ORIGINAL ARTICLE

Correlation of Predicted Birth Weight at 20–24 Weeks of Gestational Age using the Formula devised by Chi-Feng Su to Actual Birth Weight

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ABSTRACT

Aim: The aim of the study is to use the formula demonstrated by Chi-Feng Su to determine the estimated birth weight (EBW) at 20–24 weeks gestation and try to find out the correlation between the estimated fetal weight with the actual birth weight in our local population.

Materials and methods: It is a retrospective study done at the Department of Obstetrics and Gynecology, RajaRajeswari Medical College, Bengaluru. Fifty patients who were booked, followed up, and delivered at our institution were selected for our study after meeting inclusion and exclusion criteria. Participant's demographic characters like age, gravida, weight, body mass index (BMI), last menstrual period (LMP), and others were noted down as per the protocol. Their mid-pregnancy BMI, and fetal biometry report at 20–24 weeks were noted. Using the study formula, their anticipated fetal weight was calculated. After delivery, the exact birth weight was noted and was correlated with the predicted weight.

Results: In the study, majority (66%) aged less than 25 years and only 3 patients were aged above 30 years; 50% of the cases were second gravida; 60% of the participants had BMI between 20 and 25, 16% has BMI above 25, and 24% has BMI less than 20. The best correlation was seen in the weight group between 2.6 and 3.5 kg.

Conclusion: The formula demonstrated by Chi-Feng Su had variance as high as 0.303. Our study also showed high variability when the error was +17.6% with birth weight >2.5 kg.

Keywords: Actual birth weight, Body mass index, Estimated fetal weight.

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INTRODUCTION

Determining fetal weight accurately prior to delivery is very essential and is useful for taking clinical decision in labor, thereby improving perinatal outcome.

The estimation of fetal weight has undergone tremendous transformation from clinical estimation to present-day assessment by multiple parameters in ultrasonography. Clinical estimation of fetal weight relied on abdominal examination findings like symphysis fundal height (SFH), abdominal circumference (AC), and other parameters. Various clinical formulas like Johnson's and Dawn's are used for the estimation of fetal weight near term.

In the past decades, improvement in ultrasound imaging and better availability of equipment, has made possible widespread use of ultrasound for assessing fetal weight across all gestational ages. Various formulas used, such as Hadlock's, Shepard's, Campbell's, etc., predict the fetal weight with a reasonable error of 6–15%.[1]

All the above methods measure the estimated fetal weight near term, but we have very few methods to predict the birth weight at late second trimester or early third trimester. There are few studies which state fetus with intrauterine growth restriction (IUGR), and the biometry values deviate from the normogram from the second trimester itself. However, there are no reliable methods or formulas to predict IUGR.

Intrauterine growth restriction is defined as the pathologic inhibition of intrauterine fetal growth and the failure of the fetus to achieve its growth potential.[2] The IUGR is seen in about 10% of pregnancies.[3] Fetal growth is known to be as important predictor of pregnancy outcome as IUGR is associated with increased fetal and neonatal morbidity and mortality. The IUGR is also linked to neonatal complications, such as prematurity, cerebral palsy, intrauterine device (IUD), and neonatal deaths.[4]

There have been a few reports about the studies to predict the birth weight at term as early as mid-pregnancy.[5-7] Chi-Feng Su et al,[8] published a study which used a unique formula to predict birth weight using fetal biometry and maternal characteristics, as early as 20–24 weeks gestation.

They considered maternal weight factors, pregnancy time interval, and sonographic fetal biometry, and developed a simple and easy mathematical equation for term birth weight estimation at mid-pregnancy. The formula is

EBW = −700 + 49.766 × (mid-pregnancy BMI) + 13.362 × (time interval from mid-pregnancy to term delivery in days) + 68.696 × (abdominal circumference in cm).

AIM

The aim of the study is to use the formula proposed by Chi-Feng Su et al and try to find out the correlation between the estimated fetal weight with the actual birth weight in our local population.

MATERIALS AND METHODS

It is a retrospective study done at the Department of Obstetrics and Gynecology, RajaRajeswari Medical College, Bengaluru, Karnataka, India. Fifty patients who were booked, followed up, and delivered at our institution were selected for our study after meeting inclusion and exclusion criteria.

