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Risk factors for small-for-gestational age births among infants in Brazil

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ABSTRACT

Objective

To assess the risk factors for small-for-gestational-age (SGA) births.

Methods

All live births occurring in the city of Pelotas, Brazil, between October and December 1993 were identified and mothers interviewed soon after delivery. Birthweight was recorded by the maternity staff. Gestational age was obtained from the mothers' recall of their date of last menstrual period. SGA was defined as a birthweight below the 10th percentile for gestational age and sex, according to the reference developed by Williams. Chi-square test and logistic regression were used in the crude and multivariate analysis, respectively.

Results

In all, 1082 births were identified. The prevalence of SGA was 13.1%. Even after adjusting for possible confounding variables, the odds ratio for SGA among those infants whose family income was <1 minimum wage was 8.81 (95% CI, 1.12-69.46) times higher than among those for infants with a family income ≥10 minimum wages. Low quality antenatal care was associated with an odds ratio of 3.28 (95% CI, 1.09 - 9.91) for SGA. Short maternal stature and maternal smoking during pregnancy were also associated with SGA births.

Conclusions

Low socioeconomic status, maternal smoking during pregnancy, maternal height and low quality antenatal care are the main risk factors for SGA births.

Keywords

Small-for-gestational age. Birth weight.Gestational age. Fetal growth retardation. Risk factors. Prevalence. Socioeconomic factors.

INTRODUCTION

Birth weight is a strong predictive factor for perinatal morbidity and mortality. Low birth weight infants, that is, those born with <2,500 g, present a higher mortality rate in the first weeks of life than those born with ≥2,500 g. Low birth weight may be due to prematurity, retarded intrauterine growth or a combination of both factors. Each of these factors present different etiologies and consequences.[8,9]

The majority of definitions consider as small-for-gestational-age (SGA) those infants whose birth weights are below a specific cut-off point for sex and gestational age. Other authors consider as SGA those infants born at term, but whose weight at birth is ≤2,500 g. Being SGA is utilized as an indicator of retarded intrauterine growth, but these terms are not synonyms for some infants considered SGA may simply be those located at the lower end of the normal curve of fetal growth distribution, for example, sons and daughters of short mothers. Infants exposed to agents that restrict intrauterine growth, such as cigarette smoking during gestation, may have a lower birth weight than they would have had if they hadn't been exposed to this agent, but not sufficient to be considered SGA. It is impossible to determine if an infant who is SGA did or didn't suffer from intrauterine growth retardation based on a simple evaluation of fetal size and gestational age.[1] On the other hand, the larger the prevalence of SGA infants, the greater the proportion of intrauterine growth retardation. At present, the World Health Organization[15] recommends that those infants with birth weights below the 10th percentile for gestational age and sex, according to the reference developed by Williams'[14] should be considered SGA.

Infants born SGA present an increased morbidity and mortality rate for the first years of life.[2,4,6,10] Furthermore, as suggested in the studies edited by Barker et al,[3] these infants present a higher risk for developing chronic illnesses as adults, such as diabetes, hypertension and coronary disease. Consequently, preventing the birth of infants who are small-for-gestational-age will have short and long run effects.

As to the etiology of SGA, the main risk factors are: black race; low caloric intake or low weight gain during gestation, low pre-gestational weight, maternal smoking, and short maternal stature.[10]

The objective of this study is to identify the main risk factors for small-for gestational-age births and collaborate towards the implementation of measures that result in a reduction in the prevalence of this pathology.

METHODS

A cross-sectional study in which women that had given birth between October and December, 1996, in the five maternities of the city of Pelotas in Rio Grande do Sul State, Brazil were invited to participate. Initially, the study's objectives were explained to mothers who were then asked to give their informed consent. Those who participated in the study, a total of 1,082 mothers, were interviewed. The standardized questionnaire utilized for the interview included questions concerning socioeconomic as well as demographic conditions, reproductive history, maternal smoking during gestation, antenatal care and birth assistance. The maternities were visited daily in the mornings and afternoons by interviewers. The latter were medical students, previously trained in techniques for applying questionnaires.

