RESEARCH ARTICLE

Use of gravidogram for assessment of fetal weight

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ABSTRACT

Objective: To construct a gravidogram for the population in this part of the country to detect any compromise in fetal growth as early as possible**. Methodology**: A prospective study was conducted on 500 women attending the antenatal OPD and antenatal ward. 100 women were selected, each at 24 ,28,32,36,40 weeks of gestation. The symphysiofundal height (SFH) was measured for each patient and the mean SFH was derived for each period of gestation The fetal weight was calculated by using Johnson's formula and compared with fetal weight calculated by ultrasonography (USG) and also with the birth weight at 40 weeks. **Results and Observations**: The Johnson's formula was seen to overestimate the fetal weight at weights lower than 3 kg and it was seen to correlate with the fetal weight at weights more than 3kg. At 40 weeks, the difference between the fetal weight calculated by Johnson's formula and USG was found to be statistically insignificant ($p > 0.05$). **Conclusion:** The Johnson's formula can be a very important component of antenatal care and it is as useful as USG in the determination of fetal weight.

Keywords: Fetal weight, symphysiofundal height, USG, Johnson's formula.

Intrauterine growth restriction (IUGR) is a condition where the fetus fails to achieve its genetic potential and consequently is at risk of increased perinatal morbidity and mortality [1]. Birth weight is usually taken as the sole criterion to assess fetal growth and consequently fetuses with a birth weight of less than the 10^{th} percentile of those born at the same gestational age or two standard deviation below the population mean, are considered growth restricted. However, fetuses which are less than 3^{rd} to 5^{th} percentile are clinically more relevant since they are more likely to have adverse effects. The early detection of IUGR is therefore important to institute specific treatment wherever possible or plan appropriate timed delivery to reduce perinatal morbidity and mortality. Low birth weight is a major problem in India. Nearly 3 million low birth weight babies are born annually in India [2]. It accounts for more than half of the neonatal deaths in India [3]. The main contributory causes are poor maternal nutrition, hypertensive disorders complicating pregnancy, maternal medical disorder (anemia, heart disease, diabetes, epilepsy, infections), obstetric

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disorders (hydramnios, multiple pregnancy, congenital fetal malformations), lifestyle influences (physically strenuous occupation, exposure to toxic chemicals, smoking, alcohol in excess, drug abuse, infections). Ultrasonography (USG) plays an important role in identifying growth restricted fetuses and in assessing intrauterine fetal well being. Clinical palpation using anatomical landmarks is subjective and has a wide interobserver difference (Bais 2004) but is the only alternative in settings without USG machines. USG, though accurate, is expensive and also requires skill, when used as a screening tool for abnormal growth detection. In developing countries like India, where sophisticated methods of monitoring are not available in all centers, basic methods to determine intrauterine fetal growth can be of great value. Fundal height measurement (in cm) has been reported to be an objective method of evaluating fetal growth in pregnancy and is generally regarded as an acceptable screening instrument for antenatal detection of IUGR. It is specially of value in those centers where facilities for USG is not available.

Methodology

The patients were selected from those attending the antenatal out patient department (OPD) and those admitted in the antenatal ward of Guwahati Medical College and Hospital. The study was conducted on 500 women attending the OPD in a cross sectional manner. All the measurements were taken by only one observer in order to avoid bias. The exclusion criteria considered were: 1) Women who are not sure of her last menstrual period (LMP) or women who have irregular cycles, 2) Obese women, 3) Women with polyhydramnios or oligohydramnios. (as confirmed by USG), 4) Pregnancy with transverse lie or oblique lie, 5) Pregnancy with fetal anomaly or multiple gestation. (as detected by USG)

Healthy women with uncomplicated singleton pregnancy were considered for the study. Only those women who have regular menstrual cycles and are sure of their LMP were taken for the study. Early USG were used as a tool to ascertain the correct LMP. The symphysiofundal height was measured in the women attending the antenatal OPD and simultaneously an USG was also done to estimate the fetal weight at that gestational age by taking into account various combination of fetal parameters such as abdominal circumference (AC), femur length (FL), bi parietal diameter (BPD), and head circumference (HC). The liquor volume, absence of any congenital anomaly or multiple gestation was also ascertained by the USG.

