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ORIGINAL RESEARCH

Correlation of crown-rump length measured in first trimester with maternal and neonatal outcomes in singleton pregnancy: A Record Based study

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Abstract
Background: Accurate prediction and management of abnormal fetal growth are crucial in antenatal care. Small for gestational age (SGA) foetuses face increased morbidity and mortality, while large for gestational age (LGA) foetuses risk birth trauma and perinatal morbidity.**Objectives:** To determine the correlation between first-trimester crown-rump length (CRL) measurements and maternal and neonatal outcomes.**Materials and Methods:** This retrospective cross-sectional study included 288 singleton pregnancies from July 1, 2022, to June 30, 2024. Patients underwent ultrasound examination between 11 to 13+6 weeks of gestation. Data were analysed using IBM SPSS Statistics version 23.**Results:** The study found significant associations between CRL measurements and neonatal outcomes. CRL values <44mm were linked to outcomes, including SGA (38.8%) and low birth weight (20.1%). In contrast, CRL values >81mm were associated with outcomes, including LGA (18.7%) and preterm births (11.11%). Maternal characteristics, such as parity, showed significant associations with CRL values.**Conclusion:** First-trimester CRL measurements are a valuable predictor of neonatal outcomes, including birth weight, SGA, LGA, preterm birth, and NICU admission. These findings emphasize the importance of early CRL measurement in identifying high-risk pregnancies and guiding prenatal care.

Keywords: Crown-Rump Length; Small for Gestational Age; Large for Gestational Age; Low Birth Weight

Introduction

Accurate prediction and management of abnormal fetal growth are crucial objectives of antenatal care. Foetuses that are small for gestational age (SGA) are at increased risk of fetal growth restriction, leading to increase morbidity and mortality in infancy and adulthood. Conversely, large for gestational age (LGA) fetuses face risks of birth trauma and perinatal morbidity, including brachial plexus injuries and meconium aspiration.[1]Measuring crown-rump length (CRL) in the first trimester offers a simple yet effective approach. Research indicates that fetal growth impairment often begins in the first trimester, leading to adverse pregnancy outcomes.[2]Moreover, first-trimester CRL measurements can predict size disparities between preterm and term newborns.The Crown-Rump Length (CRL) measures the embryo or fetus's length from head to buttock, serving as a key indicator of gestational age. During the first trimester, CRL measurement via ultrasound provides the most accurate assessment of gestational age, enabling healthcare providers to track fetal development and inform prenatal care.[3]

Infants born with low birth weight face a significantly higher risk of perinatal and infant mortality. Additionally, low birth weight has been linked to

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increased mortality rates later in life.[4] Furthermore, mothers who give birth to low birth weight infants are more than four times more likely to develop ischemic heart disease, adjusted for other factors.[5]Given these profound implications, understanding the factors that contribute to low birth weight is crucial from both clinical and biological perspectives. Hence, the present study was planned and carried to determine correlation of crown rump length measured in cm in first trimester with maternal outcome and neonatal outcome.

Materials and Method

The present retrospective cross-sectional design consisted of patients who delivered at People's College of Medical Science and Research Centre, Bhopal, over a2 year period, from July 1, 2022, to June 30, 2024. The inclusion criteria comprised of women with singleton pregnancies who registered at the People's College of Medical Science and Research Center during their first trimester and underwent ultrasound examination between 11 and 13+6 weeks of gestation were eligible for inclusion.Patients with multifetal pregnancies, ectopic or molar pregnancies, and congenital uterine anomalies were excluded. Additionally, patients with incomplete study records were also excluded from the analysis.

Data collection for this study was conducted through a record-based cross-sectional approach. The study population consisted of women who underwent antenatal assessment, registered at PCMC & RC during their first trimester, and delivered at PCMS & RC between July 1, 2022, and June 30, 2024, spanning 2 years.The study specifically included individuals with crown-rump length (CRL) measurements between 11 and 13+6 weeks during the first trimester. The collected data was then analyzed statistically to examine the relationship between CRL values and both maternal and neonatal outcomes.

The study assessed two categories, primary outcomes included birth weight, small for gestational age (SGA), large for gestational age (LGA), preterm birth, and admission to the Neonatal Intensive Care Unit (NICU).Secondary outcomes comprised maternal age, gravidity, parity, gestational diabetes mellitus, and pregnancy-induced hypertension.

