

## **Research Article**

# **Estimation of Fetal Weight by Johnson's Formula and Its Correlation with Actual Birth Weight**

**Dr. Jili Basumatary<sup>1</sup>, Dr. Ashish Kumar Bhattacharjee<sup>2</sup>, Dr. Shaidul Islam Borah<sup>3</sup>**

<sup>1</sup>Post Graduate student, <sup>2</sup>Professor and Head, <sup>3</sup>Assistant Professor, Department of Obstetrics and Gynaecology, Gauhati Medical College and Hospital, Guwahati, Assam, India

### **\*Corresponding author**

Dr. Jili Basumatary

Email: [2609jili@gmail.com](mailto:2609jili@gmail.com)

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**Abstract:** Fetal growth assessment is an important part of antenatal care. Proper estimation of fetal weight and appropriate timed intervention in cases of intrauterine growth restriction (IUGR) can help to decrease the perinatal morbidity and mortality. A prospective study of 100 antenatal women at 40 weeks of gestation attending the antenatal outpatient department (OPD) and admitted in the antenatal wards was selected for the study. Only those women with a singleton pregnancy in vertex presentation, who are sure of their LMP and in whom congenital anomalies and liquor volume abnormalities have been ruled out by ultrasonography (USG) were included in the study. The fetal weight is calculated by using Johnson's formula and is compared with the USG weight, and the accuracy was determined by comparing with the actual birth weight. The Johnson's formula was seen to overestimate the fetal weight at birth weights less than 3 kg, and above it the results were almost correlating with the birth weight. The difference between the fetal weight calculated by Johnson's formula and the actual birth weight was found to be statistically insignificant. ( $p=0.602$ ). The Johnson's formula for estimation of fetal weight is as accurate as USG and can serve as an important tool for fetal weight estimation especially in low resource setting where USG is not available.

**Keywords:** Symphysio fundal height, Johnson's formula, birth weight, ultrasonography, IUGR, fetal growth.

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## **INTRODUCTION**

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]. Fetuses that suffer from growth restriction have higher perinatal morbidity and mortality and are more likely to experience poor cognitive development and neurologic impairment during childhood. 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<sup>th</sup> percentile of those born at the same gestational age or two standard deviation below the population mean, are considered growth restricted.

The burden of IUGR is concentrated mainly in Asia which accounts for nearly 75% of all affected infants. Africa and Latin America account for 20% and 5% cases respectively. In India, the prevalence of low birth weight has been reported as 26%[2], while the proportion of IUGR has been found to be 54% [3].

Growth restricted fetuses have an increased incidence of meconium aspiration, fetal distress and acidosis during labor; increased incidence of hypoxic

ischemic encephalopathy and persistent fetal circulation in neonatal period. They also have predisposition to hypoglycemia and chronic intrauterine hypoxia may lead to polycythemia, necrotizing enterocolitis and other metabolic abnormalities. In childhood, there is a subtle impairment in cognitive performance and educational under performance reported in these children[8]. Long term complications include increased risk of coronary heart disease, hypertension, Type II diabetes mellitus, dyslipidemia and stroke. Chronic lung disease or bronchopulmonary dysplasia is also more common in IUGR infants. IUGR also has direct effect on the developing kidneys[4].

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. The ACOG (2000) recommend symphysiofundal height (SFH) with USG

measurement where discrepancies of fundal height arise.

The present study aims at estimation of fetal weight by using Johnson’s formula and comparing it with fetal weight estimated by USG, and determining the accuracy by comparing with the actual birth weight.

**MATERIALS AND METHODS:**

The patients were selected from those attending the antenatal outpatient department(OPD) and those admitted in the antenatal ward of Gauhati Medical College and Hospital. The study was conducted on 100 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:

- Women who are not sure of her last menstrual period (LMP) or women who have irregular cycles.
- Obese women.
- Women with polyhydramnios or oligohydramnios.(as confirmed by USG)
- Pregnancy with transverse lie or oblique lie
- Pregnancy with fetal anomaly or multiple gestation.(as detected by USG)

**METHODS**

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.

The fetal weight was calculated using the Johnson’s formula:

$$\text{Estimated fetal weight (in grams)} = (\text{symphysiofundal height in cm} - x) \times 155$$

Where,

- x= 13, when presenting part is not engaged.
- x = 12, when presenting part is at station 0.
- x=11, when the presenting part is at station +1.

If the patient weighs more than 91kg,1cm is subtracted from the fundal height[5].

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.

