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RESEARCH ARTICLE
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RISK FACTORS ASSOCIATED WITH SMALL FOR GESTATIONAL AGE: A CROSS-SECTIONAL STUDY

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Abstract
Background: Small for Gestational Age is a significant public health concern in India, contributing to increased neonatal morbidity and mortality due to increased risks of perinatal complications and adverse long-term health outcomes. This study was conducted to identify risk factors associated with SGA. **Methods:** A hospital based case control study was conducted in Private Medical college and Hospital, Chennai, India, with a sample size of 120 pregnant women delivering babies in the hospital. Data was collected through pretested questionnaire regarding maternal characteristics, obstetric history, and pregnancy complications. **Results:** The study identified low maternal weight gain (OR: 1.821, p=0.024), primiparity (OR: 1.038, p=0.032), pregnancy-induced hypertension and anemia as significant risk factors for SGA. **Conclusion:** The findings suggest that focused interventions on maternal nutrition, early detection and management of hypertension and anemia, and targeted support for first-time mothers could contribute to a reduction in SGA incidence, thereby improving neonatal health outcomes.

Keywords: Primiparity, Gestational age, Perinatal complications and Pregnancy.

Introduction
Small for Gestational Age (SGA) infants, defined as those with a birth weight below the 10th percentile for their gestational age, are a significant public health concern due to increased risks of perinatal complications and adverse long-term health outcomes. SGA can arise from a range of maternal, fetal, and environmental factors, including maternal undernutrition, pre-existing medical conditions, and inadequate prenatal care. India, with its diverse socioeconomic backgrounds and varied access to healthcare, presents unique risk profiles for SGA[1] In India, the burden of SGA is high, with estimates indicating that approximately 25-35% of newborns fall into this category. This elevated rate is influenced by the country's socio-economic diversity, regional disparities in healthcare access, and variations in maternal health and nutritional status. SGA is often linked to intrauterine growth restriction (IUGR), a condition where fetal growth is hindered due to suboptimal

intrauterine conditions, which can be caused by multiple maternal, fetal, and environmental factors[2]. Maternal Factors play a substantial role in determining fetal growth. In particular, low maternal body mass index (BMI), inadequate weight gain during pregnancy, poor nutritional intake, and chronic illnesses such as hypertension and diabetes can restrict fetal growth. Other factors such as low socioeconomic status and limited access to healthcare and nutritional resources also leads to SGA[3]. Maternal age is another key factor, with both adolescent and advanced-age pregnancies associated with higher rates of SGA. Tobacco use, even when not smoked (e.g., chewing tobacco), has been shown to negatively impact fetal growth and is associated with increased rates of SGA[4] Obstetric Factors also influence the risk of SGA. Primiparity (first-time pregnancy), a history of prior SGA births, and inadequate prenatal care that can prevent early detection and management of risk factors, such as hypertension or nutritional deficiencies, that may otherwise be mitigated[5]. High parity (having multiple previous births) can also affect maternal health and, subsequently, fetal growth, as the mother's body may have reduced physiological reserves for each subsequent pregnancy. Multiple gestations are associated with higher rates of SGA and certain genetic syndromes or chromosomal abnormalities may also result in SGA. Understanding the factors associated with SGA is critical for healthcare providers, as it enables the identification of high-risk pregnancies and the implementation of early interventions to improve outcomes. With this background, this study aims to assess the risk factors associated with SGA, thereby offering insights for targeted interventions[5].

Methodology

A cross-sectional study was conducted for a period of 1 year (March 2023 - April 2024) in the Department of Pediatrics at a Private Medical College and Hospital, Chennai. About 120 term new born (< 72 hours of birth) born of single pregnancies of gestational age between 37 weeks and 41 weeks as estimated using new Ballard score were included in the study. Newborn born out of multiple pregnancies, or with any congenital anomaly, chromosomal or genetic defects and neonates requiring admission to Neonatal intensive care unit were excluded from the study. Detailed maternal history was taken and thorough physical examination of the neonate was done. Birth weight was plotted against gestational age in Lubchenco growth charts to confirm if they are small for gestational age or appropriate for gestational age.

