Research, Society and Development, v. 9, n. 8, e692986538, 2020
(CC BY 4.0) | ISSN 2525-3409 | DOI: http://dx.doi.org/10.33448/rsd-v9i8.6538

Consumo materno de cigarro durante a gestação e o baixo peso ao nascer: estudo de caso-controle

Maternal consumption of cigarette during pregnancy and low birth weight: case-control study

Consumo materno de cigarrillos durante el embarazo y bajo peso al nacer: un estudio de casos y controles

Recebido: 09/07/2020 | Revisado: 10/07/2020 | Aceito: 10/07/2020 | Publicado: 28/07/2020

Priscilla Perez da Silva Pereira
ORCID: https://orcid.org/0000-0001-8900-6801
University of Rondônia, Brazil
E-mail: priperez@unir.br
Ana Claudia Morais Godoy Figueiredo
ORCID: https://orcid.org/0000-0002-9892-1531
University of Brasilia, Brazil
E-mail: aninha_m_godoy@hotmail.com
Fabiana Araújo Figueiredo da Mata
ORCID: https://orcid.org/0000-0003-3762-9091
University of Brasilia, Brazil
E-mail: fagfigueiredo@hotmail.com
Roberta Borges Silva
ORCID: https://orcid.org/0000-0001-7273-5151
University of Brasilia, Brazil
E-mail: roberta.silva.borges@gmail.com
Mauricio Gomes Pereira
ORCID: https://orcid.org/0000-0001-9512-3502
University of Brasilia, Brazil
E-mail: mauriciogp@gmail.com
Simone Seixas da Cruz
ORCID: https://orcid.org/0000-0002-9410-5676
Federal University of Recôncavo da Bahia, Brazil
E-mail: simone.seixas1@gmail.com

Isaac Suzart Gomes-Filho
ORCID: https://orcid.org/0000-0002-4270-8491
University of Feira de Santana, Brazil
E-mail: isuzart@gmail.com
Johelle Santana Passos-Soares
ORCID: https://orcid.org/0000-0002-4541-1730
Federal University of Bahia, Brazil
E-mail: johpassos@gmail.com
Luise Maria Souza
ORCID: https://orcid.org/0000-0002-3902-5235
University of Feira de Santana, Brazil
E-mail: gubaiana@hotmail.com
Soraya Castro Trindade
ORCID: https://orcid.org/0000-0001-7125-9114
University of Feira de Santana, Brazil
E-mail: soraya.castrotrindade@gmail.com
Julita Maria Freitas Coelho
ORCID: https://orcid.org/0000-0002-9520-5177
University of Feira de Santana, Brazil
E-mail: julitamaria@gmail.com

Resumo

O peso ao nascer do recém-nascido é um indicador que reflete a condição de saúde da mãe e a qualidade dos cuidados prestados durante a gestação. O objetivo é analisar a associação entre o consumo de cigarros durante a gestação e o baixo peso ao nascer (BPN). Estudo de caso-controle em que o grupo caso foi composto por 402 mães e recém-nascidos com peso ao nascer <2.500 gramas e o grupo controle por 1.210 mães e recém-nascidos sem BPN. Os dados foram coletados por meio de entrevista e complementados por registros hospitalares. Utilizou-se regressão linear e logística na análise dos dados. A maioria das mulheres era de cor da pele parda/ negra, casada, baixo nível socioeconômico e pouco mais da metade tinha menos que nove anos de estudo. O consumo de mais de 10 cigarros ao dia foi associado ao BPN. Para cada cigarro consumido diariamente a redução no peso ao nascer foi 18,5 gramas. Entre as mães que consumiram mais de 10 cigarros por dia durante a gestação a redução no peso ao nascer foi de 283,1 gramas. Este estudo reforça que o BPN está associado ao fumo.

Palavras-chave: Gestante; Baixo peso ao nascer; Fumar; Estudos de casos e controles.

