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Association between alcohol abuse during pregnancy and birth weight

ABSTRACT

OBJECTIVE: To assess the association between alcohol abuse during gestation and low birth weight.

METHODS: Cross-sectional, population-based nested study from a cohort of 957 pregnant women who received prenatal assistance through Sistema Único de Saúde (National Health System) in the city of Pelotas, Southern Brazil, and delivered their babies between September 2007 and September 2008. The mothers were interviewed at two distinct moments: prenatal and postpartum periods. In order to verify alcohol abuse, the CAGE (Cut down, Annoyed by criticism, Guilty and Eye-opener) scale was used. Bivariate analyses were carried out, as well as multiple logistic regression adjusted by the variables prematurity and alcohol abuse. The level of significance that was adopted was 95%.

RESULTS: Of the women who participated in the study, 2.1% abused alcohol during pregnancy and, among these, 26.3% had low birth weight children. There was an association between alcohol abuse and low birth weight ($p < 0.038$).

CONCLUSIONS: The findings indicate that alcohol abuse during pregnancy is associated with low birth weight.

DESCRIPTORS: Pregnant Women. Alcohol Drinking, adverse effects. Infant, Low Birth Weight. Cross-Sectional Studies.

INTRODUCTION

Birth weight is an important parameter related to perinatal and child morbidity and mortality.¹⁸ Low birth weight is defined by the World Health Organization (WHO) as weight at birth of less than 2,500 grams,²⁰ and this is one of the factors that determine neonatal mortality, higher risk of infections, greater propensity to growth delay and postnatal neuropsychological deficit. In addition, it may influence the health conditions of the adult.⁸ The rates undergo great variations in diverse regions of the world, with evident disadvantages to the less developed countries, because they are associated with unfavorable socioeconomic conditions.^{3,9} A Brazilian study has shown a 10% incidence of low birth weight.²

Low birth weight is strongly related to harmful maternal habits, mainly the consumption of alcoholic beverages.¹⁵ The literature shows higher risk of malformations, spontaneous miscarriage, low birth weight, prematurity, asphyxia and perinatal mortality, besides several physical and mental problems deriving from the Fetal Alcohol Syndrome.¹⁸ During the gestational period, the prevalence of inadequate alcohol use varies from 2.0% to 40.6%.^{1,2,18}

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The alcohol that the mother ingests during gestation crosses the placental barrier and the fetus is exposed to this substance that is present in the maternal blood. Fetal exposure is greater due to its slow metabolism and elimination system; thus the amniotic fluid remains impregnated with unmodified alcohol (ethanol) and acetaldehyde (a metabolite of ethanol).⁷

Ethanol induces the formation of oxygen free radicals that are capable of damaging cellular proteins and lipids, which increases apoptosis or “programmed cellular death” and negatively affects cellular divisions and specifications. Ethanol also inhibits the synthesis of retinoic acid, a substance that regulates embryonic development.⁷ The consumption of 20 grams of alcohol seems to be enough to suppress fetal breathing and movements.⁴

Alcohol consumption may be underdiagnosed during gestation, probably due to the health professionals’ unpreparedness to investigate adequately or to give importance to complaints compatible with the habit of drinking.¹⁵

In addition to alcohol abuse during pregnancy, other factors may be associated with low weight, like low maternal age, not receiving prenatal care, female newborn, prematurity, low socioeconomic condition and smoking during pregnancy.^{17,19}

Thus, the present study aimed to analyze the association between alcohol abuse during gestation and low birth weight.

METHODS

The study is nested to a cohort that monitored families since the prenatal period until 12 months in the postpartum period, with the objective of evaluating psychiatric disorders in mothers and fathers and child developmental delay. The sample was constituted by 1,062 women who received prenatal care through the *Sistema Único de Saúde* (Brazil’s National Health System) of the city of Pelotas, Southern Brazil, and delivered their babies between September 2007 and September 2008. The women were captured by means of the *Sistema de Acompanhamento do Programa de Humanização no Pré-Natal e Nascimento* (System to Accompany the Prenatal and Birth Humanization Program, SISPRENATAL) of the Municipal Department of Health. The SISPRENATAL is a government program that stimulates primary care units to provide prenatal assistance. It provides funds for the unit every time a pregnant woman is enrolled. Data such as address, phone number and gestational age (calculated based on the date of the last menstruation) were obtained from the program’s medical record. The only exclusion

criterion was to reside in the rural zone of the city of Pelotas (n = 44).