Birth weight was measured by assistants working in the nursery wards. Gestational age was calculated by subtracting the date of the last menstruation from the date of birth. Those children whose birth weight, according to gestational age and sex, was below the 10th percentile, according to the reference developed by Williams,[14] were considered SGA.

In order to quantify antenatal care, an indicator developed by Kessner and adapted by Takeda[12] which combines the number of visits to the antenatal clinic and the period in which antenatal care was initiated was utilized. When the mother attended 5 or more antenatal visits and the first visit occurred up to the fourth month of gestation, antenatal care was considered adequate. Antenatal care was classified as inadequate when mothers attended antenatal clinics less than four times and initiated care after the seventh month of gestation. Antenatal care was classified as intermediate in all the remaining cases.

In addition to the Kessner index, quality of care was measured according to a score that was created based on procedures performed during the antenatal visit. Mothers were asked were asked whether the doctor had weighed her, measured her blood pressure, auscultated fetal heartbeats, measured uterine fundal height. Furthermore, mothers were asked whether in, any of the visits, the physician examined the breasts, encouraged breastfeeding, prescribed iron and tetanus toxoid, performed a gynecological examination and whether the latter included a Pap smear. Each item performed was given a score of 1. Consequently, scores varied from 0 to 8, indicating, respectively, antenatal care in which none of the above items were performed or antenatal care in which all of the above items were performed according to mothers.

As to maternal smoking, in order to ensure the quality of the information being collected, mothers were asked about their smoking habits during pregnancy. Those who stated they smoked during pregnancy were asked about their smoking habits during each trimester as well as the number of cigarettes smoked daily.

A data bank was created utilizing the Epi Info program. The Chi-Square test was performed on bivariate analysis with the objective of describing the occurrence of SGA, taking the independent variables and possible confounding factors into consideration.

In the logistic regression, the SPSS Program was utilized to analyze data hierarchically: socioeconomic and demographic variables were included in the first level; in the second level, anthropometric variables (height and corporal mass) were included; reproductive variables were in the third level; in the fourth level were maternal smoking variables; and in the fifth level were those variables related to antenatal care.

In the hierarchical model, each set of variables of a specific level were included. A retrospective selection was undertaken and all variables with p ≥0.25 were eliminated. In this type of model, variables situated in a higher hierarchical level than the variable being analyzed are considered potential confounding factors of the relation between this variable and the outcome of the study. The variables situated in lower levels are considered potential mediators of the effect of the exposure being studied. The variables selected in a particular level were retained in the subsequent models and were considered as risk factors for SGA, even if, with the inclusion of hierarchically inferior variables, they had lost their significance.

RESULTS

As a result of the 1,082 interviews conducted with mothers, 911 infants were included in the study and the remaining 171 were excluded for it was not possible to obtain information concerning their birth weight and gestational age. The prevalence of SGA within the study group was 13.1%.

Table 1 indicates that the prevalence of SGA was higher among those infants whose parents had low income or low educational level. Table 2 indicates that low maternal stature (≤150 cm) was associated with a higher prevalence of infants with SGA [odds ratio; 2.88 (95% CI 1.35-6.15)]. On the other hand, parity, sex of the newborn and previous stillborn were not associated with SGA.

Table 1 - Intrauterine growth retardation according to socioeconomic and demographic variables. Pelotas, RG, 1996.