Abstract

The birth weight of newborn is an indicator that reflects maternal health conditions and the healthcare quality delivered during pregnancy. The aim of this study is to analyze the association between maternal consumption of cigarette during pregnancy and Low Birth Weight (LBW) in the Northeast of Brazil. Case-control study with the group of cases composed of 402 mothers with newborns with a birth weight <2,500 grams, and control composed of 1,210 mothers with newborns with weight ≥2,500 grams. Data were collected based on self-reported information by mothers and complemented with hospital records. Simple linear regression and logistic regression models were conducted. Majority of women were brown/ black, married, of low income and almost half of them had less than nine years of education. The consumption of 10 or more cigarettes a day was associated with LBW. For each cigarette added to the daily cigarette consumption there was a reduction of 18.6 grams in birth weight. Among mothers who smoked more than ten cigarettes per day, the mean reduction in birth weight was 283.1 grams. This study reinforces that LBW is associated with the maternal consumption of cigarettes.

Keywords: Pregnant women; Low birth weight; Smoking; Case-control studies.

Resumen

El peso al nacer del recién nacido es un indicador que refleja el estado de salud de la madre y la calidad de la atención brindada durante el embarazo. El objetivo de este estudio es analizar la asociación entre el consumo de cigarrillos durante el embarazo y el bajo peso al nacer (LBW). Métodos: estudio de casos y controles en el que el grupo de casos estaba compuesto por 402 madres y recién nacidos con un peso al nacer <2.500 gramos y el grupo de control por 1.210 madres y recién nacidos sin BPN. Los datos fueron recolectados a través de entrevistas y complementados con registros hospitalarios. Se utilizó regresión lineal y logística en el análisis de datos. La mayoría de las mujeres eran marrones / negras, casadas, tenían un nivel socioeconómico bajo y poco más de la mitad tenían menos de nueve años de estudio. El consumo de más de 10 cigarrillos al día se asoció con BPN. Por cada cigarrillo consumido diariamente, la reducción en el peso al nacer fue de 18.5 gramos. Entre las madres que consumieron más de 10 cigarrillos al día durante el embarazo, la reducción en el peso al nacer fue de 283.1 gramos. Este estudio refuerza que BPN está asociado con el tabaquismo.

Palabras llave: Mujer embarazada; Bajo peso al nacer; Fumar; Estudios de casos y controles.

1. Introduction

Birth weight is a measure of easy assessment and can be considered as an important health indicator, because it reflects the life conditions of the mother and the care provided during pregnancy. Birth weight interferes directly on the health of the newborn, influencing the chance of survival in the first year of life and is presented as a risk factor for physical and psychological morbidities during childhood and adulthood (Moreira et al., 2017).

Seventeen percent of newborns were classified as low birth weight newborns in 2010, worldwide, and the majority of these cases occurred in countries characterized by unfavorable socioeconomic conditions (Moreira et al., 2017). In Brazil, a systematic review published in 2014 that included 20 studies found a prevalence varying from 5.6% to 10.6%, depending on the region.[4] Regarding the mortality rate in low birth weight infants, in 2008, we found the highest rates in the North and Northeast regions of Brazil (25% and 35.6% respectively) while in the other regions the rate was not higher than 19% (Alves, 2019).

In developed countries, the main cause of LBW is prematurity. However, in developing countries LBW is mainly related to fetal growth restriction. This situation is strongly associated with conditions of poverty, poor nutrition, insufficient food and access to quality prenatal care (Lima et al., 2016; Coelho et al. 2018).

Pregnant woman lifestyle is pointed a factor that influence the occurrence of LBW. In Brazil, have a decrease in cigarette consumption among the general population due to smoke-free public policies. However, in the last decade the frequency of maternal active smoking during pregnancy reached up to 23%, depending on the country's region (Coelho et al., 2018).

A newborn whose mother smoked during pregnancy may weigh 226 grams less at birth than a newborn whose mother did not smoke. Moreover, a systematic review in Americas, the odds of having a LBW newborn is 2.0 (95% CI:1.77-2.26) higher among women who smoked during pregnancy compared to those who did not smoke (Pereira et al., 2017).

