8 were incorrectly estimated. When the weight was in within the abnormal range 27 were correctly estimated and 2 were incorrectly estimated on clinical estimation. On USG 24 were correctly estimated and 5 were incorrectly estimated. The positive predictive value was 0.69 and 0.72 respectively.

**Figure I**

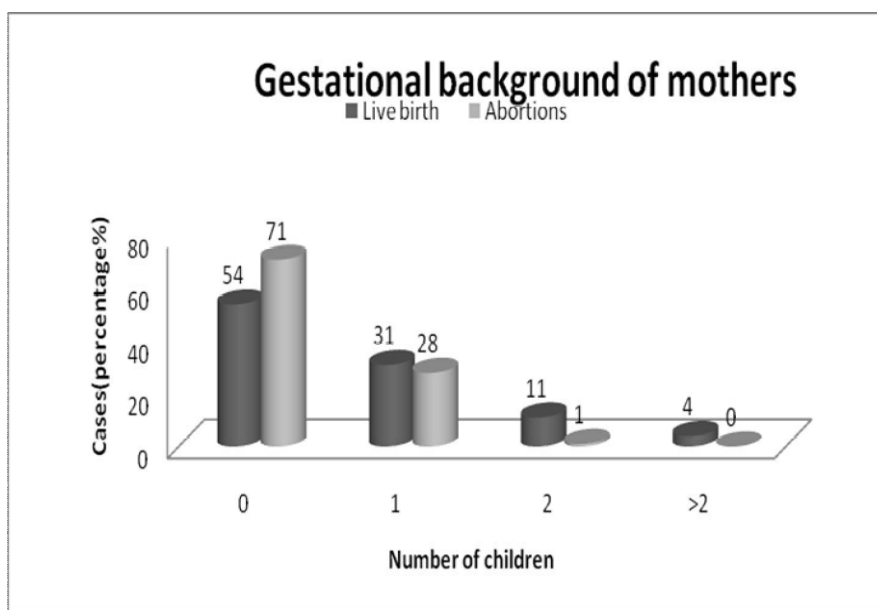


Figure II

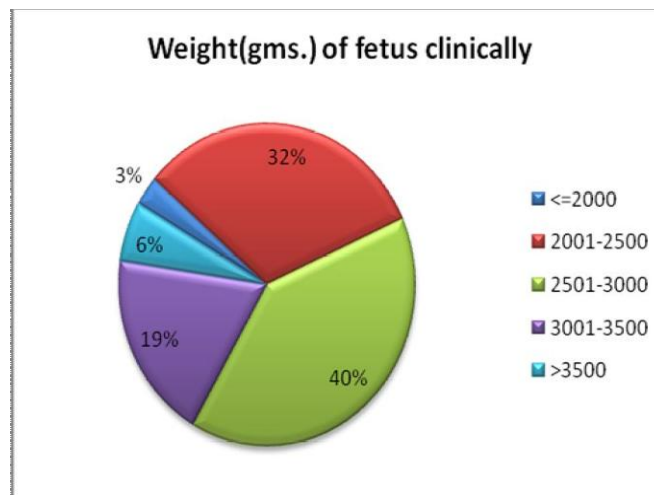


Figure III

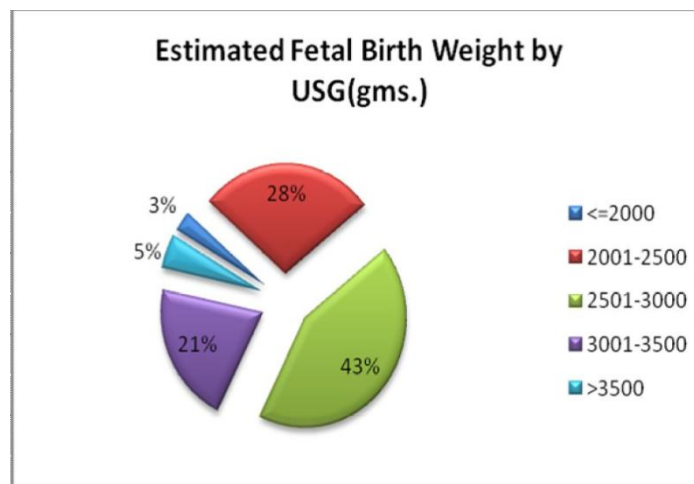


Figure IV

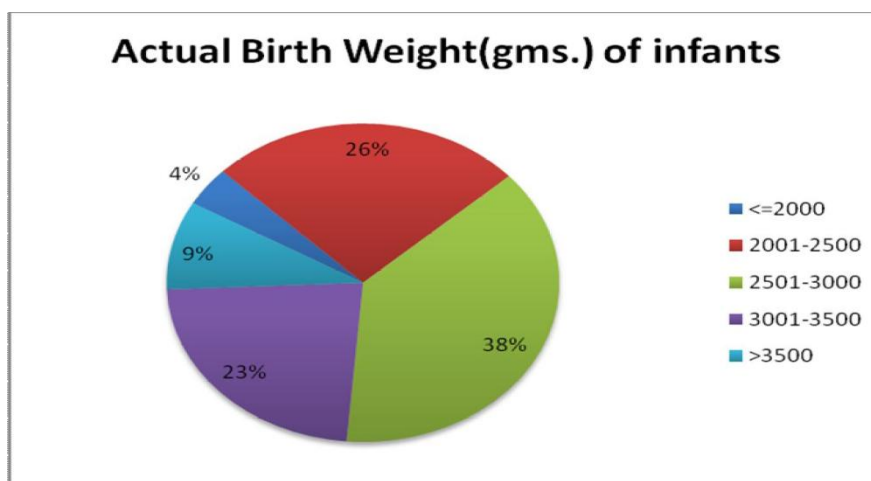


Table I: Distribution of cases as per SFH

Symphysio Fundal Height(cm.)	No of cases	Percentage
23-26	14	14.0
27-30	45	45.0
31-34	32	32.0
>34	9	9.0

**Table II** Difference between actual weight and two methods of fetal weight estimation

Method of estimation	Normal weight children		Abnormal weight children		Sensitivity	Specificity	Positive predictive value
	Correctly estimated	Incorrectly estimated	Correctly estimated	Incorrectly estimated			
Clinical	62	9	27	2	0.87	0.07	0.69
Ultrasound	63	8	24	5	0.88	0.17	0.72

### Discussion

Both fetal macrosomia and intrauterine growth restriction (IUGR) increase the risk of perinatal morbidity and mortality and of long-term neurologic and developmental disorders. Identification of intrauterine growth restriction after 37 weeks gestation is an indication for delivery to reduce the chance of fetal mortality. The diagnosis of macrosomia often leads to caesarean section to cut the risk of failed vaginal delivery and shoulder dystocia.<sup>10</sup>

Similar to our study Woo JS et al reported that the estimated fetal weight before delivery correlated well with birth weight, and concluded that the fetal weight estimation may be reasonably accurate between 2500 gm and 3500 gm.<sup>11</sup> R Mhaskar et al found a high correlation between estimated weight and actual weight using Johnson's Formula (with values  $r=0.80$ ,  $df = 98$ ,  $p < 0.001$ ), however the estimated weight was on an average 0.31kg higher than actual weight.<sup>12</sup>

