Risk Factors of Small for Gestational Age Babies Born at Term Gestation

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ABSTRACT

Background

Small-for-gestational-age is defined as birth weight below the tenth percentile of a birth weight for gestational age and gender specific reference population. The cause of birth of small for gestational age neonates can be due to maternal risk factors, placental factors and fetal risk factors or idiopathic.

Objective

To evaluate risk factors of full term small for gestational age babies of western Nepal newborns.

Method

A hospital based case control study was performed in Nepalgunj Medical College from 1st February 2018 to 31st January 2019. The full term small for gestational age babies admitted in neonatal intensive care unit over one year were taken as study group(n=50 cases) and appropriate for gestational babies with matched age and sex were taken as control group(n=50 controls). Binary logistic regression was performed to see the independent predictors of small for gestational age birth and expressed in odds ratio, using 95% confidence interval.

Result

A total of 50 cases and 50 controls were included in the study. The significant risk factors associated with small for gestational age babies in our study were maternal short stature < 145 cm, maternal post-delivery weight < 51 kg, maternal body mass index < 20 kg/m^2, living in rural area, mothers working in farm, heavy work during pregnancy, inadequate antenatal check up and multivitamin intake, maternal hypertension, multiple gestation and oligohydramnios. In binary logistic regression, hypertension during pregnancy, inadequate antenatal visits <4 visits, mothers living in rural area and mothers farmer by occupation were identified as independent predictors after adjusting with confounders.

Conclusion

This study concludes hypertension during pregnancy, inadequate antenatal visits, mothers living in rural area and working in farm caries highest risk for small for gestational age babies. We recommend adequate antenatal coverage to prevent small for gestational age babies.

KEY WORDS

Birth weight, Intrauterine growth restriction, Risk factors, Small for gestational age

INTRODUCTION

Small-for-gestational-age (SGA), which is frequently used as a measurable proxy for Intrauterine growth restriction (IUGR), is defined as birth weight below the tenth percentile of a birth weight for gestational age and gender specific reference population.[1] Normal term infants usually weigh more than 2500 g by completion of 37 weeks gestation.[2]

SGA babies may be a normal fetal response to in utero nutritional or oxygen deprivation. Therefore the main issue is ongoing risk of fetal malnutrition or hypoxia rather than SGA babies.[3] The cause of SGA may rest with the mother and placenta or the fetus itself, and the well known risk factors include maternal malnutrition, age, substance abuse, chronic illness, low socioeconomic status, primi gravida, previous SGA, infection, antepartum hemorrhage, multiple gestation, female sex, congenital malformations, genetic syndromes.[4] However, risk factors may not be elicited in 40% of SGA babies.[5]

In March 2014, the data from rural Nepal showed prevalence of SGA ranging from 10.5% to 72.5% in Nepal.[6] By determining the level of risk factors responsible for causing birth of SGA neonate in western Nepal, we can help in reducing birth of SGA babies. This study aimed to evaluate risk factors of SGA babies in a sample of western Nepal full term newborns.

METHODS

This was a hospital based case control study held at Department of Pediatrics, Nepalgunj Medical College Teaching Hospital, Kohalpur, Banke from 1st February 2018 to 31st January 2019. SGA newborn admitted in neonatal intensive care unit (NICU) over one year period were taken as cases group and appropriate for gestational age (AGA) newborns in same period with matched gestational age and sex wise were taken as control group. Non probability consecutive sampling technique was used. The sample size was calculated using unmatched case-control sample size formula from Epi Info 7 with following formula with reference to Hameed et al. where past history of SGA was 24% in case group and 2% in control group.[7]

$(N) = 2 (Z\alpha + Z\beta)^2 * P * Q / d^2$

Where,

$Z\alpha$ at 95% Confidence interval =1.96

$Z\beta$ at 10% error (90% Power) =1.282

Common prevalence of risk factor (P) =24+2 /2 = 13%

Compliment of Common P (Q) = 100-13 =87%

Proportion of exposure (past history of SGA) in case group (P1) = 24%

Proportion of exposure (past history of SGA) in control group (P2) = 2%

Meaningful clinical difference (d) = P1-P2 = 24-2 =22%

Minimum required sample for cases $(N) = 2 (Z\alpha + Z\beta)^2 * P * Q / d^2$

$= 2(1.96+ 1.282)^2 * 13* 87 / (22)^2$

$= 49.11$

The required minimum sample size is 49 cases. However we took all cases during study period. Ethical approval was obtained from institutional review committee of Nepalgunj medical college on 15th December, 2017. The informed consent regarding participation in the study was taken from mothers of the involved neonates.