In Brazil the majority of studies on maternal cigarette smoking during pregnancy were conducted in areas with better socioeconomic conditions. Although we found some studies on the subject in the Northeast region of Brazil, the effect of cigarette smoking by pregnant women on the weight of newborns in the semiarid region is still little investigated. Thus, the aim of this research is to analyze the association between cigarette smoking during pregnancy and low birth weight in the two cities of Northeast of Brazil.

2. Methodology

We performed an original epidemiological, quantitative, analytical study with a case-control design, enrolling in case group 402 mothers and newborns with birth weight <2.500 grams and in control group 1210 mothers and newborns without LBW (≥2.500 grams birth weight). The sample size was calculated using the software Epi Info version 7.2.0.1 considering the proportion of one case for four controls, 95% confidence interval (95% CI), study power of 80%, percent of cases with exposure 15.24% and percent of controls exposed 8.85% (Cruz et al, 2009). The estimated minimum sample size was 303 cases and 908 controls.

Interviews were performed between 2009 and 2011, in two public, medium-sized, secondary care hospitals located in Northeast region of Brazil in the municipalities of Petrolina and of Juazeiro. These two municipalities, although belonging to two different states (Bahia and Pernambuco), are considered sisters because their boundaries are separated by a river.

We included newborns alive and their mothers. We excluded those mothers with history of hemorrhagic disorders on the third trimester of pregnancy, pre gestational diabetes, multiple gestation, cardiovascular diseases, use of antibiotic prophylaxis, and newborn with congenital malformation.

During data collection, the selection of participants was performed daily. For each postpartum woman selected as cases, we selected four controls. All newborns with < 2.500 grams and their mothers were selected for the control group. Mothers from control group were selected by random by lot from the list of hospital registry of newborns.

Birth weight and gestational age were collected from the declaration of live birth and other information was obtained through a closed interview for the case/control status, e.g., interviewers did not know whether the postpartum woman and newborn were from case or control group. We used the same data collection instrument for the groups – a questionnaire regarding sociodemographic characteristics, current and past gestational history and lifestyle. In order to test the questionnaire, we performed a pilot project and researchers were previously trained for its appliance and have been validated to guarantee that it has been understandable by mothers.

The following sociodemographic characteristics were collected about the mothers: age (<20, 20 to 35 and ≥35 years old), years of education (≤9 and >9), race/skin color (white and brown/black), family income (≤2 minimum wages and above two minimum wages), living

arrangements (with or without spouse), and paid activity (yes and no). The reproductive, prenatal, health conditions, delivery and life style characteristics were: prematurity (gestational age below 37 weeks), number of previous gestations (multiparous and primiparous), type of birth (vaginal or caesarean), previous history of prematurity (yes and no), number of prenatal appointments (<6 and ≥6, according to the Brazilian Ministry of Health), hospital admission during pregnancy (yes and no), high risk pregnancy (yes and no), urinary tract infection (yes and no), gestational arterial hypertension (yes and no), newborn sex (male or female) and alcohol consumption during pregnancy (yes and no).

Cigarette consumption at least once in life and during pregnancy was classified as dichotomous variables (yes and no). The number of smoked cigarettes a day during pregnancy was classified as none, low/moderate (<10 cigarettes/day) and high (≥10 cigarettes/day). The frequency of consumption was classified as none, not daily, and daily (Santos et al., 2011).

Bivariate analysis was applied to assess the association between the dependent variable and other variables through Pearson Chi-Square Test or Fisher Exact Test at 95% significance level. Simple linear regression was used to verify the effect of the number of consumed cigarettes on birth weight and the effect of consumed alcohol on birth weight. The comparison between cases and controls regarding maternal exposure and LBW was conducted through crude and adjusted Odds Ratio (OR) and their respective 95% CI. In this study, the logistic regression analysis was unconditional and used the backward strategy. Variables with $p<0.05$, those that adjusted the OR in at least 20% or those that were epidemiologically important to the outcome of the study were kept in the model. The Hosmer-Lemeshow test was used to test the models' goodness of fit. We used STATA® software version 11.0 (College Station. Texas. USA) for all statistical analyses.

