

FACTORS ASSOCIATED WITH HYPERTENSIVE PREGNANCY SYNDROME: ANALYSIS MULTIPLE IN HIERARCHICAL MODELS

Fatores associados à síndrome hipertensiva da gestação: análise múltipla em modelos hierarquizados

Factores asociados al síndrome de embarazo hipertensivo: análisis múltiples en modelos jerárquicos

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ABSTRACT

Objective: To analyze the factors associated with Hypertensive Pregnancy Syndrome. **Method:** Cross-sectional, observational study, realized in a municipality in the interior of Paraná, in which 314 pregnant women participated. The variables were grouped into levels in a hierarchical manner. The distal level included biological variables; intermediate the sociodemographic and lifestyle characteristics; proximal the prenatal care variables. Multiple logistic regression analysis was performed. **Results:** Remained associated at the distal level, obesity and non-communicable chronic disease; care with food and receiving social benefits were associated at the intermediate level; at the proximal level, specialist consultation, nutritional monitoring and gestational obesity. Noncommunicable chronic disease, dietary care and nutritional monitoring have been shown to be protective factors. **Conclusion:** The factors associated with Hypertensive Pregnancy Syndrome are broad and include aspects that should be considered not only in prenatal care, but in the health care of women of childbearing age.

DESCRIPTORS: Pregnancy high-risk; Maternal and child health; Hypertension pregnancy-induced; Risk factors; Prenatal care.

RESUMO

Objetivo: Analisar os fatores associados a Síndrome Hipertensiva da Gestação. **Método:** Estudo transversal, observacional, do qual participaram 314 gestantes, realizado em um município do interior do Paraná. As variáveis foram agrupadas em níveis de maneira hierarquizada. O nível distal contemplou variáveis de caráter biológico; intermediário as características sociodemográficas e de estilo de vida; proximal as variáveis da assistência pré-natal. Realizou-se análise de regressão logística múltipla. **Resultados:** Permaneceram associados no nível distal, obesidade e doença crônica não transmissível; cuidados com a alimentação e recebimento de benefício social apresentaram associação no nível intermediário; no nível proximal, consulta com especialista, acompanhamento nutricional e obesidade gestacional. Doença crônica não transmissível, cuidados com a alimentação e acompanhamento nutricional demonstraram-se fatores

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proteccionais. **Conclusão:** Os fatores associados à Síndrome Hipertensiva da Gestação são amplos e abarcam aspectos que devem ser considerados não somente na assistência pré-natal, mas no cuidado à saúde da mulher em idade fértil.

DESCRITORES: Gravidez de alto risco; Saúde materno-infantil; Hipertensão induzida pela gravidez; Fatores de risco; Cuidado pré-natal.

RESUMEN

Objetivo: Analizar los factores asociados con el síndrome de embarazo hipertensivo. **Método:** Estudio transversal, observacional, en el que participaron 314 mujeres embarazadas en un municipio del interior de Paraná. Las variables se agruparon en niveles de forma jerárquica. El nivel distal incluía variables biológicas; intermediar las características sociodemográficas y de estilo de vida; variables de atención prenatal. Se realizó un análisis de regresión logística múltiple. **Resultados:** Factores asociados: obesidad y enfermedad crónica no transmisible a nivel distal; la atención con alimentos y la recepción de beneficios sociales se asociaron a nivel intermedio; a nivel proximal, consulta especializada, monitorización nutricional y obesidad gestacional. Las enfermedades crónicas no transmisibles, el cuidado de la dieta y el monitoreo nutricional han demostrado ser factores protectores. **Conclusión:** Los factores asociados con el síndrome de embarazo hipertensivo son amplios e incluyen aspectos que deben considerarse no solo en la atención prenatal, sino también en la atención médica de las mujeres en edad fértil.

DESCRIPTORES: Embarazo de alto riesgo; Salud materno-infantil; Hipertensión inducida en el embarazo; Factores de riesgo; Atención prenatal.

