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Original Research Article

SYMPHYSIO-FUNDAL HEIGHT: A PROMISING TOOL FOR FETAL WEIGHT ASSESSMENT

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ABSTRACT

Background: Aims and objectives: To construct a symphysis-fundal height curve as an alternative to serial ultrasound for measuring fetal growth by evaluating SFH at various gestational ages. **Materials and Methods:** A prospective observational study was conducted in Department of Obstetrics & Gynecology and Department of Radio-diagnosis, Jawaharlal Nehru Medical College, Aligarh Muslim University. 100 antenatal women attending the OPD fulfilling the inclusion criteria were recruited. Fetal weight estimation was done clinically using SFH and ultrasonography, further results were correlated with actual birth weight. Analysis of data had been performed using SPSS software. **Results:** Estimated fetal weight at term by Johnson's formula at 36 weeks and 40 weeks were 3039.55 gm ± 95.76 and 3437.9gm ± 117.36 with a difference of 275.36gm and 673.71gm from actual birth weight which was statistically significant (p value <0.0001) and by Hadlock formula at 36 weeks and 40 weeks were 2567.88gm ± 244.83 and 2853.88gm ± 251.15 with difference of 196.31gm and 89.69gm respectively (p value <0.0001). **Conclusion**: SFH measurement for fetal weight at term showed comparable results to USG when compared to actual birth weight. Hence clinical fetal weight estimation can be used sufficiently in settings with limited availability of resources.

INTRODUCTION

Recently maternal mortality has seen a global decline. Therefore, attention is being shifted towards the measures that can reduce perinatal morbidity and mortality, and to achieve this goal accurate fetal weight estimation is very important. Low birth weight caused by intra uterine growth restriction (IUGR) and small for gestational age (SGA) can lead to high morbidity and mortality.

Assessment of fetal weight is a significant part of antenatal care, management of labor and delivery. Fetal weight is crucial in growth monitoring.[1]

There are three methods for assessing fetal growth namely clinical examination of the uterine fundus in relation to anatomical landmarks like the umbilicus and xiphisternum, serial measurement of symphysis-fundal height (SFH) and third being serial ultrasound1. Serial sonography though accurate is not practical and feasible for low economic strata as a screening method for fetal weight assessment.

Abnormalities in fetal growth can be detected by ultrasound that needs training, expertise and expensive equipment. The chances of error in fetal weight estimation by ultrasonography are low for fetuses that have normal birth weight whereas it is high for fetuses that are non-term (pre-term, post term) and small for gestational age.[2]

Various epidemiological factors like education, socioeconomic status and maternal factors like antenatal care, parity, inter-pregnancy interval and bad obstetric history are found to influence birth weight. Numerous formulas like Johnson's formula, Dawn's, Dare's and Risanto's formula have been used for clinical fetal weight estimation.

Measurement of symphysio-fundal height (SFH) by means of Johnson's Formula is quite prevalent for the fetal weight estimation, inexpensive and readily available with the help of a non-elastic measuring tape1. Numerous studies and experts have found that SFH assessment is a more objective, consistent and scientific method for gauging fetal growth.

The aim of this study is to construct a symphysis-fundal height curve as an alternative to serial ultrasound for measuring fetal growth by evaluating SFH at various gestational ages.

MATERIALS AND METHODS

Present prospective observational study was conducted from December 2020 to November 2022. 100 Healthy women with singleton pregnancy,

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regular menstrual cycles, sure of their last menstrual period (LMP) or with first trimester ultrasound for dating if they are not sure of last menstrual period attending antenatal clinic were enrolled in the study after getting approval from institutional ethical committee.

Women with irregular cycles, Obese women (BMI> 28), polyhydramnios or oligohydramnios, transverse lie, oblique lie, anomalous fetus, intrauterine death (IUD), multiple gestation, Premature rupture of membranes (PROM) and Preterm premature rupture of membranes (PPROM) were excluded. Written informed consent was obtained.