Only a few studies have compared the accuracy of fetal weight by clinical and ultrasonic measurements. The most important observation of our study was that clinical estimation of fetal weight is as accurate as the ultrasonographic method of estimation within the normal birth-weight range. Although, the clinical method overestimated fetal weight, ultrasonic method underestimated it. However, when there is the case of IUGR both the methods overestimated birth-weight, but the ultrasonic method was statistically more accurate with smaller mean errors and more estimates within  $\pm 10\%$  of actual birth-weight.

In Fatemeh Ghaemmaghami et al study, the mean difference in weight is 136 gm if the ACTWT  $< 2935$  gm and 101.1 gm if the ACTWT  $\geq 2935$  gm. In the current study, the mean difference is 274gm if the fetal wt is  $< 2500$  gm and 274gm if

ACTWT is  $> 3500$ gm which is comparable.<sup>13</sup> The present study is also comparable to Sharma R et al, that found fetal weight estimation by Johnson's formula were good as ultrasonographic estimation.<sup>14</sup>

As reported by Hendrix et al.<sup>15</sup> clinical estimation was significantly more accurate than sonographic calculation. Similar results were obtained by Sharman et al. Titapant et al observed that ultrasonic estimation was more accurate only when there is low birth-weight but in their own studies, both the methods underestimated birth-weight by more than 400 g.<sup>16,17</sup> Likewise, Baum et al found no advantage of sonographic estimation over clinical or patients' estimation of fetal weight at term.<sup>18</sup>

### Conclusion

Clinical estimation of birth-weight has a definite role as a diagnostic tool, suggesting that clinical estimation is sufficient to manage labour and delivery in a term pregnancy. Among cases with macrosomic fetus; there appears to be no benefit in obtaining a routine sonographic birth-weight for making decision regarding trials of labour. When clinically estimated weight is less than  $< 2,500$  g, subsequent sonographic estimation would yield a better prediction to assess such fetuses and to do the biophysical profile to determine their well-being. This simple method of fetal weight estimation is useful particularly in remote areas where there is shortage of experienced medical personnel and to decide the mode of delivery and place of delivery.