INTRODUCTION

Hypertensive Disorders of Pregnancy (HDP) is one of the most important causes of maternal mortality in the world¹ and can be presented in several clinical forms, such as preeclampsia, eclampsia, chronic hypertension, preeclampsia superimposed on chronic hypertension or gestational hypertension.²

HDP is estimated to be among the most common causes of risk pregnancies and is responsible for more than 30,000 maternal deaths per year worldwide.³⁻⁴

Approximately 10% of all pregnancies in Brazil have some form of HDP⁵, which was the leading cause of maternal morbidity and mortality in Paraná, where, together with bleeding, have accounted for 32.6% of registered maternal deaths.⁶

Besides the high mortality rates, HDP can have serious consequences for women's health, such as cardiovascular, renal, pulmonary, encephalopathies and coagulopathies.⁷ Fetal health may also be compromised, resulting in prematurity and low birth weight⁸, and the more severe hypertension, the higher the risk of unfavorable outcomes.⁹

Thus, prenatal care is recommended during pregnancy as a method for improving maternal and neonatal outcomes, and is particularly important for high-risk pregnant women as it helps to control and prevent adverse outcomes.¹⁰ Therefore, in dealing with cases of HDP, it is necessary to clarify the diagnosis, especially the classification of the disease, as well

as increase the prenatal consultations, with resolution and effectiveness in gestational demands, providing adequate interventions to each case and ongoing risk surveillance.⁴

Studies state that maternal and perinatal mortality due to HDP are influenced by biological, socioeconomic and cultural factors as well as the quality of care received^{8,11-12}, that is, a wide range of risk factors reflect the heterogeneity of the disease. Such evidence expressed a need for studies that cover these factors to understand the disease and improve the quality of care. However, much of the scientific production talks about the factors associated with HDP, but few make a hierarchical analysis which allows a broader view of the problem, which is why this study was justified, which aimed to analyze the factors associated with HDP.

METHODOLOGY

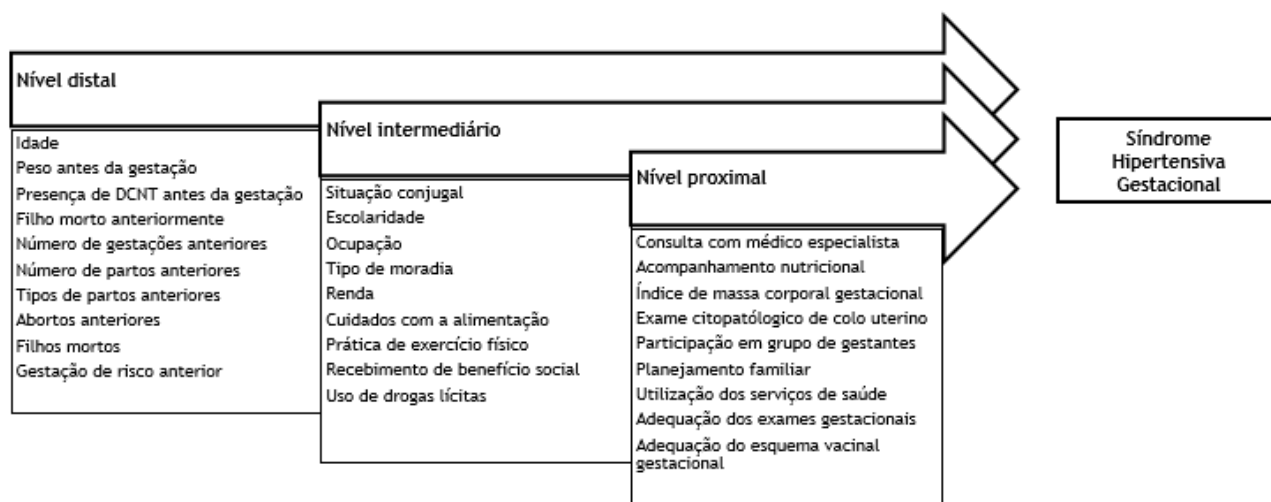
This is a cross-sectional, observational study, in which 314 high-risk pregnant women participated, conducted at the Women's Clinic (Clínica da Mulher), a specialized outpatient clinic belonging to the secondary level of health care in a municipality in the interior of Paraná state.

