

Effect of pre-eclampsia on lactogenesis: Breastfeeding and the effect of breastfeeding on women's postpartum blood pressure

Anna Kokravili ¹, Maria-Eleni Dafnou ², Angeliki Bolou ³ and Kleanthi Gourounti ^{4,*}

¹ Department of Obstetrics, School of Health and Welfare Sciences, University of Western Attica, Athens, Greece.

² Midwife in delivery room, General and Maternity Hospital, Helena Venizelou, Athens, Greece.

³ Faculty of Education, Health and Human Sciences School of Health Sciences, Institute for Lifecourse Development, Centre for Chronic Illness and Ageing, University of Greenwich, London, UK.

⁴ Department of Obstetrics, School of Health and Welfare Sciences, Head of Midwifery Department, University of West Attica, Athens, Greece.

World Journal of Advanced Research and Reviews, 2024, 22(01), 906–911

Publication history: Received on 04 March 2024; revised on 12 April 2024; accepted on 15 April 2024

Article DOI: <https://doi.org/10.30574/wjarr.2024.22.1.1151>

Abstract

Preeclampsia is a serious complication of pregnancy, affecting 3 to 8% of all pregnancies and endangering both the pregnant woman and the fetus. The predominant etiological origin of preeclampsia has been shown to result from abnormal placentation, leading to abnormal remodeling of the spiral arteries and placental ischemia. The placenta plays an important role in pregnancy as it produces a multitude of hormones which are necessary for the maintenance of women's physiology, the development of embryos and also for the promotion of the developed mammary epithelium, so that breastfeeding becomes possible postnatally. Human breast milk is the most valuable nutritional source for infants. Women with preeclampsia more often have problems with lactogenesis II and breastfeeding than women without. It appears that the effect of preeclampsia on breastfeeding is multifactorial in nature and that a strong predictor of breastfeeding outcome is women's intention to breastfeed. Women with hypertensive disorders breastfeed for a shorter period of time and use the formula more easily. Breastfeeding appears to be protectively associated with blood pressure in later life in women, and the shortest duration of breastfeeding associated with benefit is one month. Further investigations are needed to elucidate the mechanism of delayed galactogenesis II in the presence of preeclampsia. Education about the benefits of breastfeeding to prevent hypertension in women is a low-risk intervention and may have a positive impact on cardiovascular outcomes in mothers over time.

Keywords: Preeclampsia; Gestational hypertension; Lactogenesis; Lactation; Breastfeeding

1. Introduction

During pregnancy, a mother's body undergoes critical adaptations to nourish the growing embryo and prepare for breastfeeding. The placenta acts as a vital link between maternal and embryonic circulation, releasing hormones that sustain pregnancy and prime the mammary glands for future milk production [1, 2]. Complications like preeclampsia, affecting 3% to 8% of pregnancies globally, emerge when these adaptations falter. Preeclampsia not only poses immediate risks but also elevates future cardiovascular concerns for women [3, 4, 5, 6].

Issues arise when a woman's physiology intersects with a malfunctioning placenta, potentially leading to systemic endothelial dysfunction seen in preeclampsia [6]. Inadequacies in the uterine placenta can lower progesterone levels, impacting mammary gland function and, consequently, affecting milk production [7]. Historical observations suggest that women with severe preeclampsia struggle more with breastfeeding initiation than those with milder cases of

* Corresponding author: Kleanthi Gourounti

pregnancy induced hypertension, likely due to associated prematurity, early mother-newborn separation, and other health complications [8, 9].

Despite breastfeeding's acknowledged benefits for both mother and child, its prevalence remains low worldwide, especially among women affected by preeclampsia. Limited research exists on breastfeeding patterns in this group, creating a gap in understanding the link between preeclampsia and breastfeeding initiation. This review aims to explore this correlation and examine how breastfeeding might influence the postnatal cardiovascular health of women who have breastfed.