**RESULTS:**

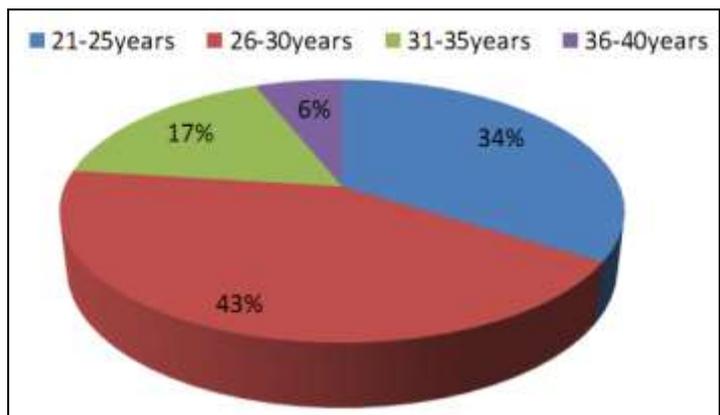
- The study population comprised of 61% illiterate and 39% literate women as shown in table 1.
- The age distribution showed 34 women between 21-35years and 43 women between 26-30years,17 women between 31-35years and 6 women between 36-40 years. The mean age was 28.08 years with a standard deviation of 4.23years.(Table 2,Fig.1)
- There were 7 primi gravidae and 93 multigravida women.

**Table 1: showing frequency of educational status**

	Frequency(n)	percentage
Literate	39	39%
Illiterate	61	61%
Total		100

**Table 2:Table showing distribution of age distribution**

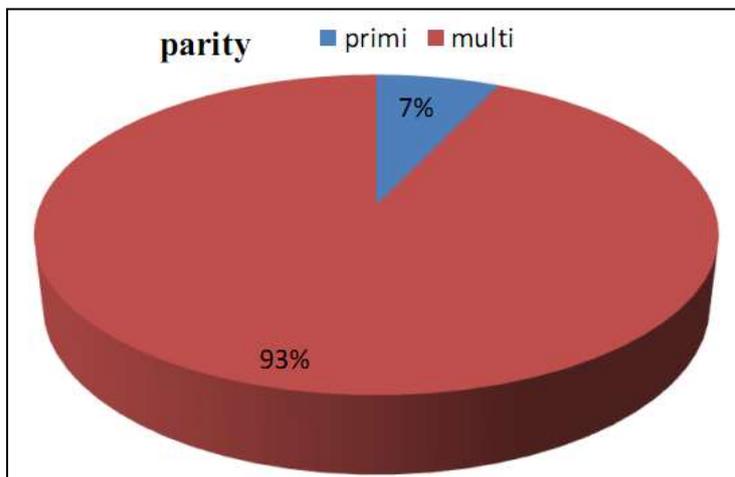
AGE(years)	Frequency(n)	Percentage(%)	mean	Standard deviaton
21-25	34	34	<b>28.08</b>	<b>4.23</b>
26-30	43	43		
31-35	17	17		
36-40	6	6		
<b>Total</b>		100		



**Fig- 1: showing frequency of age distribution**

**Table 3: showing distribution of parity**

	Frequency(n)	percentage
Primi	7	7%
Multi	93	93%
TOTAL	100	



**Fig- 2: Pie diagram showing distribution of parity.**

- There were 61 women with height between 140cm-150cm, 38 women between 151cm-160cm, 1 woman above 160cm.
- 11 women in the study group had weight between 40kg-50kg, 71 women had weight between 51kg-60kg ,18 women with weight above 60kg.

**Table 4: Table showing distribution of height**

Height(cm)	Frequency(n)	percentage
140-150	<b>61</b>	<b>61%</b>
151-160	<b>38</b>	<b>38%</b>
>160	<b>1</b>	<b>1%</b>
TOTAL	<b>100</b>	

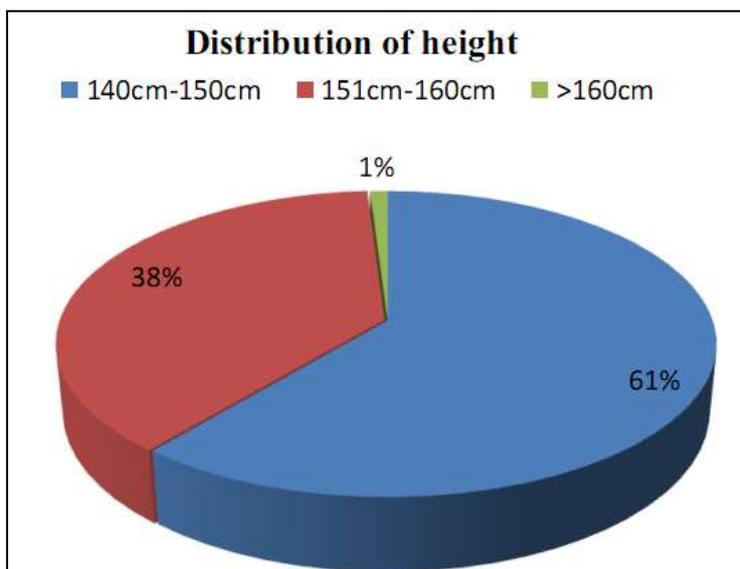


Fig-3: Pie diagram showing distribution of height

Table 5: showing distribution of weight

WEIGHT	Frequency(n)	Percentage
40kg-50kg	11	11%
51kg-60kg	71	71%
>60kg	18	18%
Total	100	