Variable	N	Intrauterine growth retardation	
		Prevalence	Odds ratio (CI95%)
Maternal age (years)		P<0.05	
<20	226	15.6%	Reference
20 to 29	505	14.0%	0.88 (0.54-1.44)
30 to 34	210	7.0%	0.41 (0.20-0.82)
≥35	140	15.4%	0.99 (0.53-1.84)
Lives with spouse		P<0.05	
No	155	19.5%	0.56 (0,34-0,93)
Yes	925	12.1%	Reference
Paternal age (years)		P<0.05	
<20	42	11.4%	1.05 (0.34-3.26)
20 to 29	441	12.6%	1.17 (0.69-2.00)
30 to 34	212	12.6%	1.17 (0.63-2.19)
≥35	236	10.9%	Reference
Maternal schooling (years)		P<0.05	
≤4	271	13.2%	3.28 (0.96-11.15)
5-8	507	16.0%	4.10 (1.25-13.39)
9-11	217	9.3%	2.22 (0.63-7.78)
≥12	78	4.4%	Reference
Paternal schooling (years)		P<0.05	
≤ 4	215	15.3%	3.22 (0.94-10.93)
5-8	416	15.3%	3.08 (0.93-10.15)

9-11	202	7.2%	1.33 (0.37-4.76)
≥12	56	5.6%	Reference
Mother's skin color		P<0.05	
White	823	13.0%	Reference
Other than white	255	13.2%	1.01 (0.64-1.60)
Family income (minimum wages)		P<0.05	
<1	272	18.3%	14.29 (1.93-105.88)
1-2.9	376	15.2%	11.39 (1.55-83.71)
3-4.9	200	9.4%	6.60 (0.86-50.45)
5-9.9	157	10.7%	7.65 (0.99-58.94)
≥10	77	1.5%	Reference

Table 2 – Intrauterine growth retardation according to anthropometric and maternal reproductive variables. Pelotas, 1996.

Variable	N	Intrauterine growth retardation	
		Prevalence	Odds ratio (CI 95%)
Maternal height (cm)		P<0.05	
≤150	68	21.6%	2.88 (1.35-6.15)
151-160	311	12.7%	1.52 (0.92-2.53)
>160	425	8.7%	Reference
Corporal mass index		P<0.05	
≤18,5	72	15.2%	1.45 (0.64-3.30)
18.6-21	208	10.9%	Reference
>21	509	10.7%	0.98 (0.56-1.69)
Parity		P<0.05	
0	394	13.9%	1.14 (0.67-1.95)
1	259	9.6%	0.76 (0.40-1.42)
2	167	17.1%	1.47 (0.78-2.74)
≥3	221	12.4%	Reference
Newborn's sex		P<0.05	
Masculine	543	11.9%	Reference
Feminine	530	14.3%	1.23 (0.84-1.81)
Previous stillborn		P<0.05	
No	986	12.5%	Reference
Yes	96	19.2%	1.67 (0.92-3.04)
Previous premature infant		P<0.05	
Yes	986	14.3%	1.12 (0.57-2.19)
No	96	12.9%	Reference

Table 3 indicates that those children whose mothers smoked during the entire pregnancy presented a greater chance of being SGA, whereas those children whose mothers stopped smoking during their pregnancy had the same chance of being SGA than those infants whose mothers did not smoke.

Table 3 – Intrauterine growth retardation according to mother's exposure to tobacco. Pelotas, 1996.

Variable	N	Intrauterine growth retardation	
		Prevalence	Odds ratio (CI 95%)
Smoked during gestation		P< 0.05	
Did not smoke	769	10.9%	Reference
Stopped smoking during pregnancy	46	10.3%	0.94 (0.32-2.72)
Smoked during the entire pregnancy	256	20.6%	2.13 (1.40-3.22)
Numer of cigarettes smoked (cigarettes/day)		P<0.05	
Did not smoke	774	10.9%	Reference
<5	129	16.7%	1.64 (0.94-2.87)
5-10	79	24.2%	2.62 (1.40-4.91)
>10	82	19.7%	2.01 (1.02-3.94)

Table 4 indicates that poor quality antenatal care was associated with a greater prevalence of SGA.

Table 4 – Intrauterine growth retardation according to antenatal care. Pelotas, 1996.