The women were interviewed at their homes between 30 and 45 days after delivery by means of a questionnaire about economic conditions, maternal characteristics, prenatal care and smoking during pregnancy. Alcohol abuse was verified by means of the CAGE scale (Cut down, Annoyed by criticism, Guilty and Eye-opener), validated to Brazil by Castells & Furlanetto.⁵ This scale considers that two or more affirmative answers are indicative of alcohol abuse.

The child’s weight and sex data, as well as gestational age at delivery, by means of which prematurity was verified, were obtained from the baby’s health card.

The newborns up to 2,499 grams were considered low weight. The families’ socioeconomic level was classified into five levels (A, B, C, D and E), according to *Associação Brasileira de Empresas de Pesquisa* (ABEP – Brazilian Survey Companies Association),^a which is based on the accumulation of material goods and on the level of schooling of the head of household. In the present study, the levels were merged into three (A and B; C; D and E). Maternal age was divided into three categories: up to 19 years, 20 to 34 and 35 or older.

After the collection, the data were double-entered in the program EpiInfo 6.04 for comparison and elimination of inconsistencies. The statistical package SPSS 10.0 for Windows was used for data analysis. Univariate analysis by simple frequency was conducted to learn about the sample’s characteristics, and bivariate analysis (chi-square test), for comparison between proportions. To control for possible confounding factors, logistic regression was used, based on the following hierarchical model: in the first level, socioeconomic classification and maternal age; in the second level, prenatal care, smoking during gestation, newborn’s sex, prematurity, and alcohol abuse; and as the outcome, low birth weight.

To verify the power of association, a significance level of 95% was used, as well as power of association of 80%. The initial sample was constituted by 1,062 women. There was 11% (105) of losses or refusals in the second part of the study and the final sample was constituted by 957 mothers. With a sample of 957 women, it was possible to establish a power of association of 99%.

The investigation was approved by the research ethics committee of Universidade Católica de Pelotas according to the norms that were in force at the time (CONEP-Res196/96), under the protocol no. 2007/95.

^a Instituto Brasileiro de Opinião Pública e Estatística. Critério de classificação econômica Brasil. Dados com Base no Levantamento Sólido Econômico 2000 – IBOPE. São Paulo; 2003[cited 2009 December 12]. Available from: <http://www.datavale-sp.com.br/CCEB.pdf>

Table. Distribution of the sample and of low weight newborns, according to maternal characteristics and prematurity condition. Pelotas, Southern Brazil, 2007-2008.

Variable	n	%	Low weight n	Low weight %	Crude OR (95%CI)	p	Adjusted OR (95%CI)	p
Socioeconomic classification						0.880		
A and B	99	11.50	11	11.2	0.90 (0.43;1.87)			
C	471	54.50	46	9.9	1.04 (0.64;1.69)			
D and E	294	34.00	30	10.2	1			
Maternal age						0.843		
Up to 19 years	174	18.30	20	11.5	1			
From 20 to 34 years	662	69.70	62	9.4	1.26 (0.74;2.15)			
35 years or older	114	12.00	13	11.4	1.00 (0.48;2.12)			
Pre-natal assistance						0.302		
Yes	821	88.90	79	9.7	1			
No	103	11.10	12	11.8	1.46 (0.73;2.93)			
Smoking in gestation						0.271		
Yes	254	33.80	28	11	1.20 (0.73;1.97)			
No	498	66.20	46	9.3	1			
Gender						0.388		
Female	411	45.80	43	10.5	1.10 (0.71;1.69)			
Male	486	54.20	47	9.7	1			
Prematurity						<0.001		< 0.001
No	719	75.10	27	3.8	1		1	
Yes	238	24.90	68	28.7	10.25 (6.37;16.51)		11.59 (7.01;19.16)	
Alcohol abuse						<0.038		< 0.020
Yes	19	2.10	5	26.3	3.22 (1.13;9.15)		4.20 (1.25;14.13)	
No	866	97.90	86	10.0	1		1	
Total	957	100		10				

RESULTS

Among the 957 participant mothers, 99 (11.5%) belonged to classes A and B, 471 (54.5%) to class C and 294 (30.0%) to classes D and E. The majority of the mothers (69.7%) were between 20 and 34 years of age. Among the interviewees, 821 (88.9%) received prenatal assistance, and 254 (33.8%) were smokers. Among the newborns, 486 (54.2%) were males, 95 (10.0%) were born at low birth weight and 238 (24.9%) were born premature (Table).