The inclusion criteria were

1. Both inborn and out born admitted within 24 hours of birth.

2. Term neonates (born at 37 weeks of gestation (WOG) to < 42 WOG)

3. Singleton or multiple pregnancies (twin/triplet pregnancy)

4. Neonates of those mothers who are willing to participate.

The exclusion criteria were

1. Newborn with congenital anomalies

2. Preterm and post-term SGA neonates

3. Admitted after 24 hrs of birth

4. Neonates of those mothers who are not willing to participate.

Case Proforma was developed and filled while enrolling the neonates.

The cases and control group were evaluated within 24 hours of birth. The detail antenatal history regarding risk factors was taken from mother. Antenatal card and Delivery record were reviewed to get the more information. Mother's height and weight was measured. The gestational age was assessed by using date of last menstrual period and confirmed by the modified Ballard scoring system. Neonate's weight was taken within 24 hours of birth without any cloth and on a digital weighing machine. Weight was taken twice and mean was taken. Length and upper and lower segment ratio of the neonate was taken by an infantometer. Chest circumference of the neonate was taken. Head circumference was taken after 24 hours when caput succedaneum and overriding of suture had disappeared.

The aberrant growth pattern was assessed by plotting the weight, length and head circumference against the gestational age on a standard fetal-infant growth chart.[8] A neonate whose weight falls between the 10th and < 90th percentile was considered as appropriate for gestational age (AGA); if the weight falls below 10th percentile, as small for gestational age (SGA); and as large for gestational age

(LGA), if the weight falls at 90th percentile or above for gestational age.

Statistical analysis and software used: all the data was entered in special formed proforma and was analyzed by using 21 version of Statistical Package for Social Science (SPSS). Data was presented through simple frequency distribution for each variable. Bivariate association of independent variables was checked between the cases and control group. Crude odds ratio with 95% confidence interval (CI) was used to interpret the strength of association in bivariate analysis. The variables significant at less than p value 0.2 were included in the Binary logistic regression to identify the independent predictors of SGA and expressed in odds ratio, using 95% CI. The p-value less than 0.05 were considered statistically significant.

RESULTS

There were 54 full term SGA babies admitted in NICU from 1st February 2018 to 31st January 2019, among which 50 babies met the eligible criteria. The Male: Female ratio in case study population was 1:1.27, comprising 22 male (44%) and 28 female (56%) babies. Gestational age and sex matched control group (term/AGA) were taken to evaluate the associated risk factors. Fifty babies in case group and 50 babies in control group were taken. All the mothers who met eligible criteria agreed to participate in the study.

Risk factors

In table 1 we presented unadjusted maternal socio-demographic, medical and previous obstetric risk factors for term SGA as compared to reference population of term AGA. Table 2 gives the univariate analysis of obstetric risk factors for giving birth to SGA babies.

Socio-demographic factors

Maternal age, height, weight, body mass index (BMI), area of living, ethnicity, education, occupation were included as socio-demographic factors to explore the association with birth outcomes. The short stature mother showed 5.268 (1.077-25.779) times risk getting SGA newborns and it was statistically significant (p value 0.04). In our study, we took post partum weight of mother because of lack of data of pre pregnancy weight and weight gain during pregnancy. The odds of having SGA babies in mother with post partum weight < 51 kg is 3.16 times more than mother with weight ≥ 51 kg (p value 0.006). Mothers with BMI < 20 kg/m2showed 3 times risk to have SGA babies than mother with BMI ≥ 20 kg/m^2 (p value 0.018). The study showed the odds of having SGA babies were 9 times higher in rural area females than in urban area (p value 0.000). With reference to housewife mothers, mothers doing farm work had 4 times risk of having SGA babies (p value 0.006) and mothers doing table work had 1.2 times (p value 0.690).

Chronic medical condition

Chronic disease like hypertension was found in three of SGA mothers and hypothyroidism was found in one AGA mother, and these were statistically insignificant.

Previous obstetric factors

Although primiparity was not significantly associated with SGA, the Odds of having SGA babies was 1.94 times more in primiparous mothers compared with multiparous mothers. History of previous SGA birth and abortion was also statistically not significant.