Data were collected from January to July 2017, along with high-risk pregnant women, during prenatal consultation at the outpatient clinic. In the aforementioned period, 493 pregnant women were referred to the outpatient clinic. The following selection criteria were considered: being a high-risk pregnant woman; at any gestational age; reside in the municipality where the outpatient clinic is located. A total of 129 women resided in other municipalities, 38 did not attend the consultations and 12 refused to participate in the research, and these exclusion criteria, thus 314 pregnant women represented the total population of this study.

The instrument used for data collection was a structured questionnaire, with survey of variables related to demographic and socioeconomic conditions; personal and obstetric history; and information of the current pregnancy.

The determinants for HDP were organized into three levels. At the distal level, the biological variables (age, weight before pregnancy, presence of non-communicable diseases (CNCD) before pregnancy, previously dead child, number of previous pregnancies, number of previous deliveries, types of previous deliveries) were grouped. previous abortions, dead children and previous risk pregnancy). At the intermediate level, sociodemographic and lifestyle characteristics were grouped (marital status, education, occupation, type of housing, income, dietary care, physical exercise, social benefit and licit drug use). The variables considered as proximal level were prenatal care characteristics (consultation with a specialist doctor, nutritional follow-up, gestational body mass index, cervical cytopathological examination, participation in pregnant women group, family planning, use of health services, adequacy of gestational examinations and adequacy of the gestational vaccination schedule) (Figure 1).

Figure 1 - Hierarchical theoretical model for the determination of Hypertensive Disorders of Pregnancy (HDP) in high-risk pregnant women.



Source: elaborated by the authors.

Multiple logistic regression analysis was performed with hierarchical entry of the variables, in blocks, in the following order: the distal ones that condition all the others; the intermediates that condition those of the lower blocks, and the proximal ones that directly predict HDP (Figure 1). This analysis is used to explain the relationship between variables in models whose set of empirical propositions already indicate the strength and direction of the relationship, and allows to identify whether the association is direct or mediated by the effect of other variables.¹³

The multiple logistic regression model, including the *stepwise forward* variables, considered those with p -value <0.20 in the univariate analysis and the variables with $p < 0.05$ or that adjusted the model remained in the final model. The magnitude of the associations was estimated by *Odds Ratio* (OR), with 95% confidence intervals as a measure of precision. The adequacy of the final model was verified from *the deviance*, Hosmer-Lemeshow tests and the collinearity of the variables was tested with the variance inflation factor (VIF). Statistical analysis was performed using *Stata 12.0 software*.

The presentation of the models followed the steps of insertion of the variables of each level. Model A shows

associations of biological factors and HDP (level 1); model B shows associations of biological, sociodemographic and lifestyle factors with HDP (levels 1 and 2) and model C shows associations of biological, sociodemographic and lifestyle factors and characteristics of prenatal care (levels 1, 2 and 3) with HDP, with their respective adjustments. The study was approved by the Research Ethics Committee Involving Human Beings, through Acceptance No. 2,073,461 and CAAE: 67756217.3.0000.0106.

RESULTS

The HDP rate among high-risk pregnant women was 26.7%. Tables 1 and 2 show the univariate analyzes with the associations included in the multiple model ($p < 0.20$). There was an association between the pregnancy-specific hypertensive disorders (PSHD), obesity and the occurrence of chronic non-communicable diseases (CNCDs), both prior to pregnancy, present in the distal level. At the intermediate level, the variables care with food and receiving social benefits were significantly associated (Table 1).