This research was approved by Ethical Research Committees from Institute of Integral Medicine Professor Fernando Figueira and from State University of Feira de Santana, under registries 2215/11 and 048/2009, respectively. All participants signed the consent form.

3. Results and Discussion

The Table 1 show that majority of postpartum women was between 20 and 34 years old, considered themselves as brown/black, had a family income lower than two minimum wages, had a partner and did not have a remunerated occupation. Almost half of the participants studied until ninth grade, which corresponds to elementary school.

Table 1 - Sociodemographic, economic, reproductive, prenatal, health conditions, delivery and life style characteristics, Northeast of Brazil, 2011 (n=1,612).

Variable	Cases = 402 n (%)	Controls =1,210 n (%)
Age (years)		
≤ 20	140 (34.8)	297 (24.5)
≥35	32 (8.0)	91 (7.5)
Years of education		
≤ 9 years	189 (47.0)	582 (48.1)
Race/Skin color		
Brown/black	337 (83.8)	1,055 (87.2)
Family income		
≤ 2 minimum wages[a]	358 (89.1)	219 (91.6)
Living arrangements		
Without spouse	79 (19.7)	219 (18.1)
Paid working activity		
No	275 (68.4)	746 (61.4)
Number of pregnancies		
Primiparity	202 (50.3)	447 (36.9)
Previous LBW		
Yes	53 (13.2)	89 (7.4)
Previous prematurity		
Yes	39 (9.7)	63 (5.2)
Number of prenatal appointments		
<6	201 (50.0)	358 (29.6)
Hospital admission during pregnancy		
Yes	86 (21.4)	148 (12.2)
High risk pregnancy		
Yes	105 (26.2)	148 (16.9)
Urinary infection		
Yes	167 (41.6)	535 (44.2)
Arterial blood hypertension		
Yes	98 (24.4)	134 (11.1)
Type of birth		
Caesarean	151 (37.6)	354 (29.3)
Newborn sex		
Male	210 (52.2)	647 (55.5)
Prematurity		
Yes	277 (68.9)	132 (10.9)
Alcohol consumption during pregnancy		
Yes	56 (13.9)	145 (12.0)

[a] The Brazilian minimum wage in 2010 was equivalent to US$ 291,00.
Source: Authors.

Regarding reproductive, prenatal and health conditions just over 40% of women had urinary tract infections during pregnancy. In the case group, half of the women were primiparous, had less than six prenatal visits, and 69% of newborns were premature.

The variables race/ethnicity, marital status, income and years of education did not show significant statistical association with low birth weight as shown in Table 2. All variable of reproductive, prenatal, health conditions, delivery and life style characteristics were associated to the outcome except urinary infection, newborn sex and alcohol consumption during pregnancy.

Table 2 - Crude Odds Ratio (OR), 95% confidence interval (CI 95%) for the association between sociodemographic, economic, reproductive, prenatal, health conditions, delivery and life style characteristics and low birth weight, Northeast of Brazil, 2011 (n=1,612).

Variable	OR Crude (95% CI)	P value
Age (years)		0.01
≤ 20	1.68 (1.31- 2.16)	
≥35	1.26 (0.82- 1.93)	
Years of education		0.30
≤ 9 years	0.96 (0.76- 1.20)	
Race/Skin color		0.71
Brown/black	0.76 (0.56- 1.04)	
Family income		0.09
≤ 2 minimum wages[a]	0.75 (0.52- 1.09)	
Living arrangements		0.13
Without spouse	1.11 (0.83- 1.47)	
Paid working activity		0.49
No	1.35 (1.06- 1.71)	
Number of pregnancies		0.01
Primiparity	1.72 (1.37- 2.16)	
Previous LBW		0.01
Yes	1.91 (1.33- 2.74)	
Previous prematurity		0.01
Yes	1.96 (1.29- 2.97)	
Number of prenatal appointments		0.01
<6	2.38 (1.89- 3.00)	
Hospital admission during pregnancy		0.01
Yes	1.95 (1.45- 2.62)	
High risk pregnancy		0.01
Yes	1.74 (1.33- 2.28)	
Urinary infection		0.35
Yes	0.90 (0.71- 1.13)	
Arterial blood hypertension		0.01
Yes	2.59 (1.94- 3.46)	
Type of birth		0.01
Caesarean	1.45 (1.15- 1.84)	
Newborn sex		0.67
Male	1.05 (0.84- 1.32)	
Prematurity		0.01
Yes	18.1 (13.7- 23.9)	
Alcohol consumption during pregnancy		
Yes	1.19 (0.85; 1.65)	0.31