Data were coded and entered into a Microsoft Excel spreadsheet. Subsequent statistical analysis was performed using IBM SPSS Statistics version 23.

Results

Table 1: Demographic details

Age	Number	Percentage
<25 years	88	30.55%
25-35 years	**130**	**45.13%**
>35 years	70	24.30%

Table 2: Maternal characteristics

Variables	Mean±SD			
	Normal CRL	Less than 44mm	More than 81mm	P value
AGE	**26.6±5.5**	**26.4±5.5**	**27.6±5.9**	**0.391**
Gravidity	**2.92±1.25**	**3.08±1.56**	**3.3±1.38**	**0.152**
Parity	**1.45±0.91**	**1.6±1.16**	**1.88±1.13**	**0.042**

Table 1 outlines the demographic details of the study population. Out of the total number of participants 288,the age distribution shows 88 (30.55%) patients were under 25, 130 (45.13%) were 25-35, and 70 (24.30%) were over 35. All patients were registered at PCMC & RC in their first trimester and had ultrasounds between 11-13+6 weeks.Majority of the participants that is 45 % were in the age group of 25-35yrs

Table 2 presents the maternal characteristics of the study population. The mean age of the participants was 26.6 years (±5.5), with no significant difference observed between the normal crown-rump length (CRL) group and the groups with CRL less than 44mm or more than 81mm (p-value = 0.391).Regarding gravidity, the mean gravidity was 2.92 (±1.25), with no significant variation across the CRL groups (p-value = 0.152). However, a notable association was found between parity and CRL. Women with higher CRL values (>81mm) had a significantly higher order of parity, with a mean parity of 1.88 (±1.13), compared to those with

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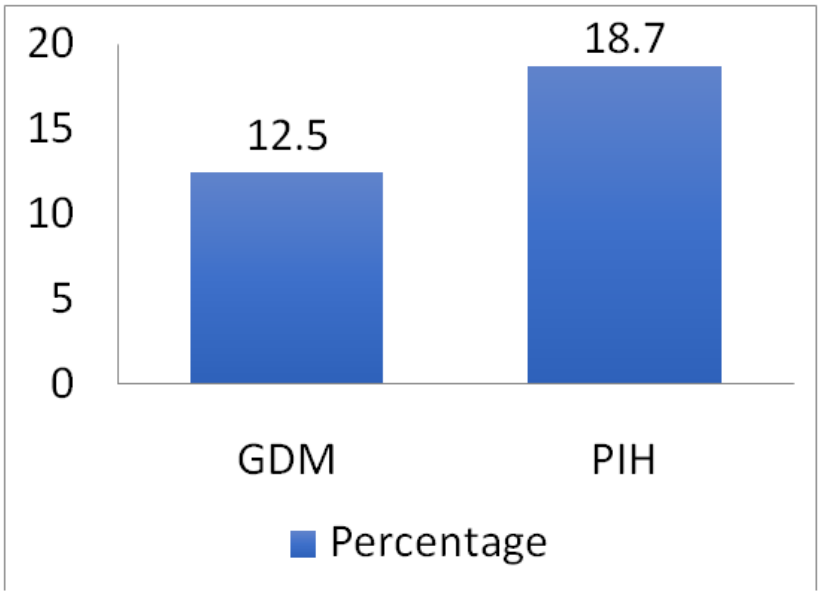
normal or lower CRL values (p-value = 0.042). Specifically, the mean parity was 1.45 (±0.91) for the overall population, increasing to 1.6 (±1.16) and 1.88 (±1.13) for the lower and higher CRL groups, respectively.This suggests that women with higher CRL values tend to have a higher number of previous births, which may have implications for prenatal care and birth outcomes.

Table3 describes maternal outcome, 12.5%(36) mothers were diagnosed as gestational diabetes mellitus, 18.7%(54) were diagnosed as pregnancy induced hypertension (p value = 0.54).

Table 4 described neonatal outcomes that revealed a significant associations with crown-rump length (CRL) measurements. It was found that CRL values less than 44mm were linked to outcomes, with 38.8% of neonates being small for gestational age (SGA) and 20.1% having low birth weight (LBW). In contrast, CRL values greater than 81mm were associated with outcomes, with 18.7% of neonates being large for gestational age (LGA) and preterm births (11.11%).Additionally, the overall neonatal outcomes demonstrated the following frequencies: 18.7% (54) of neonates were LGA, 38.8% (112) were SGA, 20.1% (58) had LBW, 11.11% (32) were preterm, and 36.8% (106) required NICU admission after birth. These findings were statistically significant (p-value <0.05), highlighting the importance of CRL measurements in predicting neonatal outcomes.