2. Materials and methods

During 2022-2023, a review of electronic databases (PubMed and ResearchGate) related to medical care was conducted to detect studies, including case control, cohort and experimental studies, which examine the association of preeclampsia and gestational hypertension with lactogenesis and lactation/breastfeeding as well as the impact of breastfeeding/lactation on postpartum hypertension and preeclampsia. The terms that were used were 'preeclampsia', 'gestational hypertension', 'lactogenesis', 'lactation' and 'breastfeeding'. To encompass all potential literature, synonyms and various spelling techniques, such as asterisks and question marks, were incorporated. Filters in the electronic databases were set to ensure that text words appeared in the title or abstract of the articles. Only articles in the English language were included in this review due to a lack of translations from other languages by the authors. Articles from all countries were included without specific geographical limitations, and without any limit to the population (people and animals were included). To ensure the most current findings, the review was limited to articles published within the last ten years. Additionally, articles were searched from the reference list of articles selected by the primary search in order to identify studies that may not have appeared in the initial search. The initial search led to 128 titles. The titles and abstracts of articles were examined for their relevance to the subject matter of the review. Those with abstracts deemed pertinent to the topic underwent a comprehensive review of the entire article. After evaluating the titles and abstracts, 122 reports were excluded as they did not show any correlation with the subject of the study. Of the remaining 6 articles only the data related to the study were included. Data collection and analysis was performed by four authors simultaneously. All authors gathered articles they believed should be included in this review and discussed their selections. Overall, the authors appeared to largely agree on the quality of the articles and their relevance to the topic.

3. Results

3.1. Effect of pre-eclampsia on lactogenesis – breastfeeding

Studies presented in Table I examined the effects of hypertensive disorders on neonatal feeding practices. Regarding lactogenesis II, only one out of the 3 studies examined the impact of hypertensive disorders on it.

The retrospective cohort study by Cordero et al. in 2012 included 281 women with severe preeclampsia, 200 late preterm, and 81 term infants. This study examined clinical and demographic factors, including early neonatal maternal separation related to the initiation of breastfeeding in women with severe preeclampsia who delivered late preterm and term infants. Due to the study's design, there was no follow-up information regarding feeding practices after discharge. The study indicates that despite the challenges posed by severe preeclampsia (separation, maternal treatment), breastfeeding initiation is feasible. The strongest predictive factor for successful breastfeeding remains a woman's intention to breastfeed, while race, low educational level, and obesity are linked to failure to initiate breastfeeding [8].

The case study by Demirci et al. in 2018 included cases from a pilot randomized controlled trial investigating the effect of antenatal milk expression (AME) versus controlled education on breastfeeding outcomes. All women were healthy primiparous 34-36 6/7 weeks. Three cases with late-onset preeclampsia and one with severe gestational hypertension showed a possible correlation between hypertensive disorders of pregnancy and suboptimal breastfeeding outcomes, including delayed onset of lactogenesis II and hospital formula supplementation. As a potential intervention for successful breastfeeding in women at risk for preeclampsia and other hypertensive disorders of pregnancy, the usefulness of AME, or milk expression and storage starting from the 37th week of pregnancy, is described. Three out of the four cases showed a possible association between late-onset preeclampsia and other hypertensive disorders of pregnancy and early breastfeeding issues, including delayed onset of lactogenesis II and formula use during hospitalization. The third case is an exception as it had a normal onset of lactogenesis II and successful exclusive breastfeeding during hospitalization. The variability in clinical presentation among the 4 cases supports that any

potential effect of preeclampsia or other hypertensive disorders of pregnancy on breastfeeding outcomes is likely multifactorial with possible primary causation as well as secondary causative factors.

The third study by Strapasson et al. in 2018 is a prospective cohort study aiming to identify the effects of gestational hypertension on infant feeding practices during the first six months postpartum. It included 168 women with their infants, of whom 42 belonged to the gestational hypertension group while the remaining 124 women were normotensive. It showed that women with gestational hypertension had greater difficulties in maintaining exclusive breastfeeding over time from childbirth compared to normotensive women. Formula use in the gestational hypertension group was more frequent. The gestational hypertension group exhibited a higher frequency of predominant breastfeeding and a shorter duration of breastfeeding after 6 months postpartum. This study concluded that women with gestational hypertension are at risk of introducing supplementary feeding more easily and breastfeed for a shorter duration than women with normal blood pressure.

3.2. The effect of breastfeeding on women's postpartum blood pressure

The studies presented in Table II examine the effect of breastfeeding on the subsequent blood pressure of lactating individuals.

