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Psychologic intimate partner violence and the risk of intrauterine growth restriction in Rio de Janeiro

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Abstract

Objective: To evaluate whether psychologic intimate partner violence (IPV) during pregnancy is a risk factor for intrauterine growth restriction (IUGR).

Methods: The cross-sectional study enrolled randomly selected mothers of infants younger than 5 months attending basic health services in Rio de Janeiro, Brazil, from January to July 2007. Psychologic and physical IPV were evaluated by the Revised Conflict Tactics Scale; IUGR was defined as below the 10th percentile of the Alexander curve. Socioeconomic status, housing conditions, stressful events, life habits, social support, and medical information were obtained by interview or from medical records. Multivariate hierarchical logistic regression models, taking into account potential confounders, were used to evaluate the relationship between mounting acts of psychologic IPV and IUGR.

Results: There were 810 women included in the study. Psychologic IPV during pregnancy was reported by 665 women (82.1%) and 126 newborns (15.6%) showed growth restriction. In the final model, each 1-unit increase in psychologic IPV score during pregnancy led to a 15% higher risk of IUGR at birth (odds ratio 1.15; $P<0.001$).

Conclusion: Psychologic IPV during pregnancy seems to be a significant and independent risk factor for IUGR. This finding reinforces the importance of preventive and intervention procedures for IPV to reduce adverse perinatal outcomes.

KEYWORDS

Dating violence; Domestic violence; Fetal growth retardation; Intimate partner violence; Intrauterine growth retardation; IUGR; Spouse abuse

1 | INTRODUCTION

Intrauterine growth restriction (IUGR) is a major cause of perinatal adverse outcomes. Conceptually, IUGR is defined as fetal growth below what would be expected for that specific fetus. Despite some controversy, the 10th percentile is commonly adopted to discriminate IUGR.[1]

The etiology of IUGR is diverse and may be of maternal, fetal, or placental origin. Nutritional problems, licit and illicit drugs, and pre-existing conditions such as hypertension, hemoglobinopathies, and autoimmune diseases are some of the maternal causes. Fetal conditions include genetic and structural defects, congenital infections, and multiple gestation. Regarding the placenta, the pathway leading to IUGR commonly involves obstructive phenomena.[1,2]

However, the etiology of IUGR often remains unknown. This so-called "idiopathic IUGR" accounts for more than 40% of cases in some series,[2] depending on the characteristics of the study population, and the depth and breadth of the search for its cause. In this context, chronic trauma and stress, which are widely described as causes of IUGR among animals and humans,[3] are often neglected in clinical studies.

Intimate partner violence (IPV) is a chronic source of trauma and stress with deleterious consequences for mental, physical, and social health, including maternal and perinatal outcomes.[4] However, the data on the relation between IPV and IUGR remain inconclusive. The most recent meta-analyses[5,6] reported insignificant results and, in the discussion of these results, the authors reiterate that the data on this subject are scarce and poor quality. Primary research studies are heterogeneous, include small numbers of participants, and do not address all types of IPV, instead emphasizing physical IPV.[5,6]

The aim of the present study was therefore to assess whether psychologic IPV during pregnancy is a risk factor for IUGR, and to identify whether the probability of IUGR depends on an upward gradient in psychologic IPV.

2 | MATERIALS AND METHODS

The present cross-sectional study was carried out among randomly selected mothers with an infant younger than 5 months who were attending five public primary health care (PHC) units in Rio de Janeiro, Brazil, between January 1 and July 31, 2007. The Research Ethics Committee of the Rio de Janeiro Municipal Health Department approved the study. All participants provided informed consent; anonymity and confidentiality were assured.

The PHC units were located around Rio de Janeiro and covered the population living in nearby areas. All PHC units provided care in internal medicine, gynecology, obstetrics, minor surgical procedures, pediatrics, and vaccinations, and promoted health activities.

The participants were mothers waiting for pediatric appointments or vaccinations. Women were ineligible if they had experienced an intimate relationship with a partner for less than 1 month or had delivered twins, or if breastfeeding was contraindicated. All eligible women present at the time of randomization were invited to participate.