Obstetric factors

This study showed eight (16%) of SGA newborn resulted from twin pregnancy (multiple gestation) and none for AGA group, which was significant (p value 0.003). The pregnant mother who perceived her work as heavy work had 3.1 times risk of having SGA babies than those who perceived her work as light work (p value 0.044).

Antenatal care

Less than four prenatal visits had an OR of 5.50 (95% CI 1.46-20.75) for SGA compared with mothers who had at least four visits (p value 0.012). The odds of having SGA babies with inadequate intake of supplements like iron, calcium, folic acid during pregnancy was 9.3 times more than adequate supplements (p value 0.039).

Complications during current pregnancy

Twenty two percent of mothers had hypertension before and during pregnancy. Mothers with high blood pressure had 6.7 times risk to get SGA births compared with normotensive mothers (p value 0.017). No association was found with anemia during pregnancy, urinary tract infection, early pregnancy bleeding. Despite being not significantly associated with SGA, the odds of having SGA birth in mothers with early pregnancy PV bleeding was 2 times more than those without bleeding. None of them had history of gestational diabetes, antepartum hemorrhage. Oligohydramnios contributed to about 32% of SGA newborns while it was none in AGA newborns so it was extremely significant risk factor for SGA babies (p value < 0.0001).

Lifestyle

None of the mothers in both group had history of smoking and alcohol consumption during pregnancy.

Mode of delivery

Forty percent of SGA babies were born via caesarian section as compared to four percent of AGA babies. AGA babies had more spontaneous vaginal deliveries (66%), induced vaginal deliveries (22%) and vacuum deliveries (8%) whereas in SGA babies 46% spontaneous vaginal deliveries, 12% had induced labour and 2% had vacuum

Table 1. Maternal socio-demographic, medical and previous obstetric risk factors with SGA babies and their respective controls

		SGA (n=50)	AGA (n=50)	Crude Odds Ratio (95% CI)	p value
Maternal Age	< 20 years	5 (10%)	8 (16%)	0.554(0.167-1.835)	0.334
	> 35 years	1 (2%)	3 (6%)	0.295(0.030-2.958)	0.300
	20-35 years	44 (88%)	39 (78%)	1.0	
Maternal Height	< 145 cm	9 (18%)	2 (4%)	5.268(1.077-25.779)	**0.04**
	≥ 145 cm	41 (82%)	48 (96%)	1.0	
Post delivery weight	< 51 kg	32(64%)	18(36%)	3.160(1.397-7.152)	**0.006**
	≥ 51 kg	18(36%)	32(64%)	1.0	
Post delivery BMI	< 20 kg/m^2	20 (40%)	9 (18%)	3.037(1.214-7.597)	**0.018**
	≥ 20 kg/m^2	30 (60%)	41(82%)	1.0	
Area of living	Rural	22 (44%)	4 (8%)	9.036(2.820-28.949)	**<0.001**
	Urban	28 (56%)	46 (92%)	1.0	
Ethnicity	Brahmin/Chhetri	22 (44%)	27 (54%)	1.0	0.123
	Janajati	2 (4%)	3 (6%)	0.489(0.197-1.215)	0.351
	Dalit	6 (12%)	8 (16%)	0.400(0.58-2.748)	0.221
	Terai Adhiwasi	20 (40%)	12 (24%)	0.450(0.125-1.615)	
Education (schooling in years)	< 6 years	10 (20%)	6 (12%)	1.11(0.262-4.719)	0.886
	6-12 years	31 (62%)	38 (62%)	0.54(0.175-1.695)	0.294
	> 12 years	9 (18%)	6 (12%)	1.0	
Occupation	Farm work	21 (42%)	8 (16%)	4.083(1.492-11.176)	**0.006**
	Table work	11 (22%)	14 (28%)	1.22(0.456-3.280)	0.690
	Housewife	18 (36%)	28 (56%)	1.0	
Chronic disease	Hypertension	3 (6%)	0		0.79
	Hypothyroidism	0	1(2%)		0.31
Parity	Primiparous	33 (66%)	25 (50%)	1.941(0.867-4.346)	0.107
	Multiparous	17 (34%)	25 (50%)	1.0	
Previous SGA baby	Yes	2 (4%)	0		0.153
	No	48 (96%)	50 (100%)		
Previous Abortion	Yes	10 (20%)	11 (22%)	0.886(0.338-2.323)	0.806
	No	40 (80%)	39 (78%)	1.0	

delivery. The odds of requirement of LSCS during birth in SGA babies were 14 times more than spontaneous vaginal delivery (95% CI 3.05-67.463, p value 0.001).