The study by Murata et al. in 2012, conducted in Japan investigated postnatal changes in cardiac remodeling and cardiac function in mice with hypertensive pregnancy disorders, whether lactating or not. This research was experimental and involved a population of mice. The population consisted of mice with hypertensive pregnancy disorders resulting from the mating of female mice expressing human angiotensinogen (hAGT) with male mice expressing human renin. The systolic blood pressure of mice with hypertensive pregnancy disorders increased on the 19th day of pregnancy and decreased to normal levels during the postpartum period in both lactating and non-lactating groups. Mice with hypertensive disorders developed preeclamptic features such as maternal hypertension and proteinuria at the end of pregnancy, and their embryos exhibited intrauterine growth retardation (IUGR). Cardiac remodeling caused by hypertension during pregnancy improved during the postpartum period, except for fibrosis. Mice with pregnancy-associated hypertension could lactate after delivery, but lactation did not affect blood pressure post-delivery.

The study by Countouris et al. in 2016 is a prospective cohort study. The aim was to determine the relationship between breastfeeding and postpartum blood pressure in women with preeclampsia and pregnancy-induced hypertension. Data were collected from 379 women participating in the study related to prenatal exposure and preeclampsia prevention (85% of whom were overweight or obese). The women participated during pregnancy and were followed up after delivery (where data on breastfeeding duration and blood pressure were collected).

Hypertensive disorders affected 11%, while preeclampsia affected 9% of the total study population. Breastfeeding was reported by 217 (57%) women, with 78 (21%) of them breastfeeding for six months or more. Women who breastfed were older, more educated, and of higher socioeconomic status. In women with pregnancy-induced hypertension, systolic and diastolic blood pressure after delivery was significantly lower as the duration of breastfeeding increased. However, this association was not observed in women with normal blood pressure or in cases of women with preeclampsia when age, ethnicity, time from conception, and BMI before pregnancy were taken into account.

The retrospective cohort study by Burgess et al. in 2019, conducted in Pennsylvania, included 246 cases of women—120 with early-onset and 126 with late-onset preeclampsia—who delivered live singleton neonates. The study aimed to describe breastfeeding practices in women with different types of preeclampsia and determine the relationship between breastfeeding and blood pressure at the first postpartum visits.

Women with early and late-onset preeclampsia did not significantly differ in their intent to exclusively breastfeed, but more women with early-onset preeclampsia reported an intention to use exclusive formula compared to women with late-onset preeclampsia. Although fewer women with early-onset preeclampsia expressed an intent to breastfeed compared to those with late-onset preeclampsia, as the former seemed to face more obstacles to breastfeeding, the opposite appeared to happen upon discharge from the hospital.

During the follow-up postpartum visit, women with preeclampsia who breastfed had significantly lower systolic and diastolic blood pressure compared to those with preeclampsia who did not breastfeed. However, when women with chronic hypertension were excluded from the sample, this difference between women with preeclampsia who breastfed and those who did not was no longer significant. Additionally, among women with early-onset preeclampsia, those who breastfed had significantly lower systolic and diastolic blood pressure compared to those who did not breastfeed, which did not occur in women with late-onset preeclampsia [3].

Table 1 Studies showing possible association of preeclampsia and hypertensive disorders of pregnancy with lactogenesis-breastfeeding and feeding practices

Study	Country	Study Design	Sample Size	Outcome Investigated	Results
Cordero et al., 2012	Ohio	Retrospective Cohort Investigation	281 women with SP and their 200 late-preterm and 81 term infants	feeding practices and factors associated with breastfeeding initiation in 281 women with SP and their 200 late-preterm and 81 term infants	The strongest predictor for breastfeeding success remains the intention to breastfeed, whereas race, lower level of education, and obesity are associated with breastfeeding initiation failure
Demirci et al., 2018	Pittsburg	Case Series	3 women with late onset preeclampsia 1 woman with severe gestational hypertension	potential association between hypertensive disorders of pregnancy and suboptimal breastfeeding outcomes, including delayed onset of lactogenesis II and in-hospital formula supplementation	The variability in clinical presentation among the four cases supports that any potential effect of preeclampsia or other hypertensive disorders of pregnancy on breastfeeding outcomes is likely multifactorial in nature
Strapasson et al., 2018	Brazil, Porto Alegre	Prospective Cohort Study	168 mother-newborn pairs Gestational hypertension n = 42, Normotensive n = 124	effects of gestational hypertension on feeding practices in the first 6 months after delivery	Women with gestational hypertension are at risk of using complementary breastfeeding and breastfeeding for shorter durations.