To determine the order in which potential participants were interviewed, a list was generated ahead of the consultation hours on each day shift. Women were selected for interview by a random draw, which was repeated until the last eligible woman in the waiting room had been interviewed. Face-to-face interviews (on average, 45–60 minutes) were performed in a private and secluded location with only the interviewee present.

The underlying theoretical model encompassed most of the variables associated with both IPV[7] and IUGR[8]; the latter was defined as a birth weight below the 10th percentile for gestational age.[9] The Revised Conflict Tactics Scale (CTS2) was used to measure IPV.[10,11] The psychologic aggression subscale comprises eight dichotomous items (the event never happened vs it happened at least once during pregnancy) relating to women as perpetrators and/or survivors in the preceding 12 months (Box 1). Summation of the items provides a psychologic IPV score ranging from 0 to 16. The physical IPV subscale comprises 12 dichotomous items, with scores ranging from 0 to 24 (Box 1).

The most distal hierarchical dimensions of the theoretical model contained socioeconomic, demographic, and reproductive characteristics. The following information was obtained from the participants: the Brazilian Criterion of Economic Classification (BCEC; providing information on the education of the household's main wage-earner, possession of selected appliances and durable assets, and employment of domestic help at home[12]); a household environmental score (providing information on household composition including building type and floor material, water supply, sanitation, waste disposal, and indoor electricity[13]); educational level; age; race; marital status; number of children living at home; and employment status.

Box 1 The Revised Conflict Tactics Scales.[a]

Psychological aggression	Physical assault
Insulted or swore at partner	Kicked, bit, or punched partner
Shouted at partner	Slapped partner
Stomped out of room	Beat up partner
Threatened to hit or throw something at partner	Hit partner with something
Destroyed something of partners	Choked partner
Did something to spite partner	Slammed partner against wall
Called partner fat or ugly	Grabbed partner
Accused partner of being a lousy love	Threw something at partner that could hurt
	Used knife or gun on partner
	Pushed or shoved partner
	Twisted partner's arm or hair
	Burned or scalded partner on purpose

[a] Synthesis of the subscales of psychologic aggression and physical assault (psychologic and physical intimate partner violence, respectively).

The intermediate hierarchical dimensions of the theoretical model contained stressful life events experienced during pregnancy. These were evaluated by questions concerning the death of a partner or close relative, the breakup of a relationship, loss of employment by the woman and/or her partner, forced change in residence, financial difficulties, and recent experience of robbery or theft. The overall score ranged from 0 to 7. In addition, three life habits were considered at the intermediate level: alcohol intake; use of illicit or psychotropic drugs by the woman or her partner; and maternal smoking. Alcohol use among the participants was assessed via TWEAK (tolerance, worried, eye-opener, amnesia, cut-down),[14] and that among their partners was assessed by proxy via CAGE (cut-down, annoyed, guilty, eye-opener).[15] A cut-off point of 2 or higher was used to define alcohol misuse in both instruments. The Non-Student Drugs Use Questionnaire[16] was employed to identify illicit drugs use by the participants and their partners (cut-off point, ≥1). Lastly, social support was evaluated by the Medical Outcomes Study Social Support Survey.[17]

The most proximal hierarchical dimensions of the theoretical model comprised selected characteristics related to prenatal care[18] and medical complications demanding hospital admission during

pregnancy. Information on these variables was obtained through the woman's own report or by consulting the medical records.

The questionnaires were codified and entered into Epi-Info 6.04 (CDC, Atlanta, GA, USA). For quality control, 15% of the questionnaires were double-entered. Data disagreed in 0.5% of entries, and most discrepancies involved identification variables. Data processing and analyses were carried out in Stata version 13 (StataCorp, College Station, TX, USA).

The theoretical model guided the statistical modeling process. To obtain the most appropriate categorization for the score of psychologic IPV and covariates in relation to outcome (IUGR), bivariate exploratory analyses using fractional polynomials were employed. Only alcohol misuse and drug use assumed previously described categorizations (defined above).