Table 1 - Univariate analysis of the association of distal and intermediate level variables and Hypertensive Disorders of Pregnancy Guarapuava, Paraná, Brazil. 2018

Variables	PSHD*		Not PSHD		OR	P-value
	n	%	n	%		
Level 1 - distal						
Pre-pregnancy weight						
Normal	22	26.2	96	41.7		Ref.
Obese	32	38.1	55	23.9	2.53	0.004
Overweight	28	33.3	71	30.9	1.72	0.095
Low weight	2	2.4	8	8.0	1.09	0.916

Variables	PSHD*		Not PSHD		OR	P-value
	n	%	n	%		
CNCD†						
Yes	55	65.5	114	49.6	0.51	0.013
No	29	34.5	116	50.4		Ref.
Previous dead son						
Yes	71	84.5	210	91.3	1.92	0.087
No	13	15.5	20	8.7		Ref.
Level 2 - intermediate						
Dietary care						
No	78	92.9	170	73.9		Ref.
Yes	6	7.1	60	26.1	4.58	0.001
Social benefit						
No	58	69.0	189	82.2		Ref.
Yes	26	31.0	41	17.8	2.06	0.013
Occupation						
Unemployed	31	36.9	138	48.7	1.62	0.064
Employed	53	63.1	92	51.3		Ref.
Use of licit drugs						
No	57	67.9	174	75.7		Ref.
Yes	27	32.1	56	24.3	1.47	0.167
Schooling						
> 14 years	11	13.1	30	13.0		Ref.
< 4 years	12	14.3	15	6.5	2.18	0.136
5 to 9 years	23	27.4	75	32.5	0.83	0.675
10 to 13 years	38	45.2	110	47.8	0.94	0.881

*Hypertensive Disorders of Pregnancy. †Non-Communicable Chronic Disease

Among the proximal level variables, we observed an association between HDP and: consultation with a specialist physician, follow-up by a nutritionist and gestational BMI classified as obesity (Table 2).

Table 2 - Univariate analysis of association of proximal level variables and Hypertensive Disorders of Pregnancy. Guarapuava, Paraná, Brazil. 2018

Level 3 - proximal	PSHD*		Not PSHD		OR	P-value
	n	%	n	%		
Consultation with specialist doctor						
No	57	67.9	102	44.3		Ref.
Yes	27	32.1	128	55.7	0.37	<0.001
Nutritionist accompaniment						
No	37	44.0	152	66.1		Ref.
Yes	47	56.0	78	33.9	0.40	<0.001

Level 3 - proximal	PSHD*		Not PSHD		OR	P-value
	n	%	n	%		
IMC†						
Normal	17	20.0	71	30.9		Ref.
Low weight	4	4.8	24	10.4	0.69	0.548
Overweight	21	25.0	62	27.0	1.14	0.348
Obesity	42	50.0	73	31.7	2.40	0.008
Cervical cytopathological examination						
No	35	41.7	132	57.4		Ref.
Yes	49	58.3	98	42.6	1.88	0.014
Participation on pregnant women's group						
No	55	65.5	117	50.9		Ref.
Yes	29	34.5	113	49.1	1.83	0.022
Contracepção						
No	42	50.0	84	36.5		Ref.
Yes	42	50.0	146	63.5	0.57	0.032
Family planning						
No	51	60.7	84	36.5		Ref.
Yes	33	39.3	146	63.5	0.60	0.052
Use of health services						
Always	20	23.8	68	29.6		Ref.
Rarely	45	53.6	131	57.0	1.16	0.614
Never	19	22.6	31	13.5	2.08	0.058
Exams suitability						
No	21	25.0	39	17.0		Ref.
Yes	63	75.0	191	83.0	1.63	0.111
Vaccines suitability						
No	28	33.3	58	25.2		Ref.
Yes	56	66.7	172	74.8	1.48	0.155

*Hypertensive Disorders of Pregnancy; †Body Mass Index.