After history, obstetrical examination was done to measure the symphysio-fundal height. Symphysio-fundal height measurements were taken by only one observer in order to avoid inter observer bias at 28th week, 32 weeks, 36/37 weeks and 39/40 weeks. Uterine fundus was palpated by placing the ulnar border of the left hand against the upper border of the uterus using a non-elastic centimeter tape. Length between above point and pubic symphysis was measured in centimeters and Symphysio-fundal height (SFH) curve was generated.

Fetal weight was calculated by **Johnson's formula**:

Fetal Weight (gm) = (Symphysio- fundal height in cm - x) x155

Where x=13, when presenting part is not engaged

x=12, when presenting part is at 0 station

x=11, when presenting part is at +1 station

If the women weighs more than 91kg, 1cm is subtracted from the fundal height.

USG estimation of fetal weight was done by **Hadlock formula:**

Hadlock formula: Log 10 EFW (gm) = 1.3596-0.00386 (AC x FL) + 0.0064 (HC) + 0.00061 (BPD x AC) + 0.0425 (AC) + 0.174 (FL)

Quantitative data were presented as the percentage and mean ± SD. Statistical analysis was done using paired T-test. Paired T-test was used for comparison between actual and estimated fetal weight. DeLong et al test was used for comparison of area under curve of EFW (gm) by Johnson's formula and Hadlock formula for predicting birth weight.

The data entry was done in the Microsoft EXCEL spreadsheet and final analysis was done with the use of Statistical Package for Social Sciences (SPSS) software, IBM manufacturer, Chicago, USA, ver 25.0. For statistical significance, p value of less than 0.05 was considered statistically significant.

Study design: Prospective observational study

Study population: Antenatal women attending the OPD, Department of Obstetrics & Gynecology, Jawaharlal Nehru Medical College, AMU, Aligarh during the study period.

RESULTS

Table 1 shows demographic distribution of antenatal women. Mostly women were of 25-30 yr age with Mean ±SD as shown. Estimated fetal weight was more among multiparous women as compared to primiparous women. Women were belonging to urban area had more fetal weight. Mean birth weight among educated women was 2788.75±208.82 with statistically significant results as compared to uneducated.

Table 1: Demographic distribution of fetal weight of antenatal women

DISTRIBUTION		MEAN ±SD	P VALUE
AGE		25.51 ± 3.1 years	0.956
PARITY	PRIMI (%)	2719 ± 166.31gm	0.045
	MULTI (%)	2802.6 ±258.85gm	
RESIDENCY	URBAN	61%; 2778.75 ± 208.82gm	0.0419
	RURAL	39%; 2741.41 ± 247.11gm	
EDUCATIONAL STATUS	LITERATE	81%%;2788.14 ± 217.79gm	0.027
	ILLITERATE	19%;2662.11 ± 227.42gm	

Table 2 shows that fundal height increases with increase in gestational age with the maximum being at 40 weeks showing mean fundal height of 35.18 ± 0.76cm. and the estimated fetal weight by Johnson's and Hadlock's formula.

Table 2: Estimated fetal weight(gm) (EFW) by Johnson's and Hadlock formula at different Gestational ages

Gestational Age (weeks)	Fundal height Mean ± SD	EFW by Johnson's formula Mean ± SD	EFW by Hadlock formula Mean ± SD
At 28 weeks	26.12 ± 0.6	2033.4 ± 97.11	1431.33 ± 209.97
At 32 weeks	29.05 ± 0.48	2487.75 ± 74.3	2125.31 ± 242.31
At 36 weeks	32.61 ± 0.62	3039.55 ± 95.76	2567.88 ± 244.83
At 40 weeks	35.18 ± 0.76	3437.9 ± 117.36	2853.88 ± 251.15