In order to control for potential confounding effects of factors listed in table 1 and table 2, multiple regression analyses were conducted and the results were listed in table 3. Eight variables with p value < 0.2 in univariate analysis were considered for binary logistic regression analysis. The variables with cells values 0 and expected cell count < 5 were not included in the multivariable analysis (previous SGA birth, multiple gestation, supplements and oligohydramnios). Independent predictors for SGA birth include inadequate ANC visits < 4 visits, hypertension during pregnancy, mothers who were farmer by occupation and mothers living in rural area. Among these, hypertension and less ANC check up were strongest predictors of SGA babies.

Compared to housewife, those mothers doing farm work were 4.12 (1.01 - 16.69) times more likely to give birth to SGA baby. The odds of giving birth to a SGA baby by mothers residing in rural area were 5.27 (1.24 - 22.34) times of mothers living in urban area. The adjusted OR for mother who had hypertension was 8.06 (1.43 - 45.42) and the adjusted OR for mothers with inadequate ANC visits (< 4) during pregnancy was 7.60 (1.51 - 38.24).

Although not significant in multivariate analysis, maternal short stature and primiparity had adjusted odds ratio of 3.87(0.53 - 28.31) and 2.02(0.62 - 5.99) respectively.

For the subtypes of SGA babies (Symmetric SGA and Asymmetric SGA babies), the multicollinearity between independent variable was checked by Pearson correlation R in the initial phase and then further assessed by variance inflation factor (VIF) less than five in the model. There was no R value above 70% so all the variables were included in

Table 2. **Obstetric risk factors in mothers of SGA babies and their respective controls.**

		SGA (n=50)	AGA (n=50)	Crude Odds Ratio (95% CI)	p value
Gestation	Multiple	8 (16%)	0		**0.003**
	Singleton	42 (84%)	50 (100%)		
Type of work during pregnancy (perceived by mom)	Heavy	13 (26%)	5 (10%)	3.16(1.032-9.685)	**0.044**
	Light	37 (74%)	45 (90%)	1.0	
ANC visits	< 4	13 (26%)	3 (6%)	5.505(1.460-20.755)	**0.012**
	≥ 4	37 (74%)	47 (94%)	1.0	
Supplements: Iron, calcium, folic acid	Inadequate	8 (16%)	1 (2%)	9.333(1.121-77.704)	**0.039**
	Adequate	42 (84%)	49 (98%)	1.0	
Hypertension before and during pregnancy	Yes	11 (22%)	2 (4%)	6.769(1.416-32.367)	**0.017**
	No	39(78%)	48(96%)	1.0	
Anemia during pregnancy	Yes	3 (6%)	2 (4%)	1.532(0.245-9.587)	0.646
	No	47 (94%)	48 (96%)	1.0	
UTI during pregnancy	Yes	10 (20%)	7 (14%)	1.536(0.533-4.422)	0.427
	No	40 (80%)	43 (86%)	1.0	
Early pregnancy PV bleeding	Yes	2 (4%)	1 (2%)	2.042(0.179-23.26)	0.565
	No	48 (96%)	49 (98%)	1.0	
Oligohydroamnious	Yes	16 (32%)	0		**<0.001**
	No	34 (68%)	50 (100%)		

Table 3. **Binary logistic regression to identify significant risk factors for term SGA babies.**

Risk Factors		Adjusted Odds ratio	95% Confidence interval	p value
Maternal height	< 145 cm	3.873	0.530-28.319	0.182
	≥ 145 cm	1.0	(reference)	
Maternal BMI	< 20 kg/m^2	1.639	0.479-5.606	0.431
	≥ 20 kg/m^2	1.0	(reference)	
Rural Area of living: Rural		5.275	1.246-22.341	**0.024**
Urban		1.0	(reference)	
Occupation Farm work		4.120	1.017-16.698	**0.047**
Table work		2.013	0.616-6.578	0.247
Housewife		1.0	(reference)	
Parity: Primiparous		2.022	0.628-5.994	0.204
Multiparous		1.0	(reference)	
Heavy work during pregnancy		1.225	0.245-6.134	0.805
Light work during pregnancy		1.0	(reference)	
ANC visit	< 4	7.600	1.510-38.245	**0.014**
	≥ 4	1.0	(reference)	
Hypertension: Yes		8.066	1.432-45.428	**0.018**
No		1.0	(reference)	

Adjusted with maternal height, BMI, area of living, occupation, parity, type of work during pregnancy, ANC visit, hypertension during pregnancy.