Alcohol abuse was verified in 19 (2.1%) women. There was association between prematurity and low weight ($p<0.001$) and alcohol abuse and low birth weight ($p<0.038$), and 26.3% of the mothers who reported alcohol abuse in gestation delivered low birth weight babies. The variables that presented association with birth weight in the bivariate analyses with level of significance <0.20 were included in the regression models.

In the multiple regression analysis, after adjustments for prematurity and alcohol abuse, low birth weight

remained associated with prematurity ($p<0.001$) and alcohol abuse in gestation ($p<0.020$). The preterm babies were 11 times more likely to be born at low weight than those who were born at term, even controlling for alcohol abuse ($p<0.020$). The likelihood of a baby being born at low weight was four times higher among those whose mothers abused alcohol during gestation (OR= 4.20; 95%CI: 1.25;14.13).

DISCUSSION

The present study revealed a 10% incidence of low birth weight, a value that is similar to the one found in Brazilian studies.^{2,8} The prevalence of alcohol abuse was of 2.1%; however, other studies have shown variation in alcohol consumption during pregnancy from 2.0% to 40.6%, depending on the utilized investigation method.^{1,2,18} Moraes & Reichenheim¹⁸ found a 7.3% prevalence of alcohol abuse in gestation. The low percentage of alcohol abuse in the present study may derive from the utilization of the CAGE instrument. Moraes & Reichenheim¹⁸ argue that the cutoff

point of this instrument (two affirmative answers) is high when employed in pregnant women, because it suggests a positive screening only for alcohol abuse or dependence.¹⁸ Thus, the CAGE instrument does not take into account lower alcohol ingestions; it only considers them as suspicion of alcohol problems. In gestation, such situation would be of great importance, since safe levels of alcohol consumption in this period are not known. Another important factor that may justify the low prevalence of alcohol abuse during gestation is the question of social acceptability. Pregnant women are usually aware that alcohol consumption is harmful to the fetus, and tend to omit the use of alcoholic beverages due to fear of being disapproved both by society and by the health services.

Nevertheless, even with the low prevalence that was found, the association between alcohol abuse and low birth weight after the adjustment should not be minimized. The literature shows variation from 32.0% to 48.1% in the incidence of low birth weight in children born to mothers who ingested alcohol during gestation.^{12,16} In the present study, 26.3% of the mothers who abused alcohol delivered low weight babies.

The statistical analysis identified that preterm children are more likely to be born weighing less than 2,500g. Birth weight is strongly associated with prematurity. Children born before 37 weeks were almost 35 times more likely to weigh less than 2,500g than those whose gestational age was higher.³ The results found by Carniel et al³ are similar to the others from the literature that were mentioned above, with a 28.7% incidence among low weight infants who were born premature. The mechanisms through which alcohol affects intrauterine growth are not well known; therefore, we decided to maintain the adjustment for prematurity in the hierarchical model. Although the causal chain alcohol-prematurity-low weight is known, the present study confirmed that the association between alcohol and low weight occurs even in the absence of prematurity.

Zambonato et al²¹ have shown greater association between smoking in gestation and intrauterine growth restriction than with low weight. In the present study, smoking during gestation did not associate significantly with low birth weight, perhaps because it was underdiagnosed, like alcohol abuse, due to social acceptability. The pregnant women, fearing a possible recrimination and disapproval on the part of health professionals, may expose less consumption of these substances or even deny it.

Giglio et al⁹ have described association between maternal age and low birth weight, with higher occurrence of low weight among children born to mothers who are in the extremes of reproductive life, that is, younger than 19 years or older than 35 years. This association was not found in the present study, but

69.7% of the pregnant women who were interviewed were between 20 and 34 years old. Kassir et al¹³ studied adolescent and adult mothers younger than 35 years and showed that maternal age did not influence the variation in birth weight. Thus, the influence of maternal age on low birth weight is contradictory, because the mother's chronological age, by itself, is not a good predictor of birth weight. The complexity of the evaluation derives from the consideration of the biological expression of an event that does not occur in isolation from other dimensions. It is fundamental to consider the interaction of many dimensions, such as the socioeconomic, psychological and cultural, over the considered and/or studied biological responses.¹³

A study has shown that poorer children have a 2.4 times higher risk of being born at low weight than those of richer families.¹⁰ In the present study there was no association between socioeconomic class and low birth weight; however, it must be considered that the sample was constituted by 54.5% of women from class C, which is considered intermediate.