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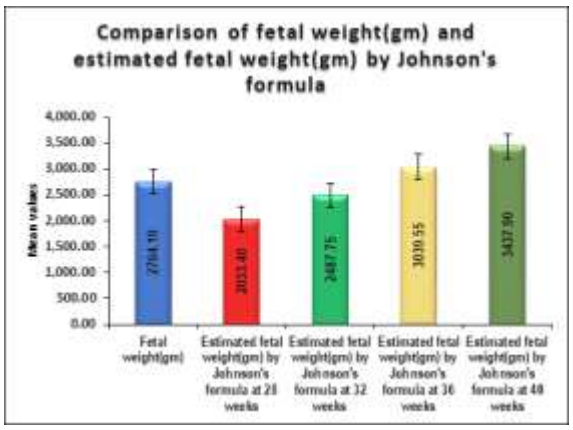

Figure 1: Comparison of birth weight and estimated weight by Johnson's formula

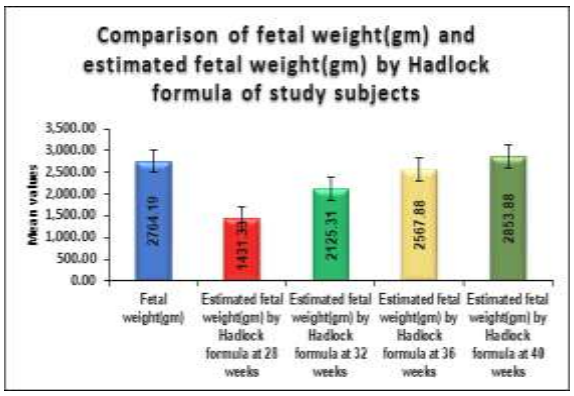

Figure 2: Comparison of birth weight and estimated weight by Hadlock formula

Table 3 shows the area under the curve for predicting birth weight

Table 3: Comparison of area under curve of EFW (gm) by Johnson's formula and Hadlock formula at 40 weeks

Variables	Values
Difference between areas	0.41
Standard Error	0.107
95% Confidence Interval	0.199 to 0.620
P value	0.0001

DeLong et al test

Table 4 shows the comparison between the estimated fetal weight at different gestation age according to the delivery of the women. Estimated fetal weight(gm) by Johnson's formula was significantly higher as compared to actual fetal weight at 36-38 weeks, 38-39 weeks, 39-40 weeks with statistically significant p value. Estimated fetal weight(gm) by Hadlock formula was significantly lower as compared to actual fetal weight at 36-38 weeks, comparable with actual fetal weight at 38-39weeks and was significantly higher than actual fetal weight at 39-40 weeks.

Table 4: Comparison of estimated and actual fetal weight(gm) at different gestational age(weeks)

Delivery (weeks)	Actual fetal weight(gm)	EFW (gm) by Johnson's formula	EFW (gm) by Hadlock formula
at 36-38 weeks			
Mean ± SD	2675.15 ± 179.48	3046.35 ± 115.51	2475.88 ± 247.87
P value	-	<0.0001‡	<0.0001‡
at 38-39 weeks			
Mean ± SD	2750.78 ± 183.77	3312.41 ± 149.84	2713.78 ± 202.85
P value	-	<0.0001‡	0.169‡
at 39-40 weeks			
Mean ± SD	2821.15 ± 252.08	3436.38 ± 108.74	2946.53 ± 278.63
P value	-	<0.0001‡	0.0001‡

