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Correlation between crown-rump length in first trimester by ultrosonography and birth weight post natal

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Abstract
Background: Crown Rump Length (CRL) is the measurement of the length of human embryo or fetus from top of the head to bottom of the buttock. Gestational age assessment by ultrasound is most accurate in the first trimester of pregnancy. CRL measurement is used to determine the gestational age. The aim of the present study is to find the correlation between first trimester Crown-Rump Length and the birth weight of neonate.
Materials and Methods: 100 women with singleton pregnancy, who attended antenatal OPD in first trimester in our hospital, were included in this study after informed consent. First trimester ultrasound measurement of Crown rump length was done. For the optimal accuracy, the average of three independent CRL value was taken for the study. They were followed up until delivery and the neonatal birth weight was noted. The data were analysed using mean, standard deviation, Pearson correlation coefficient and chi-square test.
Results: The mean age of the study population was 25.24± 3.4 years. The mean crown rump length was 3.5±2.07 and the mean birth weight was 2.9± 0.51. There was significant correlation between the first trimester crown rump length and gestational age in this study. But there was no significant correlation between crown rump length and neonatal birth weight.
Conclusion: Hence we recommend further more research in this field in large population to find the correlation between crown rump length and birth weight, so that earlier and timely intervention can minimize the adverse neonatal outcome such as low birth weight.

Keywords: Birth weight, crown rump length, gestational age, neonate

Introduction
Crown Rump Length (CRL) is the measurement of the length of human embryo or fetus from top of the head (Crown) to bottom of the buttocks (Rump). Crown rump length can be measured transabdominally or transvaginally. Amidline sagittal section of the whole embryo or fetus should be taken with the embryo or fetus placed horizontally on the screen. Magnification of the image should be done to view most of the width of the screen, so that the measurement line between crown and rump is about 90 degree to the ultrasound beam [1, 2]. Linear calliper is used to measure the fetus in neutral position. Yolk sac should not be included. To ensure that fetus is not flexed amniotic fluid should be visible between fetal chin and chest.
The optimal time in assessing CRL is between 8 and 13+ 6 weeks [3, 4]. At 11 to 13+6 weeks CRL and BPD (Biparietal diameter) are the most commonly measured parameters for dating the pregnancy [5, 6]. CRL measurement is used to determine gestational age unless it is above 84mm, after this, HC (Head circumference) is used, as it becomes slightly more precise than BPD [7]. For the optimal accuracy in dating pregnancy, it is recommended to measure 3 independent CRL and to take average of it [8].
Gestational age assessment by ultrasound is most accurate in the first trimester of pregnancy as the biological variation in fetal size is minimal during this period. In second half of pregnancy, the fetal size variation is major. Hence the gestational age estimation can be done safely and accurate with a error of 3-5 days maximum in the first trimester. Gestational age in weeks = Crown Rump Length (cm) + 6.5 [9].
Few studies have shown that fetal parameters at term may have precursors early in pregnancy. So the early diagnosis and intervention may improve the outcome in abnormal fetal growth at term.

The aim of the present study was to find the correlation between first trimester Crown Rump Length and the birth weight of newborn.

Materials and Methods

This was a prospective observational study done over one year from January 2019 to February 2020 in a tertiary hospital in Salem district of Tamilnadu.100 women with singleton pregnancy who attended antenatal OPD in first trimester were included in the study. Multiple pregnancy and bad obstetric history were excluded. Institute ethical committee clearance obtained. The study was done after obtaining informed consent from the study participants. First trimester ultrasound measurement of Crown rump length was done. They were followed up until delivery and the birth weight was noted.

The sample size was calculated using Open Epi software version 3. The sample size was calculated at 95% confidence interval and 5% error and it came out to be 100. The statistical analysis was done using SPSS 23. The data were analysed using mean, standard deviation, Pearson correlation coefficient and chi-square test.