The first step of the modeling process was to identify those independent variables that best related to the outcome within each set of factors representing the distal, intermediate, and proximal dimensions of the theoretical model. Bivariate unconditional logistic regression models were used to identify associated factors with a *P* value of 0.20 or less. These factors were then used to represent their respective dimensions in multivariate logistic regression models for each dimension; again, variables with a *P* value of 0.20 or less were used to represent their respective dimensions in the main analysis.

The main analysis of the relationship between psychologic IPV and IUGR consisted of sequentially fitting increasingly complex models. In model I, the relationship between psychologic IPV and IUGR controlled for only physical IPV. Model II included significant variables representing socioeconomic, demographic, and reproductive characteristics, whereas model III further added significant variables representing stressful life events during pregnancy, life habits, and social support. Last, all dimensions (variables) were fitted in model IV, including significant variables related to prenatal care and medical complications during pregnancy. The model assumed that all factors except psychologic IPV are potential confounders. A *P* value of less than 0.05 was considered statistically significant.

3 | RESULTS

During the study period, 853 women were invited to participate in the study. Of these, 18 (2.1%) were not eligible, 24 (2.8%) refused to participate, and 1 (0.1%) was excluded owing to a lack of information on birth weight. Thus, the final analysis included 810 participants.

Psychologic IPV during pregnancy was reported by 665 women (82.1%; 95% confidence interval [CI] 79.3–84.7). Of these, 558 women (83.9%; 95% CI 80.9–86.6) reported two or more events. Regarding physical IPV, 307 women (37.9%; 95% CI 34.5–41.3) described at least one episode, and 126 newborns (15.6%; 95% CI 12.7–18.0) were classified as IUGR.

Table 1 presents the sociodemographic and reproductive profile for the study population by presence of IUGR. The study population consisted predominantly of adult women who had a steady partner, had low educational status, were not working during pregnancy, and had fewer than three children living at home. All variables relating to the distal dimension (race, maternal education, environment score, and BCEC) had a *P* value of less than 0.2 in the bivariate analysis, but only the first three remained significant for the final multivariate model.

Among the 810 study women, 447 (55.2%; 95% CI 51.7–58.6) reported at least one stressful life event during pregnancy, and 204 (25.2%; 95% CI 22.2–28.3) reported two or more. In the bivariate analysis, stressful life events were not associated with IUGR and thus were not included in the multivariate analyses. Misuse of alcohol was found for one-third and one-quarter of women and partners, respectively. Although maternal smoking and alcohol consumption were associated with IUGR ($P<0.2$) in bivariate analyses, only the former remained significant in the multivariate analyses. Social support was also significant in the bivariate analysis and included in the final multivariate model.

Overall, 94 women (11.6%; 95% CI 9.4–13.8) needed hospitalization during pregnancy; this factor was not associated with IUGR in the study sample. Quality of prenatal care was significantly associated with IUGR and included in the final model (Table 2).

Table 3 shows the multivariate analysis of the relationship between psychologic IPV and IUGR according to increasingly complex models (I to IV). The odds ratio for the relationship between psychologic IPV score and IUGR remained stable and significant regardless of the progressive inclusion of potential confounders. For each 1-unit rise in psychologic IPV, the risk of IUGR increased by approximately 15%.

Figure 1 shows the impact of accumulating acts of psychologic IPV during pregnancy on the probability of IUGR. Controlling for all covariates, the probability of IUGR was found to be approximately 10% when no acts of psychologic IPV occur during pregnancy, but reached nearly 30% when the psychologic IPV score is at a maximum.

4 | DISCUSSION

Psychologic IPV was found to be a significant risk factor for IUGR and, to the best of our knowledge, this is the first study to show a significant dose–response effect. According to the proposed theoretical–conceptual model and statistical analysis implemented, the results infer a direct (i.e. non-confounded and independent) relationship between psychologic IPV and IUGR. This might, however, be a conservative estimate. Mediation effects by some covariates—in particular, physical IPV, maternal smoking, and prenatal care—should not be ruled out, and the total effect is potentially higher than the direct effect observed in the present study.