‡ **Paired t test**

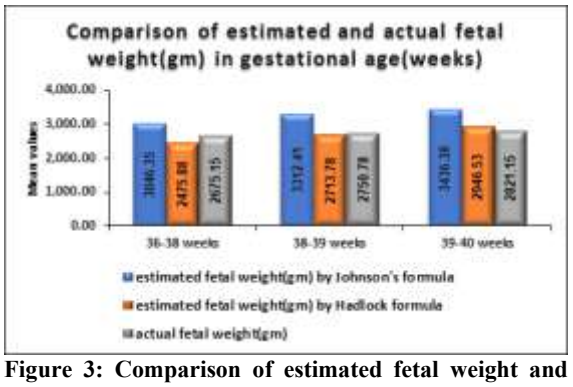

Figure 3: Comparison of estimated fetal weight and actual weight at term

DISCUSSION

In this study Mean ± SD of fetal weight(gm) in multiparous was more with significant association between them p value=0.05 which is comparable to study of Shah et al,[2] in 2010 in which lowest birth weight was observed in infants born to primi mother. Shittu AS et al3 (2007) observed excellent correlation (r-0.78, p <0.01) between symphysio-fundal height and birth weight in range of 2500gm - 4000gm. Parvin Z et al,[4] (2008) study showed Statistical tests for correlation between actual birth weight (taken as dependent variable) and foetal, weight calculated by Johnson's Formula. The tests revealed that actual birth weight was significantly correlated with fetal weight calculated by Johnson's Formula by taking symphysio-fundal height. Kashish Sehrawat et al,[5] (2020) study found that Johnson's formula correlates well with actual birth weight.

Mean actual weight is 2764.19gm ± 224.1 and mean estimated weight by Johnson formula at 36 weeks and 40 weeks are 3039.55 gm ± 95.76 and 3437.9gm ± 117.36 making a difference of 275.36gm and 673.71gm with statistically significant p value < 0.05.Our results are comparable to Dilip Kathiriya et

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al,[6] in 2014 who also found Error of 265 g and 70% of values falling within 10% of actual birth weight as recorded with Hadlock formula whereas an error of 574 g and 22% of total values fell within 10% of actual birth weight using Johnson's formula. Joshi et al (2017) 7estimated mean birth weight by clinical method was 3492.75±393.16g, by Ultrasound was 3230.02±407.22g and actual mean birth weight was 3236.32±472.87g. The estimated birth weight by ultrasonography showed slightly stronger positive correlation (r=0.54; p<0.001) Yadav et al (2016) study presented findings that were against present study that is the mean real birth weight was 3100 ±455.8 grams. While Johnson's formula and usg yielded a mean estimated birth weight of 2911 ±364 gm and 3240 ±389.7 gm respectively (p value 0.01). Area under curve being (at 40 weeks) by Johnson's formula was 0.58 and by Hadlock formula 0.99. Ingale A et al,[5] (2019) compared the same and found USG has 92.9% sensitivity to predict normal birth weight and clinical examination has 97.1% sensitivity to predict normal birth weight which are comparable with this study. Pongtipakorn N et al,[6] (2022) found that Ultrasonography had the best ability to predict low birth weight with sensitivity, specificity and Area under ROC curve of 75% (95% confidence interval (CI) 51-91%), 94% (95%CI 89-97%) and 0.84 (95%CI 0.75-0.94), while Johnson's method better predicted macrosomia than the other methods.

Over all Standard error in present study by Johnson's formula in estimating foetal weight at 36 weeks, 40 weeks is 7.03%, 10% and standard error by Hadlock formula at 36 weeks and 40 weeks is 4.16% and 0.708%. Neha singh et al,[3] (2020) study in fetal weight estimation was highest by Johnson's method 11.37% as compared to ultrasonography 7.67%. Wanjaria DK et al,[8] (2017) found contradictory results from present study that the mean percentage error in foetal weight estimation to be equal by ultrasonography and by clinical method.

CONCLUSION

Estimation of fetal weight is very important in effective management of labor. It helps to prevent/minimize foeto-maternal complications. Ultrasonographic estimation of fetal weight, being accurate and reliable, is gold standard. Fetal weight may be estimated using Symphysio-fundal height during antenatal period with reasonable accuracy. Accuracy of estimation of fetal weight by Symphysio-fundal height measurement at term is comparable not only to ultrasound estimation but also to birth weight. Being affordable, convenient and easy to understand it may be used by health care workers at grass root level. Fetal weight assessment may be an alternative to ultrasonographic assessment in low resource setting where there is paucity of infrastructure, health professionals and ultrasound machines. In such settings a health care worker trained for the purpose can easily estimate fetal weight by symphysio-fundal height for better fetal salvage. It may be concluded from present study that symphysio-fundal height measurement for fetal weight may be incorporated in "the comprehensive protocol and care pathway" which includes serial assessment for ultrasound biometry and additional investigations by Doppler studies if required.

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