Data entry and analysis:

Data entry was made in Microsoft Excel. The entered data was cleaned and validated for consistency. Analysis was done using SPSS 25.0 software. Frequency was expressed in percentage and Chi-square tests for categorical variables and t-tests or Mann-Whitney U tests for continuous variables were used to identify associations between potential risk/prognostic factors and SGA. p – Value < 0.05 was considered significant. Charts, tables and graphs were added wherever necessary

Ethical approval and informed consent:

The study was approved by the Institutional ethical committee and consent was obtained from participants before the study.

Results:

Table 1: Baseline characteristics of the newborn:

S.NO	VARIABLE	FREQUENCY (N = 120)	PERCENTAGE (%)
1.	**Gender:**		
	Male	66	55
	Female	54	45
2.	**Mode of delivery:**		
	FTNVD	68	56.7
	LSCS	52	43.3

FTNVD - Full tern normal vaginal delivery, LSCS - Lower Segment Cesarean Section

Table 2: Mean distribution of maternal characteristics:

S.NO	VARIABLE	MEAN	STANDARD DEVIATION
1.	Age	24.56	3.10
2.	Weight gain	9.78	2.2

Table 3: Variables related to obstetric history:

S.NO	VARIABLE	FREQUENCY (N = 120)	PERCENTAGE (%)
1.	**Parity**		
	Primi	89	74.2
	Multi	31	25.8
2.	**Pregnancy induced hypertension**		
	Yes	21	17.5
	No	99	82.5
3.	**Gestational diabetes**		
	Yes	22	18.3
	No	98	81.7
4.	**Anemia**		
	Yes	35	29.2
	No	85	70.8

Table 4: Mean distribution of maternal characteristics related to AGA and SGA:

S.NO	VARIABLE	SGA	AGA
1.	Age	24.86±3.22	25.04±3.50
2.	Weight gain	10.3 ± 2.4	9.3 ± 2.4

Figure 1: Prevalence of SGA:

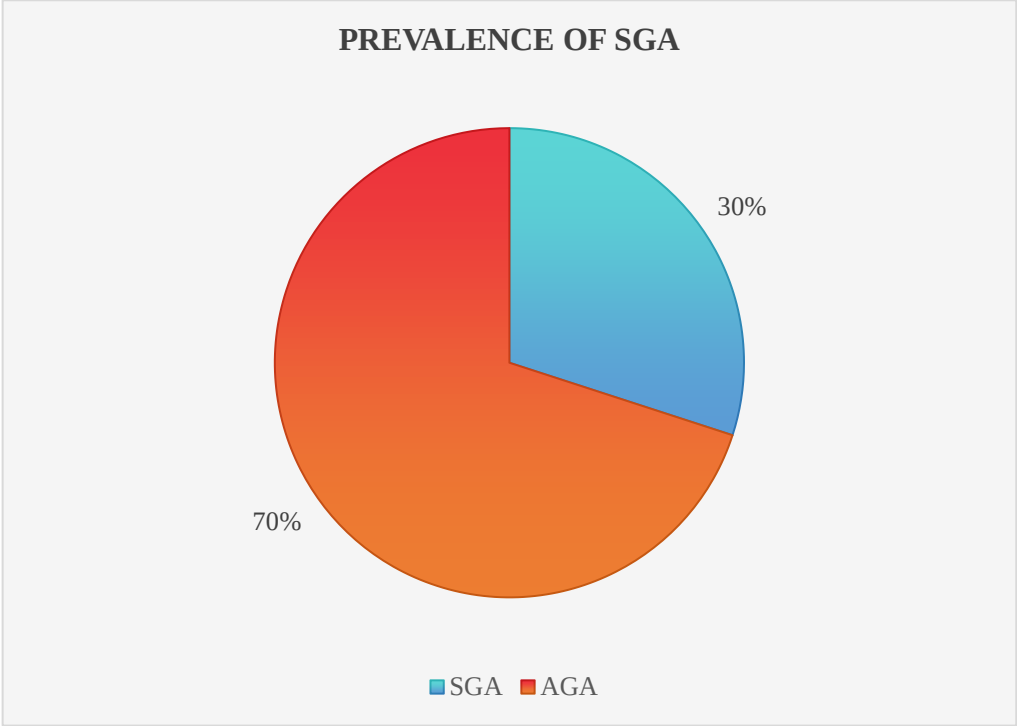

Figure 1 describes about the prevalence of SGA born among the study population. About 30% newborn were estimated to have low birth weight which was considered as small for gestational age and 60% were appropriate for that gestational age born.