Prenatal care was not related to low birth weight. This relation has been questioned by studies such as the one by Hueston et al,¹¹ which did not find lower rates of low weight babies among North-American women who received early prenatal assistance. However, in the present study 88.9% of the women received prenatal assistance, whereas the others, although they denied having received prenatal assistance, attended at least one consultation of this type, as the sample was extracted from a prenatal enrolment program.

A possible limitation of the present study is related to the non-utilization of an instrument considered to be the gold standard to identify the many stages of alcohol use during gestation. The CAGE explores specifically the social effects of the inadequate use of alcohol, based on the patient's perception of his/her own habits, and on the perception of his/her relatives and friends, which might cause misunderstandings in the interpretation of the findings.¹⁸ Yet, the CAGE is adequate to track alcohol abuse, to the detriment of the clinical interview, which is difficult to perform when we are dealing with primary care. Even with the non-ideal characteristics of the instrument, the finding of the present study should be valued. The reason is that the cutoff point of the above-mentioned instrument has high specificity, which makes the 2.1% of women who abused alcohol during pregnancy be relevant in view of the association with low birth weight.

To reduce the consumption of alcoholic beverages during gestation, multidisciplinary work is necessary. When alcohol use is diagnosed, the patient should promptly receive intensive treatment, with psychological support and approaches that motivate her to change. Educational actions since the beginning of

pregnancy and home visits increase adherence to the treatment and the chances of reduction or abandonment of alcohol ingestion during gestation.^b

The mechanisms through which alcohol affects the conceptus have not been fully clarified yet. It is believed that the fetus is exposed to alcohol concentrations that are similar to those of the maternal blood, which makes the environment inadequate to the fetus and favors the incidence of the Fetal Alcohol Syndrome. This is characterized by damage to the central nervous system,

which causes neurological and craniofacial anomalies, deficit in pre- and post-natal growth, behavioral disorders and emotional difficulties.^{6,7}

The data showed in the present study are a warning so that health professionals track the abusive use of alcohol by pregnant women, since there is an indication that alcohol consumption in gestation is related to factors that may affect delivery, like premature placental abruption, uterine hypertonia, premature labor and meconium-stained amniotic fluid.⁷

^b Babor TF, Higgins-Biddle J C. Manual de intervenção breve para indivíduos com problemas decorrentes do uso de álcool atendidos nos serviços de atenção primária. Geneva: World Health Organization; 2004 [cited 2009 Dec 16]. Available from: http://apps.einstein.br/alcooledrogas/novosite/atualizacoes/as_203.html