For the measurement of the symphysiofundal height, the woman was asked to empty her bladder and then made to lie in supine position with legs extended. The fundus was defined by placing the ulnar border of the left hand against the upper border of the uterus. One end of the non elastic tape was placed on the upper border of the pubic symphysis and gently stretched over the midline of the abdomen and the fundal height was measured in centimetre. Measurements were taken at 24, 28, 32, 36, 40 weeks of gestation with 100 women in each category and a normogram is constructed from the reading. The mean, standard deviation, 10^{th} percentile, 50^{th} percentile and 90^{th} percentile of the fundal height measurements was taken to determine its relationship to gestational age. Fetal weight is calculated by Johnson's formula for measurement of fetal weight in vertex presentation as

Foetalweight(gm)=(symphysiofundal 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 patient weighs more than 91kg, 1cm is subtracted from the fundal height [4].

Results

In this study, the majority of the women were in the age group 20-30 years. In the study population, more number of primi gravida women reported for antenatal checkup at early period of gestation as compared to multigravida women. The most of the women in the studygroup were between 140cm to 150 cm, comprising 63.4% of the total study population. The

Table 1: Distribution of maternal age, parity, height, weight, symphysio-fundal height (SFH) and abdominal girth at different period of gestation.

Categories		Gestational Age				
		24 wks	**28wks**	**32wks**	**36wks**	**40wks**
Age	<20 yrs	24	4	9	2	0
	20-30 yrs	74	84	87	87	77
	31-40 yrs	2	12	4	11	23
Parity	Primi	82	32	60	39	7
	Multi	18	68	40	61	93
Height	140-150 cm	67	60	60	69	61
	151-160 cm	31	37	37	28	38
	>160cm	2	3	3	3	1
Weight	40-50 kg	78	69	27	3	11
	51-60 kg	21	29	68	86	71
	>60 kg	1	2	5	11	18
	Mean	47.21	49.90	53.83	57.26	57.39
SFH(cm)± (SD)		22.35±0.85	25.97±0.83	29.86±0.96	33.48±1.2	34.88±1.5
Abdominal girth(inche) ± SD		25.97±1.5	29.3±1.2	34.59±1.3	37.1±1.3	39.8±2.05

mean height was 149.45cm with a standard deviation of ±5.11 (Table 1). The mean of the weight in the study population increased gradually with the period of gestation, mean value of weight at 24 weeks was 47.21kg with a standard deviation of ±4.96, and at 40 weeks, it was 57.39kg with a standard deviation of ±4.66. The symphysio-fundal height (SFH) and abdominal girth at 24 weeks, 28 weeks, 32weeks, 36 weeks and 40 weeks are shown in table 1. There is an increase in the fetal weight with the increase in the maternal height and weight, though it proved to be statistically insignificant.

Discussion

The mean age of the present study was 24.84 years with a standard deviation of (±4.56). The maximum age of the study population was 40years and minimum age was 18years. The mean height was found to be 149.27cm with a standard deviation of (±4.96).The maximum height was 163 cm and the least height was 140cm**.** It was seen that there was an increase in the estimated birth weight with the increase in the height at all periods of gestation as has also been observed by other authors [5]. It was observed that there was an in - crease in esti - mated fetal wei - ght with the increase inmaternal weight in all the groups. It has also been proved by previous authors [6, 7]. The mean of the SFH calculated at different period of gestation was compared with those obtained from other studies (table 3). The estimated fetal weight calculated by Johnson's formula was compared with the estimated fetal weight by USG and also with the birth weight at 40 weeks gestation. It was observed that Johnson's formula over estimated the fetal weight for fetal weight less than3.0kg. The difference between the fetal weight by Johnson's formula and by USG at different period of gestation was found to be statistically significant ($p < 0.0001$) at earlier period of gestation. However, it was observed that with increasing period of gestation, the difference between the mean of weight by Johnson's formula and mean of weight by USG decreased towards term as fetal weight increased. Johnson's formula had a tendency to overestimate the