Table 4. **Binary logistic regression for maternal factors associated with symmetric SGA babies.**

Risk Factors		Adjusted Odds ratio	95% Confidence interval	p value
Maternal height < 145 cm		13.131	1.121-153.779	**0.040**
≥145 cm		1	(reference)	
Maternal BMI < 20 kg/m^2		3.005	0.552-16.370	0.203
≥ 20 kg/m^2		1	(reference)	
Area of living: Rural		7.409	1.265-43.413	**0.026**
Urban		1	(reference)	
Occupation Farm work		5.080	0.618-41.740	0.130
Table work		3.920	0.694-22.129	0.122
Housewife		1.0	(reference)	
Parity: Primiparous		2.340	0.504-10.861	0.278
Multiparous		1	(reference)	
Heavy work during pregnancy		1.714	0.182-16.184	0.638
Light work during pregnancy		1	(reference)	
ANC visit	< 4	32.957	3.703-293.325	**0.002**
≥4		1	(reference)	
Hypertension: Yes		26.386	3.138-222.893	**0.003**
No		1	(reference)	

Adjusted with maternal height, BMI, area of living, occupation, parity, type of work during pregnancy, ANC visit, hypertension during pregnancy.

the binary logistic regression, and the VIF was less than five. The maternal short height, rural area of living, inadequate ANC visits, maternal hypertension were significantly associated with the symmetric SGA babies (Table 4). For asymmetric SGA babies, the maternal area of living was significantly associated with outcome (Table 5).

Table 5. Binary logistic regression for maternal factors associated with asymmetric SGA babies

Risk Factors		Adjusted Odds ratio	95% Confidence interval	p value
Maternal BMI	< 20 kg/m^2	1.352	0.314-5.827	0.686
	≥ 20 kg/m^2	1.0	(reference)	
Area of living:	Rural	5.557	1.258-24.539	**0.024**
	Urban	1.0	(reference)	
Occupation	Farm work	2.647	0.584-11.994	0.207
	Table work	1.046	0.240-4.547	0.953
	Housewife	1.0	(reference)	
Heavy work during pregnancy		1.541	0.290-8.195	0.612
Light work during pregnancy		1.0	(reference)	
ANC visit	< 4	4.204	0.694-25.455	0.118
	≥ 4	1.0	(reference)	

Adjusted with maternal BMI, area of living, occupation, type of work during pregnancy, ANC visit.

DISCUSSIONS

Small for gestational age can cause significant morbidity and morbidity in neonatal period as well as long term effect is seen in adult life as well. To determine the risk factor of SGA birth, this research conducted in full term SGA babies excluding preterm SGA birth to avoid confounding effect.

In the present study after controlling for potential confounding, we observed significant differences for maternal factors as living in rural area, working in farm, inadequate ANC visits and hypertension during pregnancy between the SGA and AGA babies.

Maternal height, weight, BMI, area of living, occupation were the socio-demographic factors that were associated with SGA birth in univariate level in our study, however only area of living and occupation remained significant after adjustment for potential confounders.

Mothers living in rural areas of Nepal had significantly higher rate of SGA babies however no studies has been found to compare the area of living (rural vs. urban). Studies have consistently shown that low socio-economic status of mother is independent predictor of having a SGA baby.[9,10] However a study done in rural Nepal have shown stunting (< 145 cm), wasting (< 18.5 kg/m^2) and low maternal weight gain per gestational week were independently associated with SGA.[11] Since the mothers of rural area had chronic malnutrition (as reflected by short stature), continued dietary inadequacy (as reflected by low BMI and inadequate weight gain in pregnancy) and low socio-economic status, our analysis of rural ladies reflect their strong association of giving birth to SGA babies. Shorter maternal height and low pre-pregnancy body weight are also an independent risk factor in other multivariate studies.[10,12-14] We divided the mothers on the basis of their occupation to housewife, table work and farm work. Mother doing farm work had significantly increased risk of delivering SGA babies. This may have happened because farm work is a strenuous activity requiring more effort, heavy lifting, bend over and inadequate rest. Also farm work is more energy consuming making mother and baby more susceptible for inadequate nutrition. These ladies are less educated and may have less accessibility to information regarding safe pregnancy. No similar comparison of occupation was found in between these groups, however in a study by Hameed, significant relationship between SGA births and no employment was found in Iraq where no employment had 2.1 times risk to get SGA births with p value 0.0355.[7] They did not differentiate between type of work but it was a comparison between employed and unemployed.