OR - Odds Ratio; CI - Confidence Interval; LBW- Low Birth Weight
Source: Authors.

Among sociodemographic variables, only age and working activity were associated to LBW. Other studies carried out in Brazil also have showed the lack of association between sociodemographic variables and LBW (Lima et al., 2016; Coelho et al., 2018).

Primiparity, previous LBW and prematurity, less than six prenatal appointments, hospital admission during pregnancy, high risk pregnancy, arterial blood hypertension, caesarean and prematurity were association to LBW. Only urinary infection (41.6% versus 44.2%), alcohol consumption during pregnancy (13.9% versus 12.0%) and newborn sex (52.2% versus 55.5%) were not associated with LBW.

In the medical literature we found that the relationship between LBW and prematurity, extremes of age, previous history of LBW and prenatal access is well established (Coelho et al., 2018; Oliveira et al., 2016; Carvalho et al., 2016). Prematurity is one of the main causes for LBW.[20] The incidence of LBW is twice as high in women of extreme age (Alves et al., 2019). Prior history of LBW may increase the risk of a new birth with LBW up to five times. The access and quality of prenatal care allows the early identification of problems that interfere with fetal weight gain, thus, the higher the number of consultations performed, the lower the prevalence of LBW (Alves et al., 2019; Almeida et al., 2014).

The percentage of mothers who have smoked cigarettes at least once in life was 16.4%. During pregnancy, 6.8% of women continued to smoke. The Table 3 show that the consumption of cigarettes before or during pregnancy was not associated with LBW when it was assessed as a dichotomous variable. After stratification, this variable showed that smoking ten or more cigarettes a day was associated with LBW, and this association held even after adjusting for confounding variables (OR 3.87; 95%CI: 1.85; 8.10).

Table 3 - Crude and adjusted Odds Ratio (OR), 95% confidence interval (CI 95%) for the association between cigarettes consumption during pregnancy and low birth weight, Northeast of Brazil, 2011 (n=1,612).

Variables	Cases, n=402 (%)	Controls, n=1,210 (%)	Crude OR (IC 95%)	P value	Adjusted OR[a] (IC 95%)	P value
Cigarette consumption at least once in life						
Yes	71 (17.7)	194 (16.0)	1.12 (0.83- 1.51)	0.44	0.96 (0.68- 1.34)	0.80
Cigarette consumption during pregnancy						
Yes	31 (7.7)	78 (6.5)	1.21 (0.79- 1.87)	0.38	1.08 (0.67- 1.75)	0.75
Number of consumed cigarettes a day[b]						
< 10	11 (2.7)	33 (2.8)	1.02 (0.51- 2.03)	0.96	0.91 (0.43- 1.94)	0.82
≥ 10	20 (5.0)	16 (1.4)	3.81 (1.96- 7.44)	0.01	3.87 (1.85- 8.10)	0.01
Frequency of cigarette consumption						
Not daily	11 (2.7)	32 (2.6)	1.05 (0.52- 2.10)	0.89	0.88 (0.41- 1.87)	0.74
Daily	20 (5.0)	46 (3.8)	1.33 (0.77- 2.27)	0.30	1.23 (0.68- 2.21)	0.50

[a]Cigarette consumption adjusted by maternal age, family income, number of prenatal appointments, high risk pregnancy, previous LBW history, hospital admission during pregnancy and alcohol consumption during pregnancy.
[b]Some women did not answer this question.
Source: Authors.