In model A of the hierarchical multiple regression analysis remain independently associated with HDP the occurrence of non-communicable chronic disease prior to pregnancy, such as a protective factor for HDP. In the presence of intermediate level variables (model B), dietary care remained associated with HDP as a protector, but social benefit lost significance. In the last stage of the

analysis, with the presence of the proximal level variables, occurrence of chronic noncommunicable disease prior to pregnancy and dietary care presented protections to HDP. Of the proximal level variables, consultation with a specialist physician, nutritional monitoring, as a protective factor, and participation in groups of pregnant women remained associated with HDP (Table 3).

Table 3 - Multiple logistic regression analysis for hypertensive disorders of pregnancy and associated factors in high risk pregnant women. Guarapuava, Paraná, Brazil. 2018

Independent variable	Model not adjusted		Model A		Model B		Model C	
	OR	CI 95%	OR	CI 95%	OR	CI 95%	OR	CI 95%
Level 1 - distal								
CNCD*	0.51	0.30; 0.87	0.51	0.30; 0.87	0.56	0.33; 0.95	0.36	0.19; 0.66
Level 2 - intermediate								
Dietary care	4.58	1.90; 11.07			4.07	1.67; 9.90	4.05	1.61; 10.21
Social Benefit	2.06	1.16; 3.66			1.84	1.02; 3.32	1.49	0.78; 2.83
Level 3 - proximal								
Consultation with specialist doctor	0.37	0.22; 0.63					0.36	0.19; 0.68
Nutritionist accompaniment	0.40	0.24; 0.67					0.43	0.23; 0.78
Participation on pregnant women's group	1.83	1.09; 3.07					1.91	1.08; 3.37

*Non-Communicable Chronic Disease;

DISCUSSION

This study identified an HDP rate of 26.7% in 2017 in the municipality of Guarapuava-PR, considered high compared to other international and national studies, in which it was found that the prevalence ranged from 24.6% to 32, 6% in pregnancies.^{6,14}

The literature has focused on acute diseases during pregnancy and chronic diseases in the general population, so there are few studies investigating chronic diseases in pregnant women.¹⁵ CNCDs appeared in this study as a protective factor for HDP, since the association occurred for those women who have non-pregnancy related CNCDs. It can be understood that among women with CNCDs, health care is taken more diligently¹⁶, since prior to risk pregnancy, they are already accustomed to following a specific and continuous treatment, due to the greater demand and use of health services, which consequently allows proper diagnosis and treatment¹⁷, which may explain the protective factor.

Regarding the occurrence of CNCDs in pregnant women, a study conducted in CHECK... verified known risk factors for the development of hypertension in pregnancy, as 72% of participants had a BMI ≥ 25 kg/m², therefore overweight or obese and 97% had a family history of hypertension.¹⁸

It is known that the occurrence of CNCDs in the female population in general is growing today, which inevitably will reflect a growing profile of pregnant women with CNCDs under prenatal care, which is a concern when it comes to obstetric and neonatal health, due to complications that can lead to pregnancy, childbirth, birth and postpartum.^{3,19}

Fortunately, due to progress in health care, policy development and investments in health programs and services, it is rarely necessary to advise women with CNCDs against pregnancy, but surveillance and monitoring of these cases should be intensified.¹⁸

Research has shown that women with CNCDs are more prevalent than men. A national-based study revealed that among women the prevalence was 50.4%, while among men 39.2%²⁰, as well as another study, also conducted in Paraná, evidenced 54.2% of women's personal antecedents as being chronic diseases.¹⁴

Among the Brazilian states, research indicated that the southern region has a higher prevalence of chronic diseases among women, with Rio Grande do Sul with 54.2%, Paraná with 52.3% and Santa Catarina with 48.4%.²⁰

Monitoring CNCDs, their burden of morbidity and mortality, and risk factors is crucial, so strengthening surveillance should be a national and global priority²⁰, especially in women of childbearing age, given the considerable increase in these diseases in this population.^{16 20-21}

Coping with CNCDs in the female population of childbearing age is unquestionable, and should be carried out through health promotion and disease prevention actions, but it is essential to articulate intersectoral actions and especially to strive to reduce health disparities²² so that all have access to services intergral and equanimously.