Results

100 women were included in this study. The mean age of the study population was 25.24± 3.4 years. Table 1 describes the distribution of age in study participants. 41% (n= 123) of women were in the age group of 21 to 25 years. 30% (n= 90) of women were in the age group of 26 to 30 years. 22% (n= 66) of women were in the age group of less than 20 years. 7% (n=21) of women were in the age group of more than 30 years.

Table 1: Age Distribution

Age Group (Years)	N=100 n(%)
<20	9 (9)
2030	85 (85)
>30	6 (6)

Table 2 describes the distribution of gravida in the study participants. 55% (n=55) of women were primigravida. 37% (n= 37) of women were second gravida. 6% (n= 6) of women were third gravida.

Table 2: Distribution of Gravida

Gravida	N=100 n(%)
1	55 (55)
2	37 (37)
3	6 (6)
>3	2 (2)

Table 3 describes the distribution of maternal BMI in the study participants. 2% (n= 2) of women were underweight. 30% (n= 30) of women were of normal BMI. 58% (n= 58) of women were overweight. 10% (n= 10) of women were obese.

Table 3: BMI Distribution

BMI (KG/M^2)	N=100 n(%)
Underweight <18.5	2 (2)
Normal 18.5 To 24.9	30 (30)
Overweight 25.0 To 29.9	58 (58)
Obese >30	10 (10)

Table 4 and 5 describes the distribution of neonatal birth weight, gestational age and crown rump length. Of the 100 antenatal pregnant mothers, 40% had neonatal birth weight more than 2.5 to 3 kg, 40% had neonatal birth weight more than 3 kg, 15% had neonatal birth weight between 2 to 2.5kg and 5% had birth weight less than 2 kilogram.

Table 4: Neonatal Birth Weight

Neonatal Birth Weight	N= 100 n (%)
< 2 kg	5 (5)
2-2.5 kg	15 (15)
2. 51- 3 kg	40 (40)
>3 kg	40 (40)

Table 5: Gestational age, crown rump length and birth weight

Gestational Age	Crown Rump Length (Crl)		Birth Weight		N=100 (n)
	Minimum	Maximum	Minimum	Maximum	
6-8 WEEKS	0.5	1.7	2	3.6	23
9-10 WEEKS	2	3.8	1	3.6	28
11-14 WEEKS	4.2	7.7	1.96	4.2	49

The mean maternal age in the study population is 25.24± 3.4 years; the mean crown rump length was 3.5±2.07 and the mean birth weight was 2.9± 0.51

CRL vs Birth Weight

Pearson correlation: 0.110

Significance: 0.279 not statistically significant as depicted in figure 1.