Table 5: Association between SGA and risk factors associated with it:

S. NO	VARIABLE	NEWBORN GROUP		CHI SQUARE	P VALUE	ODDS RATIO (95% CI)
		SGA (n = 36)	AGA (n = 84)			
1.	**Maternal characteristics:**					
	Age	24.86 ± 3.22	25.04 ± 3.50	0.379	0.706	0.930
	Weight gain	10.3 ± 2.4	9.3 ± 2.4	0.223	0.024*	1.821
2.	**Parity:**					
	Primi	22	67	**4.575**	**0.032***	**1.038**
	Multi	14	17			
3.	**Pregnancy induced hypertension:**					
	Yes	11	10	**6.071**	**0.013***	**3.256**
	No	25	74			
4.	**Gestational diabetes:**					
	Yes	10	12	3.063	0.081	2.307
	No	26	72			
5.	**Anemia:**					
	Yes	16	19	**5.810**	**0.015***	**2.736**
	No	20	65			

Discussion:

The prevalence of SGA in this study was 30%. The prevalence of SGA ranged from 12.0% to 78.4% in India, depending on the reference population according to a meta analysis study conducted by Katz J *et al*[6]. The occurrence of SGA depends on various modifiable factors such as lifestyle, environment and health status of mothers

This study found a statistically significant association between lower maternal weight gain and increased SGA risk (p = 0.024). similar result were obtained from studies done by Mavalankar DV *et al*[7] and Mehl CV *et al*[8] in which the most important risk factors for SGA was poor maternal nutritional status (weight <51 kg) with an attributable risk of 42 per cent and low maternal pre-pregnancy weight increased the risk of SGA birth almost twofold. Low maternal weight gain often reflects poor nutritional intake, a common challenge in certain regions of India, and can be due to socioeconomic factors, limited access to nutrient-rich foods, and health issues. This emphasizes the need for nutritional support and monitoring of weight gain during pregnancy to reduce SGA risk

According to this study, primiparous mothers (first-time pregnancies) had a higher risk of delivering SGA babies compared to multiparous mothers, with a significant association (p = 0.032). similar result was observed in a conducted by Palatnik A *et al*[9] in which a significant association was found between maternal age and parity toward the risk of SGA ($p < 0.001$). This trend has been observed in other Indian studies, where primiparity has been associated with increased SGA risk, possibly due to physiological adaptation differences in first pregnancies. Additional support and monitoring for primiparous mothers, especially in terms of nutrition and prenatal care, could potentially lower SGA incidence in this group The present study demonstrated a significant association between PIH and SGA (p = 0.013), which is concordant with other studies that found hypertensive disorders to be strong predictors of SGA. Study done by Liu Q *et al*[10] suggested that Pregnancy-induced hypertension (p-value < 0.001)) were the risk factors of SGA. PIH can compromise placental blood flow, thus impacting fetal growth. This finding emphasizes the importance of early diagnosis and management of hypertensive disorders in pregnancy to improve birth outcomes Maternal anemia was also significantly associated with SGA in the present study (p = 0.015). studies done by Vanie SC *et al*[11] and Nair M *et al*[12] also concluded that increased risk of small-for-gestation was associated with maternal anemia. Anemia is prevalent among Indian women due to nutritional deficiencies, and its impact on fetal growth is well-documented. Anemia reduces the oxygen supply to the fetus, hindering growth

Conclusion:

This study findings on associations with maternal weight gain, parity, PIH, and anemia highlight modifiable risk factors for SGA in India. These insights suggest potential targets for intervention, particularly nutritional support and careful monitoring of blood pressure and hemoglobin levels during pregnancy. Addressing these factors could contribute to reducing SGA rates, particularly in resource-limited settings where these risks are more prevalent

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