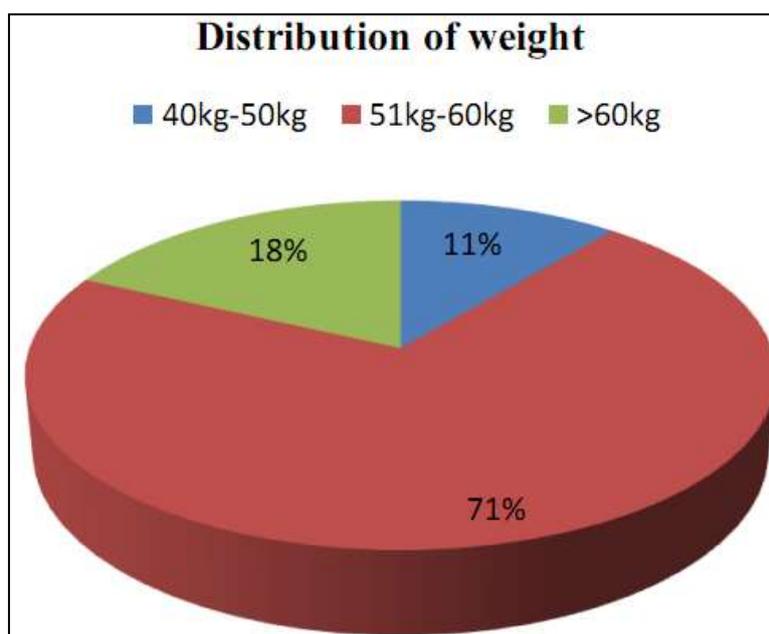


Fig -4: Pie diagram showing distribution of weight

Table -6: The estimated fetal weight (EFW) calculated by different methods

METHOD	Frequency(n)	Mean	Standard deviation
Johnson's formula	100	3394.5	233.67
USG	100	3331.14	223.71
Actual birth weight	100	3335.00	211.00

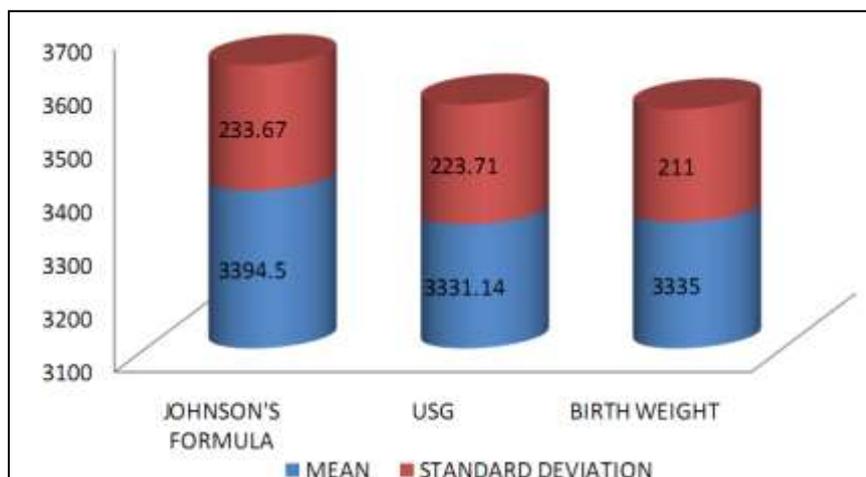


Fig -5: Fetal weight by different methods

Table- 7: The mean weight calculated by all the 3 methods are compared

	MEAN	STANDARD DEVIATION	P value by ANOVA test
Johnson's formula	3394.55	233.67	0.0808
Ultrasonography	3331.14	223.71	
Actual weight	3335.00	211.00	

**DISCUSSION**

- The mean age of pregnant women in the present study 28.08 years .The minimum age was 21years,and maximum age was 40years. The percentage of literate patients 39%. There were 7 primigravida and 93 multigravida patients.
- The mean height of the study population was 149.59cm and, the range was140cm-162cm and it was seen that there was an increase in the fetal weight with the increase in the maternal height, this was also proved by other authors.
- The weight of the study population was between 45 kg-68 kg .with a mean of 57.39 kg. It was seen that there was an increase in the fetal weight with increase in the maternal weight as also observed by other authors.
- The Johnson's formula was seen to overestimate the fetal weight at lower weights especially at fetal weights more than 3kg.For weight more than 3 kg the weights were almost correlating.
- Similar results have been reported by Sharma and Bharadwaj[6]; Niswander *et al*[7]; Tewari and Sood[8]. 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 is compared with the birth weight and the calculated p value by ANOVA test was found to be insignificant. While other studies have confirmed that Johnson's formula correctly predicts actual birth weight[9-12] only two previous papers have compared the accuracy of this formula with ultrasound estimates.

**CONCLUSION**

The estimation of fetal weight by Johnson's formula is comparable with the estimated weight by USG. Therefore, the clinical method can be a very important tool for fetal weight estimation, particularly in a setting where USG is not available. It is also cost effective, easy and no special skill is required. The early detection of IUGR can help in the timely intervention and thereby improve the perinatal morbidity and mortality of the country. Despite the superiority of USG, the simple clinical method of EFW is of great value especially in a developing country.

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