The prevalence of cigarette consumption during pregnacy in this study was 6.8%, a lower measure when compared to other Brazilian regions (Pedraza, 2014). Smoking at least once in life and during pregnancy were not associated with LBW when assessed as dichotomous variables. Likewise, the frequency of cigarette consumption was not associated with the outcome. However, the consumption of 10 or more cigarettes per day was associated with LBW in the stratified analysis. Worldwide, other studies also revealed an association when at least ten cigarettes were smoked a day (Juárez Merlo, 2013; Windham et al., 2000; Aagaard-Tillery et al., 2008). In Brazil, two studies assessing the quantity of cigarette consumption observed an association between smoking and LBW in regions of high socioeconomic status. The association holds for any number of smoked cigarettes (Coutinho et al., 2009; Silva et al., 2006).

The mean number of daily cigarette consumption in the group of cases was roughly 11.7 and in the group of controls were approximately 7.8. We observed in the Table 4 an average reduction of 82.6 grams (95%CI: -223.40; 58.19; p=0.25) in the birth weight of newborns whose mothers smoked during pregnancy compared to those whose mothers did not smoke. Among mothers who smoked more than ten cigarettes per day, the mean reduction in birth weight was 283.1 grams (IC 95%: -556.81; -9.36; p=0.04) compared to newborns whose mothers smoked less than ten cigarettes.

Table 4 - Linear regression parameters between cigarette consumption during pregnancy and weight at birth, Northeast of Brazil, 2011 (n=1,612).

Variables	Number (N)	Percentage (%)	Mean weight (g)	Standard Deviation	β (IC 95%)	p>t
Cigarette consumption						
No	1,503	93.2	2.990,2	731,9		
Yes	109	6.8	2.907,6	596,2	-82.60 (-223.40; 58.19)	0.25
Number of cigarettes a day[a]						
<10	44	2.7	2.942,1	602,6		
≥10	36	2.2	2.659,0	622,9	-283.08(-556.81; -9.36)	0.04

β: Regression coefficient; CI95%: 95% Confidence Interval.
[a]Some women did not answer this question.
Source: Authors.

The linear regression (using the number of cigarettes per day as a continuous variable) showed that, for each cigarette added to the daily consumption, there was an average reduction of 18.6 grams (95%CI: -34.92; -2.21) in birth weight. This result supports the dose-response relationship between smoking during pregnancy and LBW.

This study showed an average decrease of 82.6 grams in birth weight of newborns whose mothers smoked while pregnant compared to those newborns whose mothers did not smoke. However, among mothers who smoked ten or more cigarettes, the reduction in birth weight was 283.1 grams. A Brazilian cohort of 5,166 mothers showed that children from women who smoked during pregnancy had an average reduction of 142 grams in birth weight compared to children whose mothers did not smoke (Horta et al., 1997). Another study conducted in the state of Minas Gerais showed that smoking was a determinant variable for insufficient birth weight - daughters of mothers who reported smoking during pregnancy had a mean birth weight of around 250 grams less than those of mothers who reported no tobacco use (Moreira et al., 2017).

We found a linear relationship between the number of consumed cigarettes per day and birth weight. For each additional smoked cigarette per day, there was a decrease of approximately 19 grams in a newborn's birth weight. One of the first studies that showed a dose-response relationship between the number of consumed cigarettes during pregnancy and birth weight was published in 1957 (Benowitz & Jacob, 1984). From this date onwards, several studies have reported this dose-response relationship (Coutinho et al., 2009; Silva et al., 2006).

As the exposure variable and some of the co-variables were self-reported, it is likely that information bias has been introduced in this study. However, self-reporting is still the most practical way to acquire data on cigarette consumption and alcohol consumption because the use of biological markers is limited, especially when evaluating low and moderate doses (Nykjaer et al., 2014).