Inclusion Criteria

- Singleton pregnancy

Exclusion Criteria

- Multiple pregnancy.
- Obstetrics complications like pregnancy-induced hypertension, gestational diabetes mellitus
- Medical disorders like congenital heart diseases.
   Participant's demographic characters like age, gravida, weight, BMI, LMP, and others were noted down as per the protocol. Their mid-pregnancy BMI, fetal biometry report at 20 to 24 weeks were noted. Using the study formula, their anticipated fetal weight was calculated. After delivery, the exact birth weight was noted and was correlated with the predicted weight.

RESULTS

Out of 50 participants analyzed in the study, majority (66%) were aged less than 25 years and only 3 patients were aged above 30 years; 50% of the cases were second gravida; 60% of the participants had BMI between 20 and 25, 16% had BMI above 25, and 24% had BMI less than 20 (Table 1).

Table 2 shows the correlation of EBW to the actual birth weight. According to the formula, there were no babies with anticipated birth weight of <2 kg, but there were 9 babies with actual birth weight of <2 kg. The best correlation was seen in the weight group between 2.6 and 3.5 kg. The estimated weight in this group showed

Table 1: Demography

Age (years)	<25	33
	25–30	14
	>30	3
Gravida	I	9
	II	25
	>II	16
BMI	<20	12
	20–25	30
	>25	8

Table 2: Correlation of EBW to actual birth weight

Range	*Estimated weight (kg)*	*Actual weight (kg)*
<2.0	0	9
2.1–2.5	10	5
2.6–3.0	5	22
3.1–3.5	29	11
>3.5	6	3

34 babies, and 33 babies were born with actual birth weight ranging between 2.6 and 3.5 kg. In the weight group >3.5 kg, there were 6 cases in the estimated group and 3 cases in the actual birth weight group showing reasonable correlation.

DISCUSSION

Various formulas or methods are used to estimate the fetal weight during antenatal care, but actual birth weight can only be measured after child birth. Chien et al[9] used ultrasound measurement of various fetal biometric parameters at term to assess fetal weight and found reasonable correlation with actual birth weight. They stated that the mean error and the rate of estimated weight was within 10% of the birth weight.

However, predicting macrosomia or IUGR at mid-trimester was not possible with their formula.

We have used the formula that was constructed by Chi-Feng Su et al as a predictive model that could be used during mid-pregnancy in order to predict the birth weight.

The formula was EBW= −700+49.766× (mid-pregnancy BMI) + 13.362 × (time interval from mid-pregnancy to term delivery [days]) + 68.696 × (AC). The formula was used to test the possibility of predicting small or large babies at 20 and 24 weeks of gestation. This formula would be valuable for obstetricians to provide appropriate prenatal care and to prevent the birth of very small or very large babies.

In their study, many contributory factors were included related to birth weight, such as gestational age, maternal characteristics, and fetal ultrasound biometrics. Maternal weight variables during pregnancy were significant factors that affect the newborn birth weight.

In their study, maternal weight gain and BMI gain had a significant correlation (r = 0.18, p < 0.05). However, maternal BMI and weight at 20–24 weeks of gestation showed the highest correlation coefficient (r = 0.388 and 0.358 respectively, p < 0.05).

Our study shows that the formula was reliable with an error of ±2.9% in predicting the weight among the group of 2.6–3.5 kg. Among the weight group >3.5 kg, 6 participants were predicted but actual weight of >3.5 kg was seen in 3 patients.

However, most problem group was < 2 kg, where no participant had estimated weight <2 kg, and actual weight was <2 kg in 9 participants. In the actual weight group, there were 14 participants with weight less than 2.5 kg with an average weight of 2.21 kg. But the average EBW of these 14 participants was 2.605 kg with an error percent of +17.6%.

Similar to the original study, the average error in the estimation of fetal weight when all the 50 participants were considered was ±0.333 kg.

CONCLUSION

The formula demonstrated by Chi-Feng Su had variance as high as 0.303. Our study also showed high variability when the error was +17.6% with birth weight >2 kg.

However, predicting term birth weight at mid-pregnancy had some limitations. There are many unpredictable factors that affect birth weight during the period from mid-pregnancy to term delivery, and some factors, such as maternal behavior, nutrition, and exercise vary individually. As much as 30% of the factors for preventing larger and smaller infants at delivery can be predicted as early as 20–24 weeks of gestation; therefore, it would be worthwhile to plan necessary interventions to prevent neonatal morbidity and mortality.

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