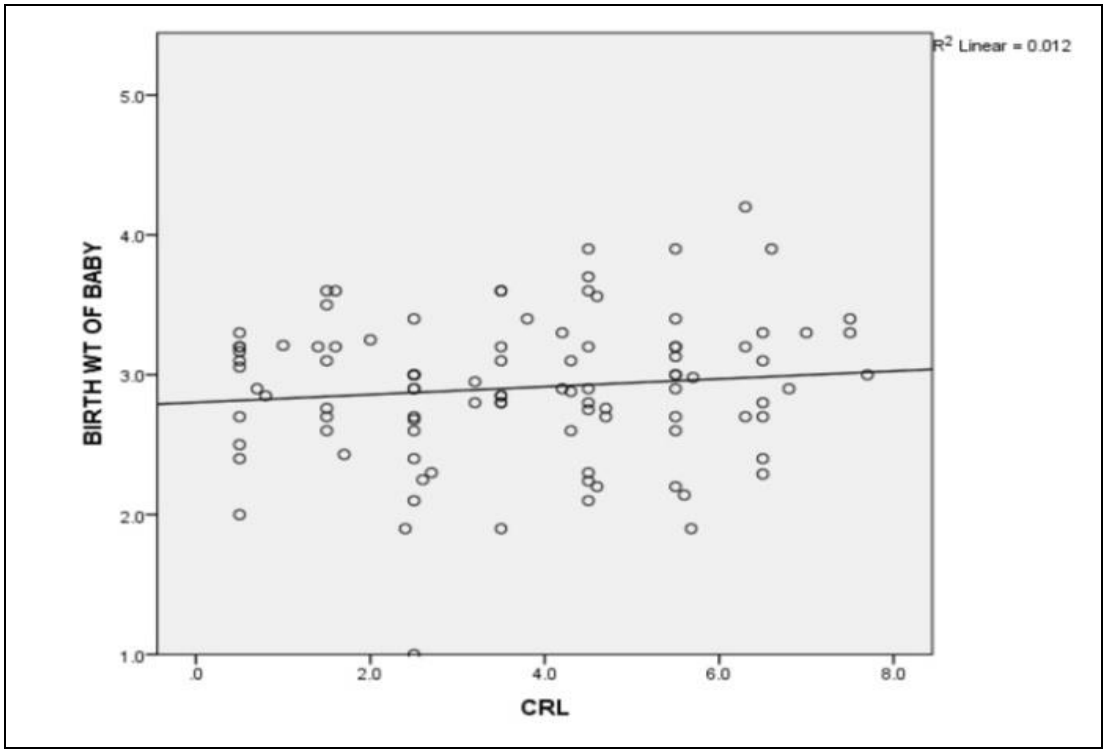

Fig 1: CRL VS Neonatal Birth Weight

CRL vs BMI
Pearson correlation: 0.009
Significance: 0.932 Not statistically significant

BMI vs Birth Weight
Pearson correlation: -0.151
Significance: 0.136 Not statistically significant

CRL vs Gestational Age
Pearson correlation: -198
Significance: 0.000 Statistically significant

Discussion

In the present study, there was no direct correlation between crown rump length and neonatal birth weight. There are various studies conducted in different parts of world to find correlation between crown rump length and birth weight. In a study conducted by Ben Ami *et al* there was no significant correlation between crown rump length and birth weight [10]. Mongelli *et al* found no significant correlation between birth weight and crown rump length [11].

In contrast to this,Vafai et el study concluded that consistent measurement of crown rump length during first trimester was used to prevent adverse pregnancy outcomes with shorter crown rump length for that gestational age [12].

In the study byLeung T.Y *et al*, in 2760 cases, it was concluded that the first trimester crown rump length is an independent factor in influencing the final birth weight. Smaller the Crown rump length, the higher the risk for a small for gestational age baby (SGA) [13].

In Pardo J *et al* study, there was a significant linear correlation between the Crown rump length and birth weight percentile [14] In his study on 521 women, he concluded that large for gestational age (LGA)neonatal group had significantly larger than expected CRL measurements. In Shabanian S *et al*, there was a direct correlation between crown rump length and birth weight [15].

In the present study there was significant correlation between crown rump length and gestational age. This was similar to the study done by Shahshan Z *et al* in 118 women in Isfahan, in which there was significant correlation between small for gestational age and crown rump length [16].

There is evidence that fetal growth pregnancy is not uniform throughout even during the first trimester. Hence the relationship between subsequent course of pregnancy and early fetal growth is difficult to interpret. Apart from abnormality in placentation, environmental, genetic factors, nutritional and hormonal factors also influence fetal growth [17, 18]

Some fetusmay be physiologically small throughout pregnancy. Gowsami *et al* found an association between newborn baby weight and age of the mother, whereas in Adamsons H *et al* there was no significant correlation between age of the mother and the birth weight of the newborn baby [19, 20]

In the study by Mook– Kanamori d *et al* it was found that the maternal physical characteristics and lifestyle habits also influence the first trimester fetal growth based on the crown rump length. It also showed that maternal smoking and lack of folic acid supplementation was associated with shorter crown rump length [21]

Conclusion

Although there was no correlation between crown rump length and neonatal birth weight in the present study, further research is needed in large population in futureto find the correlation between crown rump length and birth weight, so that earlier and timely intervention can minimize the adverse neonatal outcome.

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