Inadequate ANC visits (< 4) as a risk factor in our study is consistent with studies conducted by Gao et al in New Zealand, Arif et al. in Pakistan and Muhihi et al. in Tanzania.[9,12,14] Antenatal visits are not merely routine appointment with a doctor but they represent a comprehensive approach to ensuring the well being of expecting mother and fetus. Maternal weight gain, intake of nutritious food and multivitamin supplementation, TT vaccination are monitored. It detects complications like hypertension, diabetes, anemia or infections. It helps to track fetal growth, identify complications thus preventing it. Most importantly education and counseling of mother and her guardian regarding pregnancy care, labour, breastfeeding, newborn care and complication are done in ANC visits. Those mothers with inadequate ANC visits may lacks mental and physical well being and has increased risk of delivering SGA babies.

Maternal hypertension during pregnancy was also a significantly risk factor for SGA at multivariable level. Similar findings are also reported by Gao et al., Muhaamad et al., Arif et al. and Thompson et al.[9,10,12,13] Hypertension (both chronic idiopathic or preganancy induced) causes placental insufficiency leading to intrauterine growth restriction. Severe hypertension can lead to pre-eclampsia and eclampsia which further compromises fetal growth.

Primiparity described as important independent risk factor for SGA in many studies was not significant in our study.[9-11,13,14] Multiple gestation (16%) and oligohydroamnious (32%) were a significantly associated with SGA birth in univariate analysis however due to zero cell count in control group, it couldn't be included in multivariate analysis. Multiple gestation pregnancy include twin and triplet pregnancy and due to limited uterine space it may leads to intrauterine growth restriction. Multiple other univariate studies suggest multiple gestation pregnancy as a significant risk factor for SGA babies.[7,15] Oligohydroamnious on the other hand has less amniotic fluid for the fetus to grow which ultimately restrict fetal growth. It is considered significant risk factor for SGA babies in the study by Doctor et al.[15]

For the subtypes of SGA babies, the maternal short height, rural area of living, inadequate ANC visits, maternal hypertension were significantly associated with the symmetric SGA babies whereas, the maternal rural area of living was significantly associated with asymmetric SGA outcome. Similar subtype multivariate analysis is done by Muhammad et al. where the maternal factors as maternal age, hypertension, previous SGA, placenta previa were significantly associated with symmetric SGA babies whereas maternal age, hypertension, low BMI, anemia, low socioeconomic status were significantly associated with asymmetric SGA babies.[10]

There are few limitations to our analysis. This study is a single center study done with small sample size. Also design of our study has its limitations, as the problems of recall and reporting bias are associated with the studies relying on information of the respondents. However we tried to overcome this by checking the hospital record of the mothers when available. We could not adjust for variables like previous SGA birth, multiple gestation, inadequate supplements during pregnancy and oligohydramnios despite having significant result because of violation of cell count assumptions which might cause information bias in the study.

CONCLUSION

The significant risk factors found in our study were short stature, low maternal weight, low BMI, residing in rural areas, poor ANC visits and multivitamins supplements, and doing heavy work in farm.

Health of women should be promoted since childhood with appropriate nutrition. Education level of girls should be promoted. Smoking and alcohol should be discouraged. Good ANC coverage should be provided in rural areas and malnutrition during pregnancy should be addressed. Early diagnosis and treatment of hypertension, anemia, UTI, APH.

Certain measures that could reduce SGA birth are improving maternal wellbeing by providing nutritious food to girl child that will maintain good height and weight before conception, promoting education of girls, discouraging smoking and alcohol habit (none in our study), avoiding heavy work during pregnancy and having adequate rest, adequate ANC coverage in rural areas with vitamin supplementations. A good maternal health will lead to birth of healthy baby.

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