From a sociobiological perspective, psychologic IPV works as a major stressor that might result in suboptimal conditions in the intrauterine environment, with subsequent detrimental effects on pregnancy and long-term adverse "programming" in the fetus.[19] These consequences are mostly initiated through activation of the maternal hypothalamic–pituitary–adrenal axis and the sympathetic branch of

TABLE 1 Sociodemographic and reproductive profile of the study population by intrauterine growth restriction.

	Overall		IUGR		
Characteristic	No. (%)	(95% CI)	%	(95% CI)	*P* value
Age, y[a]					0.950
<20	183 (22.6)	(19.7–25.5)	14.7	(9.6–19.9)	
20–35	554 (68.4)	(65.2–71.6)	15.9	(12.8–18.9)	
>35	73 (9.0)	(7.0–11.0)	15.1	(6.8–23.3)	
Race					0.10
White	228 (28.1)	(25.0–31.2)	12.3	(8–16.6)	
Brown	418 (51.6)	(48.2–55.0)	16.0	(12.5–19.5)	
Black	154 (19.0)	(16.3–21.7)	17.5	(11.5–23.6)	
Yellow/indigenous	10 (1.2)	(0.4–2.0)	40.0	(7.9–72.0)	
Education[a]					0.017
Incomplete high school	582 (71.9)	(68.7–74.9)	16.7	(13.6–19.7)	
High school or more	228 (28.1)	(25.0–31.2)	12.7	(8.4–17.1)	
Steady partner					0.786
No	109 (13.5)	(11.1–15.8)	14.7	(8.0–21.4)	
Yes	701 (86.5)	(84.2–88.9)	15.7	(13.0–18.4)	
Work during gestation					0.979
No	417 (51.5)	(48.0–54.9)	15.6	(12.1–19.1)	
Yes	393 (48.5)	(45.1–60.0)	15.5	(11.9–19.1)	
No. of live children					0.912
<3	614 (75.8)	(72.8–78.8)	15.6	(12.8–18.5)	
≤3	196 (24.2)	(21.2–27.1)	15.3	(10.2–20.4)	
BCEC score					0.025
A, B, or C	466 (57.5)	(54.1–60.9)	13.1	(10.0–16.2)	
D or E	344 (42.5)	(39.1–45.9)	18.9	(14.7–23.0)	
Environmental score[a]					0.001
Good conditions	741 (91.5)	(89.5–93.4)	14.7	(12.1–17.3)	
Poor conditions	69 (8.5)	(6.6–10.4)	24.6	(14.4–34.9)	

Abbreviations: BCEC, Brazilian Criteria of Economic Classification (categories A to E indicate progressively lower purchase powers); IUGR, intrauterine growth restriction.

[a]Variables were modeled in continuous (age and education) or ordinal (environmental score) form, but are shown as logical categories to better observe the profile of the study population, and to facilitate a calculation of conditional probabilities of IUGR by subgroup (*P* values were obtained by using continuous and ordinal variables, respectively).

the autonomic nervous system, leading to increased release of glucocorticoids and catecholamines, respectively.[3]

The effects of increased glucocorticoids and catecholamines in the placental bed are diverse. In fact, the placenta is a "hypothalamic–pituitary end organ" that controls several factors closely related to fetal growth. Most notably, the amount of maternal glucocorticoids that cross the placenta is mainly regulated through 11β-hydroxysteroid dehydrogenase (11βHSD) enzymes. 11βHSD type 2 limits the maternal cortisol that reaches the fetus by converting cortisol into inactive cortisone; however, its placental expression and function is diminished in distinct conditions, including chronic stress, which results in a greater amount of maternal glucocorticoids reaching the fetus. By contrast, the expression and function of 11βHSD type 1, which regenerates cortisol from cortisone, is decreased in fetuses that are small for gestational age, thereby preventing even larger amounts of cortisol entering into fetal circulation.[20,21] Regarding maternal catecholamines, elevated levels lead to increased peripheral vascular resistance and reduced uterine and fetal placental blood flow, which further compromises fetal homeostasis.[22]

Although a high concentration of circulating glucocorticoids in the fetus is expected if chronic maternal stress is present, negative feedback mechanisms can prevent sustained high fetal concentrations of glucocorticoids. In this context, some authors have suggested that high levels of fetal catecholamines are the main effectors of the relationship between maternal stress and restricted fetal growth.[22,23] Catecholamines are proposed as primary mediators that maintain glucose levels in the fetus, resulting in decreased insulin, increased

TABLE 2 Stressful life events, substance use, and level of perceived social support in the study population by intrauterine growth restriction.