Table 3: Maternal outcome

Outcome	Percentage
GDM	12.5
PIH	18.7



Graph 1: Maternal outcome

Table 4:Neonatal outcome

CRL	LGA	SGA	LBW	Preterm
Less than 44 mm	**-**	**38.8%**	**20.1%**	**-**
More than 81	**18.7%**	**-**	**-**	**11.11%**

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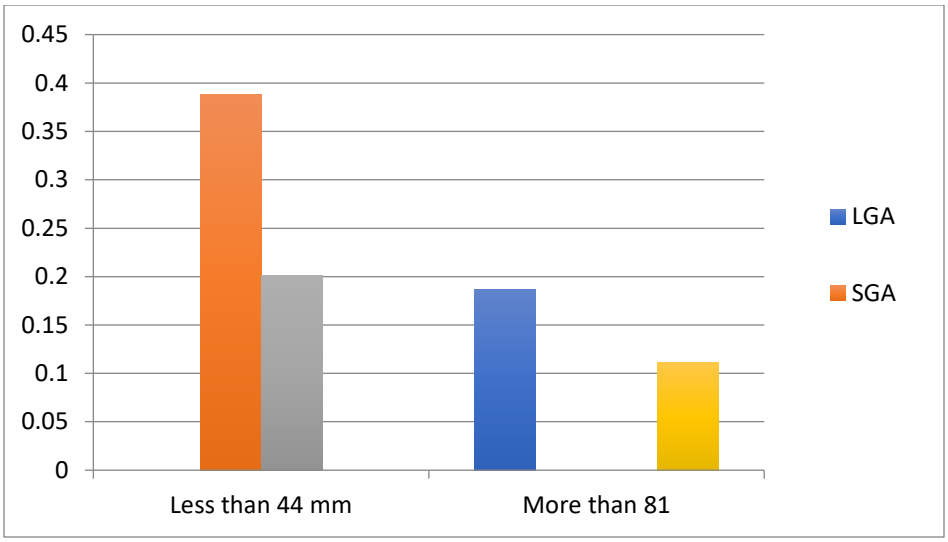
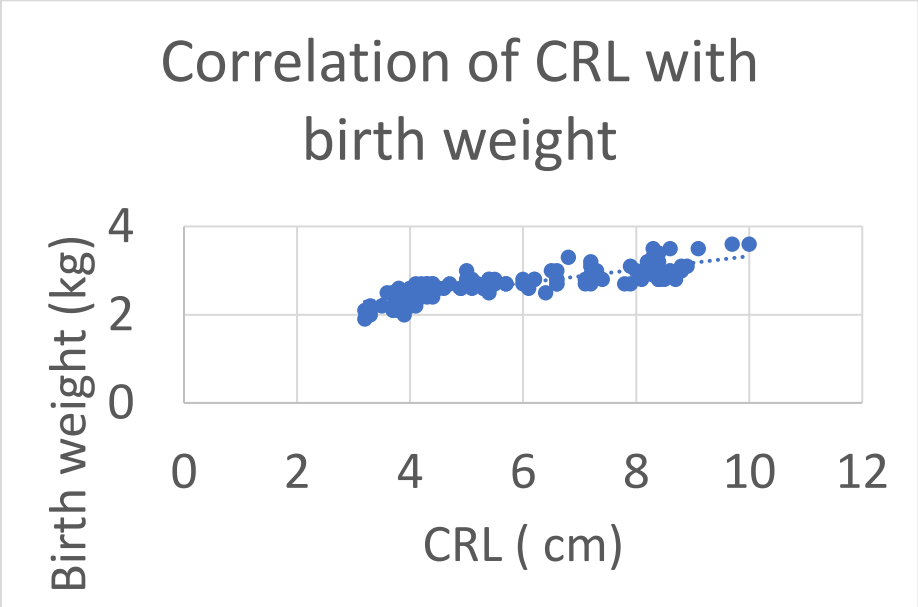


Graph 2:Neonatal outcome



Graph 3: Association of crown-rump length (CRL) measurements w.r.t birth weight

Discussion

In the present study,the age distribution shows 88 (30.55%) patients were under 25, 130 (45.13%) were 25-35, and 70 (24.30%) were over 35. Notably, the majority of participants (45%) fell within the 25-35 years age range. Similarly, in the study by Patel S et al,[6] the mean age of the study population was 26.6 years, and the mean period of gestation was 8.28 weeks (±1.01). In another study by Kang JY et al,[7]the mean age of the study subjects was 32.8 years (range: 21-43). The mean gestational age was 38.7 weeks (range: 21-41). Janardhan Det al[3] reported the mean age of study population was 25.24 years (±3.4 years).

