

OBSTETRICS

Effects of lactation on postpartum blood pressure among women with gestational hypertension and preeclampsia



Malamo E. Countouris, MD; Eleanor B. Schwarz, MD, MS; Brianna C. Rossiter, MD; Andrew D. Althouse, PhD; Kathryn L. Berlacher, MD, MS; Arun Jeyabalan, MD, MS; Janet M. Catov, PhD

BACKGROUND: Women with a history of hypertensive disorders of pregnancy are at an increased risk of hypertension and cardiovascular disease in later life. Lactation has been associated with a reduced risk of maternal hypertension, both in the postpartum period and later life. However, little is known about whether lactation is also cardioprotective in women with hypertensive disorders of pregnancy such as preeclampsia or gestational hypertension.

OBJECTIVE: This study aimed to characterize the relationship between lactation and postpartum blood pressure among women with preeclampsia and gestational hypertension.

STUDY DESIGN: Data were obtained from women who participated in the Prenatal Exposures and Preeclampsia Prevention study ($n = 379$; 66% African American; 85% overweight or obese). Women enrolled during pregnancy and attended a postpartum visit (on average, 9.1 months after delivery) during which data on lactation duration and blood pressure were collected. The significance of the associations between postpartum blood pressure and lactation among women who remained normotensive during pregnancy, developed gestational hypertension, or developed preeclampsia were assessed with an analysis of variance. Linear regression models were used to adjust for maternal age, race, education, prepregnancy weight, and time since delivery.

RESULTS: Gestational hypertension affected 42 subjects (11%) and preeclampsia affected 33 (9%). Lactation was reported by 217 (57%) with 78 (21%) reporting ≥ 6 months of lactation. Women who lactated were somewhat older, more educated, and had higher socioeconomic status. Among women who had gestational hypertension, lactation was associated with lower systolic blood pressure ($P = .02$) and diastolic blood pressure ($P = .02$). This association persisted after adjustment for age, race, education, prepregnancy weight, and time since delivery. However, for women who had preeclampsia and women who remained normotensive during pregnancy, lactation was not associated with postpartum blood pressure in either bivariate or multivariate analyses.

CONCLUSION: This study found that lactation is associated with lower postpartum blood pressure among overweight women who develop gestational hypertension but not among women who develop preeclampsia. Future studies are needed to explore the association of lactation and blood pressure in later life for women with hypertensive disorders of pregnancy.

Key words: gestational hypertension, hypertension, lactation, postpartum blood pressure, preeclampsia

Hypertensive disorders of pregnancy are increasingly common in the United States,¹⁻⁶ and women who develop preeclampsia or gestational hypertension are at increased risk of hypertension and cardiovascular disease in later life.⁷⁻⁹ In particular, women with a history of preeclampsia have approximately double the risk of cardiovascular events in the 5–15 years after pregnancy compared with women who are normotensive during pregnancy.⁷ Similarly, women with a history of gestational hypertension are at increased risk for hypertension, ischemic heart disease, and stroke in later life.¹⁰

The American Heart Association guidelines for prevention of cardiovascular disease (CVD) in women suggest that women with hypertensive disorders of pregnancy should receive ongoing postdelivery and life-long care from a primary care physician or cardiologist to monitor and control risk factors for CVD such as hypertension, diabetes, and hyperlipidemia.¹¹

Women with a history of preeclampsia may also benefit from lifestyle interventions such as exercise, changes in dietary habits, and smoking cessation.¹² Less attention has been given to the role breast-feeding may play in improving women's cardiovascular health.

Increased lifetime duration of lactation has been associated with reduced CVD risk in women and lower rates of hypercholesterolemia, diabetes, and the metabolic syndrome.¹³⁻¹⁵ Lactation affects multiple hormones, which has an

impact on blood pressure, including oxytocin,¹⁶ prolactin,¹⁷ cortisol,¹⁸ estrogen, and progesterone. Among normal-weight women, lactation has been associated with lower blood pressure at 1 month postpartum.^{19,20}

There have now been at least 9 studies^{14,19-26} examining the association between lactation and maternal blood pressure after menopause, which have consistently shown that mothers who do not breast-feed are more likely to develop hypertension. However, whether lactation may differentially affect women with preeclampsia or gestational hypertension is not well understood.

We therefore characterized the relationship between lactation and postpartum blood pressure among women who did or did not develop preeclampsia or gestational hypertension. We hypothesized that participants who did not lactate would have higher postpartum

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blood pressure than mothers who lactated, whether or not they had developed gestational hypertension or preeclampsia, after adjustment for relevant confounders.