In the same way that CNCDs, lifestyle habits, including care with food, have also been shown to be a protective factor for HDP, since the association with this disease was among those who do not have this kind of care. Women who did not have HDP were found to have more healthy eating habits than those who developed the disease. The eating habits of pregnant women are influenced by several factors, and it is essential to know them for the definition of nutritional interventions in prenatal care.²³

The importance of considering the eating habits of pregnant women focuses on the possibility of consequences for the health of mother and child. Thus, the nutritional component can be seen as a positive factor in the prevention of morbidity and mortality, with improvement in maternal and child health outcomes²³, as verified in this study.

In Brazil, prenatal care has as one of its actions related to eating habits, the monitoring and monitoring of weight gain during pregnancy and the provision of nutritional guidance to women from the beginning of pregnancy until the end of breastfeeding.²⁴

High-risk pregnancy due to its complexity requires care provided by an interdisciplinary and multiprofessional team⁵. The mother line of the Network Paranaense Mother (Rede Mãe Paranaense) recommends at least five visits during the high-risk gestational period, with obstetricians, nurses, pharmacists, nutritionists, social workers and others.²⁴

In the present study, nutritional monitoring has been shown to protect pregnant women from HDP, as it has been shown in studies that as uncontrolled increase in gestational weight is associated with the risk of HDP²⁵⁻²⁶ with a ratio of twice as many risks for each increase from 5 to 7 kg/m² in gestational BMI.²⁶

In Mexico, 75% of high-risk pregnant women were overweight or obese before becoming pregnant and developed associated metabolic conditions, including HDP.²⁷

Current recommendations reflect that the most effective interventions are actions taken before pregnancy, women of childbearing age should adopt habits that reduce the risk of chronic diseases²⁸, which will be considered as high gestational risk factors.

The assistance to the HDP recommended by the Network Paranaense Mother (Rede Mãe Paranaense) provides beyond monitoring with obstetrician, the cardiologist. In this study, such determination showed a protective association between HDP and the reasons are explained in previous researches. The therapeutic plan through the indication and monitoring of antihypertensive action is fundamental¹⁰, since the goal of treatment is to normalize blood pressure. HDP requires more intensive care, more appointments, expert follow-up, use of specific medications, possible hospitalizations during pregnancy.²⁹

In order to cope with the cases of HDP, it is necessary to clarify the diagnosis, as well as the increase of prenatal consultations, resolution and effectiveness in gestational demands, provision of appropriate interventions in each case and continuous risk surveillance.⁴

Nursing care for pregnant women should strive for the quality of prenatal care based on an individual care plan, systematized by the nurse and the multidisciplinary team, also using light technologies⁵, such as health education. In the present study, the lack of participation of pregnant women in groups was an important element associated with the occurrence of PSHD.

FINAL CONSIDERATIONS/ CONCLUSION

This research identified an HDP rate of 26.7% and the statistical analysis of the characteristics in the multiple model allowed us to identify factors that most influenced obesity and the occurrence of non-communicable chronic disease, both prior to pregnancy, at the distal level; maintaining dietary care and receiving social benefits were significantly associated

with HDP in the intermediate; and at the proximal level, there was an association with HDP, consultation with a specialist doctor, follow-up by a nutritionist and gestational obesity.

It is concluded that the factors associated with HDP are broad and complex and include individual and social aspects, which should be considered not only in prenatal care, but in the health care of women of childbearing age. Thus, women's health care should be organized to prevent factors, aiming at reducing the occurrence of HDP and the unwanted obstetric and neonatal consequences.

The development of studies in other regions of the country is recommended, considering the cultural, social and economic factors that permeate the HDP, so that it is possible to elucidate mechanisms that enable the qualification of obstetric and neonatal care.

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