In the present study, the mean age was 26.6 years (±5.5), with no significant difference observed between the normal CRL group and the groups with CRL less than 44mm or more than 81mm (p-value = 0.391). The mean gravidity was 2.92 (±1.25), with no significant variation across CRL groups (p-value = 0.152). However, a significant association was found between parity and CRL, with women having higher CRL values (>81mm) showing a higher order of parity (mean parity = 1.88 ± 1.13, p-value = 0.042).Similarly, Xu Y et al[8]carried a multivariate analysis that revealed a significant association between maternal characteristics and crown-rump length (CRL) in the first trimester with advanced maternal age and multiparity being positively associated with CRL. Another study by Janardhan D et al[3] found the average crown-rump length (CRL) measured during the first trimester was 3.5 cm (±2.07

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cm), and the mean birth weight was 2.9 kg (±0.51 kg) and a significant correlation was found between first-trimester CRL and gestational age. Nasr MGet al[9]revealed a significant correlation between first-trimester Crown-Rump Length (CRL) and actual birth weight ($r = 0.288$, $p = 0.0002$). The findings suggest that CRL measurements can predict birth weight, with above-average CRL values indicating higher birth weights and below-average values indicating lower birth weights.

In the present study, 12.5% (36) of mothers diagnosed with gestational diabetes mellitus and 18.7% (54) with pregnancy-induced hypertension (p-value = 0.54).

The present study found a significant association between CRL measurements and neonatal outcomes. CRL values less than 44mm were linked to outcomes, including 38.8% of neonates being small for gestational age (SGA) and 20.1% having low birth weight (LBW). Conversely, CRL values greater than 81mm were associated with outcomes, including 18.7% of neonates being large for gestational age (LGA) and a lower incidence of preterm births (11.11%). The overall neonatal outcomes demonstrated the following frequencies: 18.7% (54) LGA, 38.8% (112) SGA, 20.1% (58) LBW, 11.11% (32) preterm, and 36.8% (106) NICU admissions. Similarly, in the study by Patel S et al,[6] the incidence of low birth weight (LBW) was 22.1%.

Further, our results stand in concordance with the study carried by Patel S et al[6] in which the distribution of LBW varied significantly across three CRL categories ($\chi 2 = 15.868$, $p < 0.001$), with a substantially higher incidence in the CRL <5th centile category and conversely, no embryos with CRL >95th centile had low birth weight, thus a strong correlation between first-trimester CRL measurements and birth weight was found. Another corresponding study by Kang JY et al[7]explored the link between crown-rump length (CRL) and birth weight. A positive correlation was found between CRL measurements taken on days 60-74 and birth weight. Notably, a CRL of ≤26.5 mm on day 67 predicted low birth weight. Early CRL measurement may serve as a valuable tool for predicting birth weight outcomes.Similarly, Xu Y et al[8]found increased CRL was linked to reduced risks of small for gestational age (SGA) and neonatal intensive care unit (NICU) admission, but increased risk of large for gestational age (LGA). Notably, preterm birth risk was higher with increased CRL, although this association was only significant in women with a lean pre-pregnancy BMI (<18.5 kg/m2). Another study by El Daouk M et al[10] found that the mean first-trimester CRL of LGA neonates at term (63 LGA-term neonates) was significantly higher (62.7 ± 6.0 mm) compared to SGA-term neonates (58 SGA-term neonates) (58.8 ± 6.9 mm). The 3.9 mm difference between the means was statistically significant ($P = 0.01$) revealing that birth weights of LGA and SGA neonates at term are associated with their first-trimester CRL measurements, indicating that fetal growth patterns established early in pregnancy persist through term.