Materials and Methods

Participants

The study population was derived from the Prenatal Exposures and Preeclampsia Prevention 3 study, a prospective study of the impact of obesity on preeclampsia risk in women who received antepartum, delivery, and postpartum care at Magee-Womens Hospital of the University of Pittsburgh Medical Center.²⁷

Eligibility criteria included age 18–40 years, singleton pregnancy, and gestational age of 6–16 weeks at enrollment. Overweight and obese women (body mass index [BMI], $> 25 \text{ kg/m}^2$) were preferentially recruited to comprise 85% of the study population to examine mechanisms linking obesity to preeclampsia and gestational hypertension; a small group of lean women were enrolled for comparison. Women with a BMI < 18 , having preexisting hypertension, diabetes, or seizure disorders, having liver, heart, or kidney disease, having a collagen vascular disorder, having drug or alcohol abuse, having a major fetal anomaly, or having a fetal demise were excluded.

As part of the study protocol, women were asked to attend a postpartum visit at least 3 months after delivery. Of the initial cohort ($n = 651$), 437 women completed a postpartum visit 3–24 months after delivery. There were 55 women who became pregnant in the follow-up period and thus were ineligible for a postpartum visit and excluded from our analyses.

For this study, we excluded women who had a postpartum visit < 6 months after delivery because these women would not have had data regarding whether they lactated for up to 6 months and those who had a postpartum greater than 24 months after delivery. Additionally, 3 participants attended a postpartum visit but did not have recorded blood pressure data and were thus excluded.

Our final analyses included 379 women (mean postpartum visit at 9.1 months, median at 7.0 months, SD, 4.3 months). All women provided written informed consent and this study received exempt approval by the University of Pittsburgh's Institutional Review Board (approval number PRO14080003).

At enrollment, participants completed a questionnaire that included demographic information (age, race, parity, marital status, education, income, occupation, smoking history, and plans for breast-feeding) as well as self-reported prepregnancy height and weight. The correlation between the first study weight measure and the self-reported prepregnancy weight was high (> 0.97).

Prepregnancy BMI (kilograms per square meter) was calculated with self-reported weight and height and categorized based on the World Health Organization guidelines as normal weight (BMI, 18.5–24.9 kg/m^2), overweight (BMI, 25–29.9 kg/m^2), obese class I (BMI, 30–34.9 kg/m^2), class II (BMI, 35–39.9 kg/m^2), and class III (BMI, $\geq 40 \text{ kg/m}^2$).

Trained research personnel measured participant weight and blood pressure by standardized methods (measured twice after participants had been sitting for 5 minutes at rest and a third time if the first 2 measurements varied by more than 10 mm Hg).

Delivery data including gestational age at delivery, delivery type, and pregnancy complications were abstracted from delivery medical records. Gestational hypertension (2 or more blood pressure (BP) measurements $> 140/90$ mm Hg) and preeclampsia (gestational hypertension plus proteinuria) were defined based on American College of Obstetricians and Gynecologists guidelines in 2002²⁸ and adjudicated by the Prenatal Exposures and Preeclampsia Prevention 3 research team based on chart reviews using strict research criteria. Five women who attended a postpartum visit had a history of chronic hypertension; however, none of these women developed superimposed preeclampsia.

At the postpartum visit, weight and blood pressure data were again gathered by trained research personnel. A variable to assess weight change postpartum compared with prepartum, depending on follow-up time, was defined as (postpartum weight [pounds] – prepartum weight [pounds])/follow-up month postpartum.

Lactation history

At the postpartum visit, participants completed a questionnaire that assessed their breast-feeding practices. To assess duration of breast-feeding, participants were initially asked, “Did you ever breast-feed or pump breast milk to feed your new baby after delivery, even for a short period of time?” Those who answered no were placed in the never breast-fed category. Those who answered yes were subsequently categorized by duration, depending on their answers to 2 additional questions: “Are you currently breast-feeding or feeding pumped milk to your new baby?” and “How many weeks or months did you breast-feed or pump milk to feed your baby?” Based on these questions, participants were categorized into 4 groups: never lactated, lactated < 3 months, lactated 3–6 months, and lactated > 6 months.

Statistical analysis

Maternal characteristics (mean $\pm$ SD or n [%]) were compared according to lactation history using an analysis of variance for continuous variables and χ^2 tests for categorical variables. We then tested the relationship between lactation and postpartum BP for participants with the following (1) normotensive pregnancies, (2) preeclamptic pregnancies, or (3) gestational hypertensive pregnancies.

We used an analysis of variance to compare differences in both postpartum systolic blood pressure (SBP) and diastolic blood pressure (DBP) between each of the 4 lactation groups. Linear regression was used to adjust for potential confounding and mediating variables including maternal education (the socioeconomic status indicator that has been most strongly related to pregnancy

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