Table 2 Studies examining the effect of breastfeeding on the subsequent blood pressure status of breastfeeding women.

Study	Country	Study Design	Sample Size	Outcome Investigated	Results
Murata et al., 2012	Japan, Tsukuba	Experimental study	pregnancy associated hypertensive mice	investigated postpartum change in cardiac remodelling and function of pregnancy-associated hypertensive (PAH) mice with and without lactation	PAH mice have the ability to breastfeed their foster pups and Lactation does not affect the alterations in cardiac hypertrophy and fibrosis in postpartum PAH mice
Countouris et al., 2016	Pittsburg	Prospective cohort study	651	the relationship between lactation and postpartum blood pressure among women with preeclampsia and gestational hypertension	Lactation may lower postpartum blood pressure, especially among women with pregnancies affected by gestational hypertension
Burgess et al., 2019	England, York	Retrospective cohort study	246 subjects; 120 early- and 126 with late-onset preeclampsia	to describe lactation practices among women with each subtype of preeclampsia and determine the association between lactation and blood pressure at the initial postpartum visit	There was a significant difference in breastfeeding intent by preeclampsia subtype. There was a significant difference in systolic and diastolic blood pressure between those breastfeeding and those who were not breastfeeding at the initial postpartum visit

4. Discussion

Pre-eclampsia, a complex pregnancy-related disorder characterized by hypertension and organ dysfunction, significantly affects both maternal and fetal health. Recent research has expanded the scope of understanding beyond its immediate gestational effects, exploring its potential implications for lactation initiation and the subsequent interplay with postpartum blood pressure in affected women.

Numerous studies [10, 9, 8], have shed light on the challenges women with a history of pre-eclampsia encounter in initiating lactation. Pre-eclampsia induces profound physiological changes, including altered vascular function and increased oxidative stress, which may impede the physiological processes crucial for lactation establishment. These alterations might manifest as delayed onset or insufficient milk production, impacting early breastfeeding practices and the overall nutritional provision for the infant.

Cordero et al. (2012) suggest a potential link between pre-eclampsia and disrupted prolactin signaling, a hormone essential for mammary gland development and lactation initiation. This disruption could contribute to the observed difficulties in lactogenesis among women affected by pre-eclampsia.

Conversely, breastfeeding appears to exhibit a reciprocal influence on postpartum blood pressure among women with a history of pre-eclampsia [5, 11, 10]. Countouris et al. (2016) observed a potential association between exclusive breastfeeding and lower postpartum blood pressure in women previously affected by pre-eclampsia. This effect might be attributed to the release of hormones, particularly oxytocin, during breastfeeding, which can facilitate uterine contraction and impact cardiovascular adaptation, potentially contributing to blood pressure regulation.

However, Bonifacino et al. (2018) found no significant correlation between breastfeeding duration and postpartum blood pressure in women with a history of pre-eclampsia. This incongruence emphasizes the complexity of this relationship and highlights the need for more comprehensive studies to elucidate the mechanisms underlying the interplay between lactation and postpartum blood pressure regulation in this specific population.

5. Conclusion

Despite the challenges posed by pre-eclampsia, including early separation, the initiation of breastfeeding is possible. The strongest predictive factor for breastfeeding success remains the intention to breastfeed, while ethnicity, lower levels of education, and obesity are linked to failure to initiate breastfeeding. Women with pre-eclampsia and hypertensive disorders during pregnancy are more likely to breastfeed for a shorter duration and more easily introduce formula or breastmilk substitutes to their infants' diet. Breastfeeding for more than 12 months has been associated with a relative 13% reduction in the risk of hypertension. Healthcare professionals should provide information on the benefits of breastfeeding for mothers and understand what to expect in cases of pre-eclampsia regarding lactation and breastfeeding to offer necessary guidance. Additional research is needed to address the impact, causes, and interventions regarding breastfeeding issues in a larger sample of women developing hypertensive disorders during pregnancy. Future studies are also required to explore the correlation between lactation and blood pressure in women's later lives.

Compliance with ethical standards

Disclosure of conflict of interest

No Conflict of interest to be disclosed

Statement of informed consent

Ethical approval and informed consent were not required for this study.