Among the limitations from this study, we must consider that some variables may be potential confounders between exposure and outcome and some of this information was not collected such as pre gestational weight, Body Mass Index (BMI) and passive exposure to smoke. Besides theses, some of these variables are of difficult measurement, such as stress, genetic factors and environmental exposure.

4. Final Considerations

The results of our study reinforce the importance of an early prenatal approach about the disadvantages of cigarette during pregnancy. It is necessary to establish prevention and treatment policies towards women who consume this substance. Public policies should warrant access to information about the harms of consuming cigarettes and implement a follow up strategy over prenatal and post-partum periods.

For future studies, we suggest investigating which measures are efficient to stop consumption as soon as possible during pregnancy. Among these actions we have interdisciplinary monitoring in health services or self-supported care by the family health team.

References

Aagaard-Tillery, K. M., Porter, T. F., Lane, R. H., Varner, M. W., Lacoursiere, D. Y. (2008). In utero tobacco exposure is associated with modified effects of maternal factors on fetal growth. Am J Obst Gynecol, 198(66), e1-6. Doi: 10.1016/j.ajog.2007.06.078.

Almeida, A. H. V., Costa, M. C. O., Gama, S. G. N., Amaral, M. T. R., Vieira, G. O. (2014). Baixo peso ao nascer em adolescentes e adultas jovens na Região Nordeste do Brasil. Rev Bras Saúde Mater Infant., 14(3),279-286. Doi: https://doi.org/10.1590/S1519-38292014000300009.

Alves, J. M., Martins, A. C. P., Rocha, J. F. D., Costa, F. M., Vieira, M. A. (2019). Causas associadas ao baixo peso ao nascer: uma revisão integrativa. Rev.Uningá,56(S6),85-102. Available in: http://revista.uninga.br/index.php/uninga/article/view/2989.

Benowitz, N. L., Jacob, P. (1984). Daily intake of nicotine during cigarette smoking. Clin Pharmacol Ther.,84(4),499-504. Doi: 10.1038/clpt.1984.67.

Carvalho, S. S., Oliveira, B. R. (2019). Fatores preditivos para a ocorrência de baixo peso ao nascer e prematuridade: um estudo caso-controle. Rev Educação em Saúde. 2019, 7(1):1-9. Doi: https://doi.org/10.29237/2358-9868.2019v7i1.p100-108.

Coelho, J. M. F., et al. (2018) Associação entre qualidade do pré-natal e baixo peso ao nascer em uma instituição hospitalar em Feira de Santana/BA. Revista de Epidemiologia e Controle de Infecção, 8(2),129-135. Doi: http://dx.doi.org/10.17058/reci.v1i2.10406.

Coutinho, P. R., Cecatti, J. G., Surita, F. G., Souza, J. P., Morais, S. S. (2009). Factors associated with low birth weight in a historical series of deliveries in Campinas, Brazil. Rev Assoc Med Bras., 55(6), 692-699. Doi: http://dx.doi.org/10.1590/S0104-42302009000600013.

Cruz, S. S., Costa, M. C., Gomes-Filho, I. S., Rezende, E. J., Barreto, M. L., Santos, C. A., Vianna, M. I. (2009). Contribution of periodontal disease in pregnant women as a risk factor for low birth weight. Community Dent Oral Epidemiol., 37 (6),527-533. Doi: 10.1111/j.1600-0528.2009.00492.x.

Horta, B. L.,Victora, C. G., Menezes, A. M., Halpern, R., Barros F. C. (1997). Low birthweight. preterm births and intrauterine growth retardation in relation to maternal smoking. Paediatr and Perinat Epidemiol., 11(2), 140-151.doi: 10.1046/j.1365-3016.1997.d01-17.x.

Juárez, S. P., Merlo, J.(2013). Revisiting the Effect of Maternal Smoking during Pregnancy on Offspring Birthweight: A Quasi-Experimental Sibling Analysis in Sweden. PLoS One, 8(4), e61734. doi: 10.1371/journal.pone.0061734.