	Overall		IUGR		
Factor	**No. (%)**	**(95% CI)**	**%**	**(95% CI)**	***P* value**
Stressful life events[a]					0.960
No	333 (41.1)	(37.7–44.5)	15.9	(12.0–19.8)	
Yes	477 (58.9)	(55.5–62.3)	15.3	(12.1–18.5)	
Smoking, cigs/d[b]					0.06
<10	757 (93.5)	(91.7–95.2)	14.9	(12.4–17.5)	
≥10	53 (6.5)	(4.8–8.2)	24.5	(12.8–36.2)	
Misuse of alcohol (woman)					0.17
No	538 (66.4)	(63.2–69.7)	14.3	(11.3–17.3)	
Yes	272 (33.6)	(30.3–36.9)	18.0	(13.4–22.6)	
Misuse of alcohol (partner)					0.660
No	623 (76.9)	(74.0–79.8)	15.2	(12.4–18.1)	
Yes	187 (23.1)	(20.2–25.6)	16.6	(11.2–21.9)	
Use of illicit drugs (woman)					0.58
No	753 (93.0)	(91.2–94.7)	15.5	(12.9–18.1)	
Yes	57 (7.0)	(5.3–8.8)	15.8	(6.2–25.3)	
Use of illicit drugs (partner)					0.5
No	686 (84.7)	(82.2–87.2)	16.0	(13.3–18.8)	
Yes	124 (15.3)	(12.8–17.8)	12.9	(7.0–18.9)	
Social support[c]					0.144
Low	75 (90.7)	(88.7–92.7)	18.7	(9.8–27.6)	
Medium/high	735 (9.3)	(7.3–11.3)	15.3	(12.6–17.8)	
Hospitalization					0.472
No	716 (88.4)	(86.2–90.6)	15.2	(12.6–17.9)	
Yes	94 (11.6)	(9.4–13.8)	18.1	(10.2–25.9)	
Adequacy of prenatal care					<0.001
No	426 (55.1)	(51.6–58.6)	9.5	(15.7–23.2)	
Yes	347 (44.9)	(41.4–48.4)	9.8	(6.7–12.9)	

Abbreviation: IUGR, intrauterine growth restriction.

[a]Modeled in ordinal form for its relationship to IUGR, but displayed dichotomously to better observe the profile of the study population and to facilitate calculation of conditional probabilities of IUGR by subgroup.

[b]Modeled in dichotomous form for its relationship to IUGR in bivariate and multivariate analyses.

[c]Modeled in ordinal form for its relationship to IUGR, but displayed dichotomously taking into account the 10th percentile (29; range, 0–76) to better observe the conditional probabilities of IUGR by subgroup.

glucagon, and altered fetal phenotype. These changes lead to a favoring of neural cells and tissues, with greater anaerobic metabolism in peripheral and skeletal tissues, and consequently restricted growth and increased lactate.[22,23]

The study has both strengths and limitations. Because information on IUGR was obtained from routine medical records about gestational age and birthweight, the findings should be re-evaluated using gold standard measures. However, the quality of the information on the exposure of interest (psychologic IPV) and covariates was higher because these factors were evaluated through standardized and widely validated measurement tools. The multivariate approach, which was based on a comprehensive theoretical model, might also strengthen the validity of the results.