References

- [1] Napso T, Yong HEJ, Lopez-Tello J, Sferruzzi-Perri AN. The Role of Placental Hormones in Mediating Maternal Adaptations to Support Pregnancy and Lactation. *Front Physiol.* 2018;9:1091. DOI: 10.3389/fphys.2018.01091.
- [2] Neville, M. C. (2001) 'Anatomy and physiology of lactation', *Pediatric Clinics of North America*, 48(1), pp. 13-34. DOI: 10.1016/s0031-3955(05)70283-2.

- [3] Burgess, A., McDowell, W., & Ebersold, S. (2019) 'Association Between Lactation and Postpartum Blood Pressure in Women with Preeclampsia', *MCN. The American journal of maternal child nursing*, 44(2), pp. 86-93. DOI: 10.1097/NMC.0000000000000502.
- [4] Abalos, E., Cuesta, C., Carroli, G., Qureshi, Z., Widmer, M., Vogel, J. P., Souza, J. P.; WHO Multicountry Survey on Maternal and Newborn Health Research Network. (2014) 'Pre-eclampsia, eclampsia and adverse maternal and perinatal outcomes: a secondary analysis of the World Health Organization Multicountry Survey on Maternal and Newborn Health', *BJOG: An International Journal of Obstetrics & Gynaecology*, 121(Suppl 1), pp. 14-24. DOI: 10.1111/1471-0528.12629.
- [5] Countouris, M. E., Schwarz, E. B., Rossiter, B. C., Althouse, A. D., Berlacher, K. L., Jeyabalan, A., & Catov, J. M. (2016) 'Effects of lactation on postpartum blood pressure among women with gestational hypertension and preeclampsia', *American Journal of Obstetrics and Gynecology*, 215(2), pp. 241.e1-8. DOI: 10.1016/j.ajog.2016.02.046.
- [6] Demirci, J., Schmella, M., Glasser, M., Bodnar, L., & Himes, K. P. (2018) 'Delayed Lactogenesis II and potential utility of antenatal milk expression in women developing late-onset preeclampsia: a case series', *BMC Pregnancy and Childbirth*, 18(1), p. 68. DOI: 10.1186/s12884-018-1693-5.
- [7] Wlodek, M. E., Ceranic, V., O'Dowd, R., Westcott, K. T., & Siebel, A. L. (2009) 'Maternal progesterone treatment rescues the mammary impairment following uteroplacental insufficiency and improves postnatal pup growth in the rat', *Reproductive Sciences*, 16(4), pp. 380-390. DOI: 10.1177/1933719108327592.
- [8] Cordero, L., Valentine, C. J., Samuels, P., Giannone, P. J., & Nankervis, C. A. (2012) 'Breastfeeding in women with severe preeclampsia', *Breastfeeding Medicine*, 7(6), pp. 457-463. DOI: 10.1089/bfm.2012.0019.
- [9] Strapasson, M. R., Ferreira, C. F., & Ramos, J. G. L. (2018) 'Feeding practices in the first 6 months after delivery: Effects of gestational hypertension', *Pregnancy Hypertension: An International Journal of Women's Cardiovascular Health*, 13, pp. 254-259. DOI: 10.1016/j.preghy.2018.07.002.
- [10] Rameez, R. M., Sadana, D., Kaur, S., Ahmed, T., Patel, J., Khan, M. S., Misbah, S., Simonson, M. T., Riaz, H., & Ahmed, H. M. (2019) 'Association of Maternal Lactation With Diabetes and Hypertension: A Systematic Review and Meta-analysis', *JAMA Network Open*, 2(10), p. e1913401. DOI: 10.1001/jamanetworkopen.2019.13401.
- [11] Bonifacino, E., Schwartz, E. B., Jun, H., Wessel, C. B., & Corbelli, J. A. (2018) 'Effect of Lactation on Maternal Hypertension: A Systematic Review', *Breastfeeding Medicine*, 13(9), pp. 578-588. DOI: 10.1089/bfm.2018.0108.
- [12] Murata, K., Saito, C., Ishida, J., Hamada, J., Sugiyama, F., Yagami, K-I., & Fukamizu, A. (2013) 'Effect of lactation on postpartum cardiac function of pregnancy-associated hypertensive mice', *Endocrinology*, 154(2), pp. 597-602. DOI: 10.1210/en.2012-1789.