Variable	N	Intrauterine growth retardation	
		Prevalence	Odds ratio (CI 95%)
Attended antenatal care		P<0.05	
Yes	1.025	12.9%	Reference.
No	57	16.7%	1.35 (0.59-3.12)
Number of visits		P<0.05	
Did not attend antenatal care	57	16.7%	1.39 (0.60-3.3)
≤5	242	14.%	1.4 (0.1-1.2)
6 or more	734	12.%	Reference
Kessner index		P<0.5	
Adequate	741	12.%	Reference
Intermediate	307	13.7%	1.5 (0.3-1.9)
Inadequate	34	34.8%	2.23 (1.19-4.17)
Qualitative prenatal score		P<0.05	
0	58	16.3%	3.98 (1.10-14.43)
1 a 4.5	123	18.8%	4.74 (1.55-14.52)
5 a 7.88	763	13.1%	3.07 (1.10-8.58)
8	101	4.7%	Reference

In the multivariate analysis (see Figure), the variables entered the regression model according to the hierarchical theoretical model, previously discussed. In the first set, the marital status of the mother, maternal age and family income remained in the model, and the latter was the variable most strongly associated with SGA. Even after adjusting for socioeconomic and demographic variables, the chance of an infant being SGA was 2.3 (CI 95% 1.07-5.07) times greater among infants whose mothers' height was ≤150 cm than among infants whose mothers' height was ≥160 cm. The children whose mothers smoked during pregnancy also continued to present a greater chance of being SGA. Mothers with poor quality antenatal care continued to present a greater chance of having a SGA child as well.