The study's findings underscore the importance of CRL measurements in predicting neonatal outcomes. The association between higher CRL values and increased parity suggests that women with previous births may have different fetal growth patterns. The observed relationships between CRL and neonatal outcomes support the utility of first-trimester CRL measurements as a predictor of fetal growth and development.The high incidence of SGA and LBW among neonates with lower CRL values highlights the potential for early fetal growth restriction identification through CRL assessment. Conversely, higher CRL values were linked to outcomes, including increased LGA rates.These findings have implications for prenatal care, emphasizing the importance of accurate CRL measurement in the first trimester to guide fetal monitoring and interventions. Early identification of growth restrictions or potential complications enables targeted management strategies, ultimately improving neonatal outcomes.

The study's retrospective design and limited sample size may impact generalizability. Future prospective studies with larger sample sizes are warranted to confirm these findings.

Future research should investigate optimal CRL thresholds for predicting adverse outcomes and explore integrating CRL measurements into clinical guidelines for prenatal care. Additionally, examining the relationship between parity and CRL in larger cohorts may provide further insights into fetal growth patterns and prenatal care strategies.

Conclusion

To conclude, research findings revealed a significant association between crown-rump length (CRL) and birth outcomes. Specifically, an increased CRL was linked to a higher likelihood of large for gestational age (LGA) and preterm birth. Conversely, a decreased CRL was associated with outcomes, including low birth weight, small for gestational age (SGA), and increased Neonatal Intensive Care Unit (NICU) admissions. Notably, no significant correlation was found between CRL and gestational diabetes mellitus (GDM) or pregnancy-induced hypertension.Analysis of maternal characteristics revealed an independent association with CRL in the first trimester. Furthermore, a significant correlation was observed between CRL and parity, suggesting that maternal reproductive history influences fetal growth and development. These findings underscore the importance of accurate CRL

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measurement in the first trimester for predicting birth outcomes and guiding prenatal care.

References

1. Mongelli M, Lu C, Reid S, Stamatopoulos N, Sankaralingam K, Casikar I, Hardy N, Condous G. Is there a correlation between aberrant embryonic crown-rump length growth velocities and subsequent birth weights?. Journal of Obstetrics and Gynaecology. 2016 Aug 17;36(6):726-30.
2. Vafaei H, Samsami A, Zolghadri J, Hosseini-Nohadani A. Correlation of first-trimester fetal crown–rump length with outcome of pregnancy and birth weight. International Journal of Gynecology& Obstetrics. 2012 Nov;119(2):141-4.
3. Janardhan D, Jeyamani B. Correlation between crownrump length in first trimester by ultrosonography and birth weight post natal. Internat J Clinic Obstetrics Gynaecology. 2021;5(2):134-7.
4. Bukowski R, Smith GC, Malone FD, Ball RH, Nyberg DA, Comstock CH, Hankins GD, Berkowitz RL, Gross SJ, Dugoff L, Craigo SD, Timor-Tritsch IE, Carr SR, Wolfe HM, D'Alton ME; FASTER Research Consortium. Fetal growth in early pregnancy and risk of delivering low birth weight infant: prospective cohort study. BMJ. 2007 Apr 21;334(7598):836.
5. Smith GC, Pell JP, Walsh D. Pregnancy complications and maternal risk of ischaemic heart disease: a retrospective cohort study of 129,290 births. Lancet 2001;357:2002-6.
6. Patel S, Sarkar A, Pushpalatha K. A Prospective Study on Correlation of First Trimester Crown-Rump Length With Birth Weight. Cureus. 2022 Sep 4;14(9):e28781.
7. Kang JY, Park EJ, Yang YS, Park M, Park WI. Crown-rump length measured in the early first trimester as a predictor of low birth weight. Yonsei Med J. 2013 Jul;54(4):1049-52.
8. Xu Y, Ni M, Zhang Q, Zhao J, Tang Z, Liu Z. Correlation between crown-rump length in the first trimester of pregnancy and neonatal outcomes. BMC Pediatr. 2022 Jul 1;22(1):386.
9. Nasr MG, Elmorshidy MA. Correlation between First Trimester Crown-Rump Length and Birth Weight. International Journal of Life Sciences 2018;7(4):110-14.
10. El Daouk M, Langer O, Lysikiewicz A. First-trimester crown-rump length as a predictor of fetal LGA and SGA at term. The Journal of Maternal-Fetal& Neonatal Medicine. 2012 Feb 1;25(2):162-4.