Lima, J. C., Oliveira Júnior, G. J., Takano, O. A. (2016). Factors associated to fetal death in Cuiabá, Mato Grosso. Rev Bras Saude Mater Infant., 16(3), 353-361. Available in: https://pesquisa.bvsalud.org/portal/resource/pt/lil-798113.

Moreira, M. E. F. H., Silva, C. L., Freitas, R. F., Macedo, M. S., Lessa, A. G. (2017). Determinantes socioeconômicos e gestacionais do peso ao nascer de crianças nascidas a termo. Medicina, 50(2),83-90. Doi: https://doi.org/10.11606/issn.2176-7262.v50i2p83-90.

Nykjaer, C., Alwan, A. N., Greenwood, D. C., Simpson, N. B. A., Hay, A. W. N., White K.L.M., Janet E.C. (2014). Maternal alcohol intake prior to and during pregnancy and risk of adverse birth outcomes: evidence from a British cohort. J Epidemiol Com Health., 68(6),542-49. Doi: 10.1136/jech-2013-202934.

Oliveira, L. L., Gonçalves, A. C., Costa, J. S. D., Bonilha, A. L. L. (2016). Maternal and neonatal factors related to prematurity. Revista da Escola de Enfermagem da USP, 50(3),382-389. Doi:https://doi.org/10.1590/S0080-623420160000400002.

Pedraza, D. F., Souza, M. M., Cristóvão, F. S., França, I. S. X. (2014). Baixo peso ao nascer no Brasil: revisão sistemática de estudos baseados no sistema de informações sobre nascidos vivos. Rev Atenção à Saúde, 50 (2),37-50. Doi: 10.13037/rbcs.vol12n41.2237.

Pereira, P. P. S., Da Mata, F. A., Figueiredo, A. C., Andrade, K. R., Pereira, M. G. (2017). Maternal Active Smoking During Pregnancy and Low Birth Weight in the Americas: A Systematic Review and Meta-analysis. Nicotine Tob Res., 19(5), 497-505. doi: 10.1093/ntr/ntw228.

Rojas, P. F. B., Carminatti, A. P. S., Hafemann, F., Stein, A. C., Francisco, C. C. (2013). Fatores maternos preditivos de baixo peso ao nascer: um estudo caso-controle. Arq Catarin Med.,42(1), 68-75, 2013. Available in: http://bases.bireme.br/cgi-bin/wxislind.exe/iah/online/?IsisScript=iah/iah.xis&src=google&base=LILACS&lang=p&nextAction=lnk&exprSearch=673851&indexSearch=ID.

Santos, J. D. P., Silveira, D. V., Oliveira, D. F., Caiaffa, W. T. (2011). Instruments used to evalue smoking habits: a systematic review. Ciência & Saúde Coletiva, 16(12), 4707-4720. https://dx.doi.org/10.1590/S1413-81232011001300020.

Silva, A. A., Bettiol, H., Barbieri, M. A., Brito, L. G., Pereira, M. M., Aragão, V. M., Aragão, V. M. F., Ribeiro, V. S. (2006). Which factors could explain the low birth weight paradox? Rev Saude Publica, 40(4), 648-655. https://doi.org/10.1590/S0034-89102006000500014.

Windham, G. C., Hopkins, B., Fenster, L., Swan, S. H. (2011). Prenatal Active or Passive Tobacco Smoke Exposure and the Risk of Preterm Delivery or Low Birth Weight. Epidemiology, 11(4), 427-433. doi 10.1097/00001648-200007000-00011

Percentage of contribution of each author in the manuscript

Priscilla Perez da Silva Pereira – 30%

Ana Claudia Morais Godoy Figueiredo – 10%

Fabiana Araújo Figueiredo Da Mata – 10 %

Roberta Borges Silva – 5%

Mauricio Gomes Pereira – 10%

Simone Seixas da Cruz –10%

Isaac Suzart Gomes-Filho – 5%

Johelle Santana Passos-Soares – 5%

Luise Maria Souza – 5%

Soraya Castro Trindade – 5%

Julita Maria Freitas Coelho – 5%