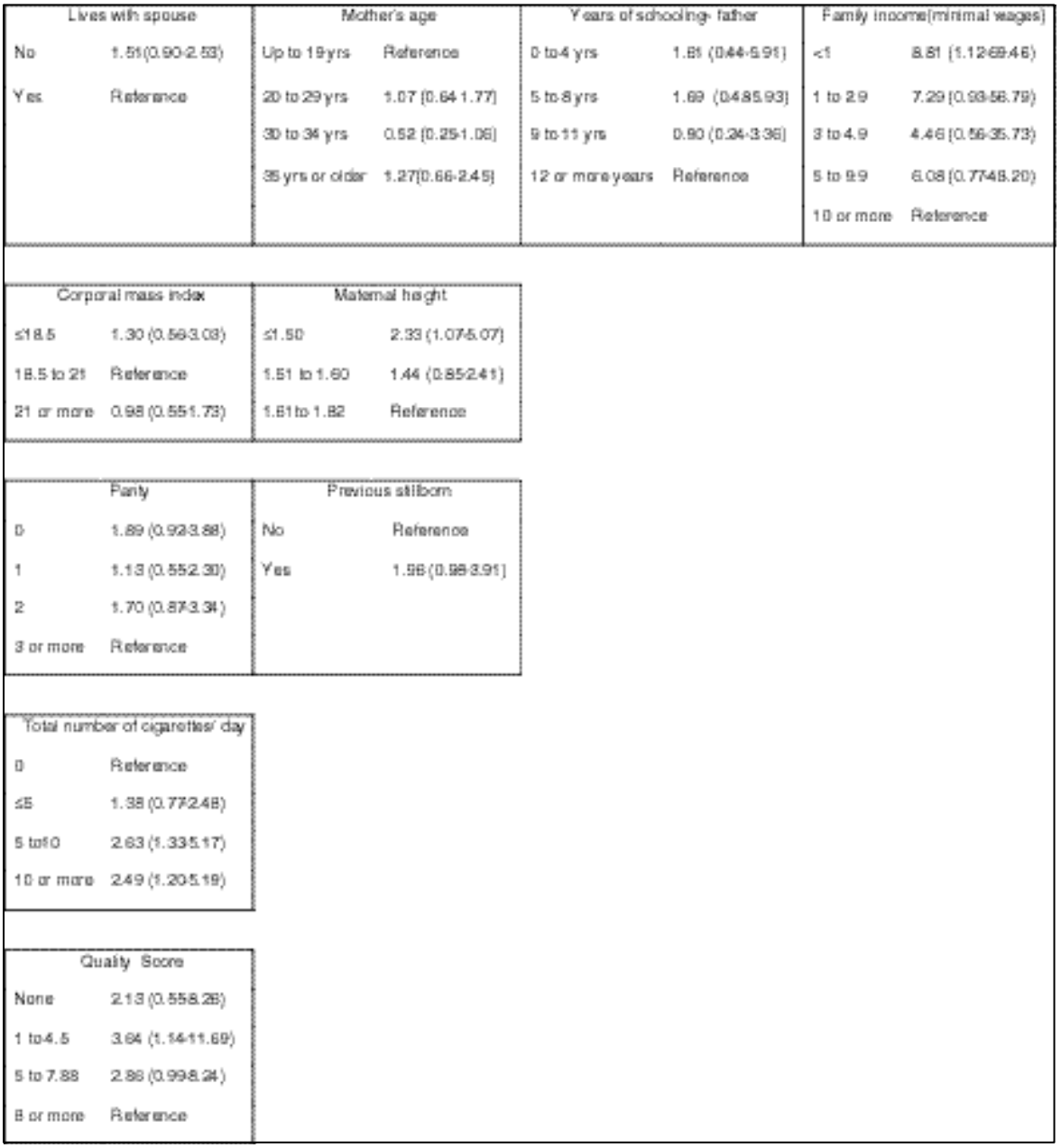

Figure - Final hierarchical model for births of small-for-gestational-age (SGA) infants.

DISCUSSION

This study encompassed almost all births which occurred in hospitals in the city of Pelotas, Rio Grande do Sul State, in southern Brazil, during a three month period in the year 1996, thus reducing the possibility of a selection bias. On the other hand, gestational age was estimated utilizing the date of the last menstruation as a parameter, which led to the exclusion of some mothers who did not remember this date. Mothers who do not remember this date present a greater prevalence of low birth weight and belong to a lower socioeconomic status.[5] Consequently, the prevalence of SGA is underestimated in this study.

As to the effect of socioeconomic status on intrauterine growth, low socioeconomic status is associated to smoking, poor nutritional state and other factors which are considered determinants of intrauterine growth. In this study, even after adjusting for the variables situated in the lower hierarchical levels, the children from low income families continued to present a greater chance of being SGA. This is probably a consequence of not including some of the possible mediators of the effects of low socioeconomic status, such as infections during pregnancy and the drug abuse.

In our study, low maternal stature was associated with the birth of SGA infants, in consonance with the literature.[9,11] Since this association was observed even after adjustment for confusion by socioeconomic status and pre-gestational weight, it is probably due to a genetic effect or is adaptive to the environmental conditions in the uterus.

As it has been observed in other studies[9,11] maternal smoking during pregnancy increases the infants' risk for SGA, in a direct dose-response relation, in which an increase in the number of cigarettes smoked during gestation increases the risk of SGA newborns. Maternal smoking may effect intrauterine growth in at least three different ways: fetal hypoxia due to increased levels of carboxyhemoglobulin; uterine vasoconstriction and interference in fetal metabolism.[9]

Theoretically, antenatal care should have a beneficial impact on intrauterine growth, for it makes it possible to identify and to treat complications during gestation and to eliminate or reduce modifiable risk factors, such as, for example, the habit of smoking. Evidence of the repercussion of antenatal care on the conditions of birth are weak, since the majority of studies failed to establish criteria capable of evaluating the quality of antenatal care. A reduced number of visits would be associated to poor quality antenatal care. For this reason, it would be interesting if the estimates were adjusted to the number of antenatal visits.[12] The Kessner index evaluates adequacy, but not quality. The creation of a score related to the content of the visits is an attempt to objectify this process and is one more criteria for evaluating quality. Halpern et al[7] demonstrated that, despite the high antenatal coverage in the municipality of Pelotas, Rio Grande do Sul State, there are inequities in the care pregnant women receive. Since the association between poor quality antenatal care and births of SGA infants was observed in this study, even after controlling for the number of antenatal visits, the effect of quality is independent of the number of antenatal visits during gestation, suggesting that, in addition to stimulating an increase in the number of visits, an increase in the quality of antenatal care should be sought.

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