Table 2: Fetal weight in relation to maternal height and weight

Categories		Mean fetal weight(gm)at different period of gestation				
		24wks	28wks	32wks	36wks	40wks
Height	140-150cm	1432.01	2004.66	2511.75	3105.43	3369.34
	151-160cm	1475.00	2006.62	2601.48	3154.28	3430.39
	>160cm	1627.00	2170.00	2790.00	3202.33	3565.00
Weight	40-50kg	1440.70	1788.05	2554.62	3013.33	3339.54
	51-60kg	1468.80	2015.00	2630.44	3116.97	3392.53
	>60kg	1705.00	2247.50	2697.00	3181.81	3435.83

birth weight range of less than 3000g as compared to the USG weight. For weights more than 3000g, the USG weight and the calculated weight by Johnson's formula were almost correlating. Similar results have been reported by Sharma and Bharadwaj; Niswander et al; Tewari and Sood [13-15]. At term, i.e at 40weeks, when the calculated fetal weight was compared with the birth weight, by applying unpaired t test, the p value was found to be 0.602 (statistically insignificant), and when compared with the USG weight, the p value was calculated to be 0.0516 (statistically insignificant). The mean weight at 40 weeks calculated by the 2 methods are compared with the birth weight and the calculated p value by ANOVA test was found to be insignificant.

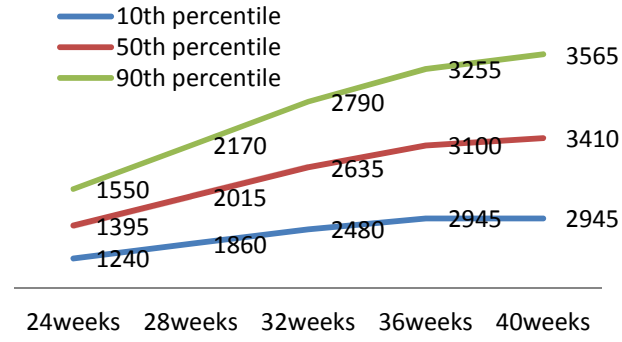
Table 3: Comparison of mean SFH of various study [8-12]

Gestation (wks)	Mean SFH Value					
	Tian et al	Hextan et al	Present study	Stephen et al	Belizan et al	Quaranta et al
24	18.9	22	22.3	23.9	22.5	24.1
28	23.2	25.9	25.9	28.2	26.5	28.1
32	26.7	29.5	29.8	31.9	30.5	31.8
36	30	32.8	33.4	35.7	33.5	34.7
40	32	36.1	34.8	39.1	34.5	36.3

Table 4: Comparison of birth weight

	Mean±Standard deviation	P value by ANOVA test
Johnson's formula	3394.55±233.67	0.0808
Ultrasonography	3331.11±223.71	
Actual weight	3335.00±211.00	

Figure 1: Graph showing the 10th, 50th and 90th percentile of fetal weight at different period of gestation



In the present study, the 10th, 50th and 90th percentile of the estimated fetal weight has been calculated by Johnson's formula. Considering that, all the patients selected for the study were normal(using the inclusion and exclusion criteria), a gravidogram is thus constructed using the 10th,50th and 90th percentiles at each gestational age and this may be considered as the normogram for our population.

Conclusion

The Johnson's formula can be a very important component of antenatal care and it is as useful as USG in the determination of fetal weight. In the present study, the 10th, 50th and 90th percentile of the estimated fetal weight has been calculated by Johnson's formula and a gravidogram is thus constructed using the 10th, 50th and 90th percentiles at each gestational age and this may be considered as the normogram for our population.

Conflict of interest: None. **Disclaimer:** Nil.

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