REFERENCES

1. Aliyu MH, Wilson RE, Zoorob R, Brown K, Alio AP, Clayton H, et al. Prenatal alcohol consumption and fetal growth restriction: Potentiation effect by concomitant smoking. *Nicotine Tob Res.* 2009;11(1):36-43. DOI:10.1093/ntr/ntn014
2. Barros AJD, Santos IdSd, Victora CG, Albernaz EP, Domingues MR, Timm IK, et al. Coorte de nascimentos de Pelotas, 2004: metodologia e descrição. *Rev Saude Publica.* 2006;40(3):402-13. DOI:10.1590/S0034-89102006000300007
3. Carniel EdF, Zanolli MdL, Antônio MÂRdGM, Morcillo AM. Determinantes do baixo peso ao nascer a partir das Declarações de Nascidos Vivos. *Rev Bras Epidemiol.* 2008;11(1):169-79. DOI:10.1590/S1415-790X2008000100016
4. Chaudhuri JD. Alcohol and developing fetus: a review. *Med Sci Monit.* 2000;6(5):1031-41.
5. Castells MA, Furlanetto LM. Validade do questionário CAGE para rastrear pacientes com dependência ao álcool internados em enfermarias cínicas. *Rev Bras Psiquiatr.* 2005;27(1):54-7. DOI:10.1590/S1516-44462005000100012.
6. Freire K, Padilha PdC, Saunders C. Fatores associados ao uso de álcool e cigarro na gestação. *Rev Bras Ginecol Obstet.* 2009;31(7):335-41. DOI: 10.1590/S0100-72032009000700003
7. Freire TdM, Machado JC, Melo EvD, Melo DG. Efeitos do consumo de bebida alcoólica sobre o feto. *Rev Bras Ginecol Obstet.* 2005;27(7):376-81. DOI:10.1590/S0100-72032005000700002
8. Guimarães EAdA, Velasquez-Meléndez G. Determinantes do baixo peso ao nascer a partir do sistema de informação sobre nascidos vivos em Itaúna, Minas Gerais. *Rev Bras Saude Matern Infant.* 2002;2(3):283-90. DOI:10.1590/S1519-38292002000300009
9. Giglio MRP, Lamounier JA, Neto OLdM, César CC. Baixo peso ao nascer em coorte de recém-nascidos em Goiânia-Brasil no ano de 2000. *Rev Bras Ginecol Obstet.* 2005;27(3):130-6. DOI:10.1590/S0100-72032005000300006
10. Horta BL, Barros FC, Halpern R, Victora CG. Baixo peso ao nascer em duas coortes de base populacional no Sul do Brasil. *Cad Saude Publica.* 1996;12(Supl. 1):27-31. DOI:10.1590/S0102-311X1996000500005
11. Hueston WJ, Gregory GE, Davis L, Sturgill V. Delayed prenatal care and the risk of low birth weight delivery. *J Community Health.* 2003;28(3):199-208. DOI:10.1023/A:1022908307844
12. Jaddoe VWV, Bakker R, Hofman A, Mackenbach JP, Moll HA, Steegers EAP, et al. Moderate alcohol consumption during pregnancy and the risk of low birth weight and preterm birth. *Ann Epidemiol.* 2007;17(10):834-40. DOI:10.1016/j.annepidem.2007.04.001
13. Kassar SB, Gurgel RQ, Albuquerque MdfMd, Barbieri MA, Lima MdC. Peso ao nascer de recém-nascidos de mães adolescentes comparados com o de puérperas adultas jovens. *Rev Bras Saude Matern Infant.* 2005;5(3):293-9. DOI:10.1590/S1519-38292005000300005
14. Kaup ZdOL, Merighi MAB, Tsunehiro MA. Avaliação do consumo de bebida alcoólica durante a gravidez. *Rev Bras Ginecol Obstet.* 2001;23(9):575-80. DOI: 10.1590/S0100-72032001000900005
15. Larroque B, Kaminski M, Lelong N, Subtil D, Dehaene P. Effects on Birth Weight of Alcohol and Caffeine Consumption during Pregnancy. *Am J Epidemiol.* 1993;137(9):941-50.
16. Lundsberg LS, Bracken MB, Saftlas AF. Low-to-Moderate Gestational Alcohol Use and Intrauterine Growth Retardation, low birthweight, and preterm delivery. *Ann Epidemiol.* 1997;7(7):498-508. DOI:10.1016/S1047-2797(97)00081-1
17. Minamisawa R, Barbosa MA, Malagoni, L, Andraus LMS. Fatores associados ao baixo peso ao nascer no Estado de Goiás. *Rev Eletron Enferm.* 2004;6(3):336-49
18. Moraes CL, Reichenheim ME. Rastreamento de uso de álcool por gestantes de serviços públicos de saúde do Rio de Janeiro. *Rev Saude Publica.* 2007;41(5):695-703. DOI:10.1590/S0034-89102007000500002
19. Shu XO, Hatch MC, Mills J, Clemens J, Susser M. Maternal smoking, alcohol drinking, caffeine consumption, and fetal growth: results from a prospective study. *Epidemiology.* 1995;6(2):115-20. DOI:10.1097/00001648-199503000-00005
20. WHO: recommended definitions, terminology and format for statistical tables related to the perinatal period and use of a new certificate for cause of perinatal deaths. Modifications recommended by FIGO as amended October 14, 1976. *Acta Obstet Gynecol Scand.* 1977;56(3):247-53.
21. Zambonato AMK, Pinheiro RT, Horta BL, Tomasi E. Fatores de risco para nascimento de crianças pequenas para idade gestacional. *Rev Saude Publica.* 2004;38(1):24-29. DOI:10.1590/S0034-89102004000100004

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