Regarding the limitations, women at high risk of IPV and IUGR may have been omitted from the study population because they can be prone to social isolation and irregular prenatal visits, or may be more likely to attend emergency units or tertiary maternity wards when IPV and IUGR are more severe. Such selection bias would have attenuated the findings. Stronger associations between IPV and IUGR would have probably been identified if more women with both psychologic IPV during pregnancy and IUGR had participated in the study.

It might be argued that potential medical risk factors for IUGR should have been included as covariates. However, because IPV has been identified as a risk factor for maternal hypertension, preeclampsia, and gestational weight gain,[24,25] these variables were

TABLE 3 Multivariate analysis of the relationship between psychologic IPV during pregnancy and IUGR.[a]

Psychologic IPV	OR (95% CI)	*P* value
Model I	1.13 (1.06–1.20)	<0.001
Model II	1.13 (1.06–1.21)	<0.001
Model III	1.13 (1.06–1.21)	<0.001
Model IV	1.15 (1.07–1.23)	<0.001

Abbreviations: CI, confidence interval; IPV, intimate partner violence; IUGR, intrauterine growth restriction; OR, odds ratio for each 1-unit increase in psychologic IPV score.

[a]Model I: unadjusted estimate of relationship between psychologic IPV and IUGR (except for the physical IPV score; $P>0.05$). Model II: as model I, but adjusted for sociodemographic and reproductive variables (environmental score, education, race). Model III: as model II, but additionally adjusted for smoking during pregnancy and perceived social support. Model IV: as model III, but additionally adjusted for variables concerning adequacy of perinatal care.

assumed to be mediators in the relationship between psychologic IPV and IUGR and were not included in the analysis.

The present results reinforce the relevance of IPV in the perinatal period. Not only are the rates of psychologic and physical IPV during pregnancy and the postpartum period conspicuously high, but also the relevance of the former type as a risk factor for IUGR is notable. Although further studies should explore certain points, especially with regard to disentangling the complex relationships between different forms of IPV and other psychosocial variables in the development of adverse perinatal outcomes, the available evidence highlights the need for preventive, screening, and intervention procedures for IPV during pregnancy. These policies should be broad and multidisciplinary, and include information on women's rights and laws as means of empowerment. In addition, easy access to emotional, social, and economic support, as well as to treatment for existing injuries, should be guaranteed.

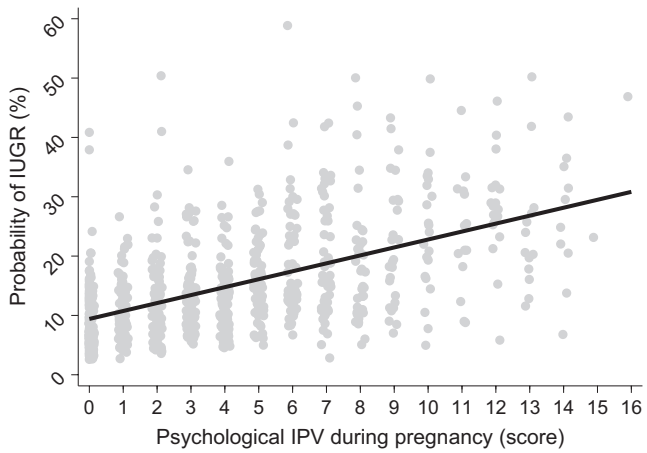

FIGURE 1 Relationship between psychologic IPV during pregnancy and the likelihood of IUGR. Abbreviations: IPV, intimate partner violence; IUGR, intrauterine growth restriction.

AUTHOR CONTRIBUTIONS

GL designed the study, wrote the protocol, coordinated data collection, undertook statistical analysis, and drafted the final manuscript. LSM assisted in study design and drafting the first manuscript. MER managed study funds, designed the study, wrote the protocol, supervised data collection, and revised the manuscript. CLM managed study funds, designed the study, wrote the protocol, supervised data collection, and revised the manuscript. FMPF assisted in study design and drafting the first manuscript. All authors read and approved the final manuscript.

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CONFLICTS OF INTEREST

The authors have no conflicts of interest.

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Supporting Information

Additional Supporting Information may be found online in the supporting information tab for this article.

File S1. Portuguese translation of abstract.