### References

1. Steer P, Alam MA, Wadsworth J, Welch A. Relation between maternal haemoglobin concentration and birth weight in different

- ethnic groups. *BMJ*. 1995; 310(6978):489-91.
2. Williams R.I, Cunningham GC, Haines WE, Norris FD, Tashiro M. Fetal growth and perinatal viability in California. *Obstet. Gynaecol.* 1982;59 (5):624-32.
  3. Chauhan SP et al. Limitations of clinical and sonographic estimates of birth weight: experience with 1,034 parturients. *J Obstet Gynecol.* 1998; 91:72–7.
  4. Kurmanavicius J et al. Ultrasonographic fetal weight estimation: accuracy of formulas and accuracy of examiners by birthweight from 500 to 5000 g. *Journal of perinatal medicine*, 2004; 32:155–61.
  5. Ratanasiri T et al. Comparison of the accuracy of ultrasonic fetal weight estimation by using the various equations. *J Med Assoc Thai.* 2002; 85:962–7.
  6. Jolly MC, Sebire NJ, Harris JP, Regan L, Robinson S. Risk factors for macrosomia and its clinical consequences: a study of 350,311 pregnancies. *Obstet Gynecol Reprod Biol.* 2003;111(1):9-14.
  7. Coomarasamy A, Connock M, Thornton J, Khan KS. Accuracy of ultrasound biometry in the prediction of macrosomia: a systematic quantitative review. *BJOG* 2005;112(11): 1461-1466.
  8. Shamley KT, Landon MB. Accuracy and modifying factors for ultrasonographic determination of fetal weight at term. *J Obstet Gynecol* 1994;84:926-930.
  9. Ben-Haroush A et al. Accuracy of sonographically estimated fetal weight in 840 women with different pregnancy complications prior to induction of labor. *Ultrasound Obstet Gynecol.* 2004, 23(2):172–176.
  10. Shittu AS, Kuti O, Orji EO, Makinde NO, Ogunniyi S, Ayoola O. et al. Clinical versus Sonographic Estimation of Foetal Weight in Southwest Nigeria. *J HEALTH POPUL NUTR.* 2007;25(1):14-23
  11. Woo JS, Ngan HY, AuKK et al. “Estimation of fetal weight in utero from symphysis - fundal height and abdominal girth measurements” *Br J Obstet Gynecol.* 1979;86(12):722-728
  12. Mhaskar R, Mhaskar A, Molly SR. Symphysiofundal height (SFH) measurement for prediction of birth weight-A new formula. *J Obstet Gynecol.* 2001;51:73-76.
  13. Fatemeh Ghaemmaghami MD, A sharaf Jamal MD, Mohammed Reza Soleimani MD et al. - “ Parturient fundal height and birth weight estimation”. *Arch Iranian Med* 2002; 5(2):80- 83.
  14. Rajyashri Sharma, Namrata A, Bharwaj - “Use of Johnson’s formula in HCH training” *J Obstet Gynaecol of India.* 2002;53(3):44-50
  15. Hendrex NW, Grady CS, Chauhan SP. Clinical vs. sonographic estimate of birth weight in term parturients. A randomized clinical trial. *J Reprod Med.* 2000;45 (4):317-322
  16. Sherman DJ, Joseph SA, Torbin J. A comparison of clinical and ultrasonic estimation of fetal weight. *Obstet Gynecol.* 1998; 91(2):212-217
  17. Titapant v, Chawan PS, Mingnitpatanakul KA. Comparison of clinical and ultrasound estimation of fetal weight. *J Med Assoc Thai.* 2001;84:1251-1257.
  18. Baum JD, Gussman D, Wirth JC. Clinical and patient estimation of fetal weight versus ultrasound estimation. *J Reprod Med.* 2002;57(9):558-559.