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The Effect of Magnesium Sulfate in the Treatment of Maternal Postpartum Hypertension on Breastfeeding: An Integrative Review

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Abstract

Background: Magnesium sulfate is widely prescribed postpartum for seizure prophylaxis in women with preeclampsia and other hypertensive disorders of pregnancy, yet its potential effects on lactation outcomes remain underexplored.
Objectives: To evaluate and synthesize the current evidence on how postpartum magnesium sulfate therapy affects lactation outcomes, including breastfeeding initiation, exclusivity, duration, pumping habits, and secretory activation (SA).
Methods: This integrative review followed PRISMA guidelines and Whittemore and Knafl's framework. Literature was obtained from five databases without date restrictions. A total of 11 studies met the inclusion criteria. Methodological quality was evaluated using the Joanna Briggs Institute tools and Melnyk and Fineout-Overholt's hierarchy of evidence.
Results: Data were synthesized from 11 studies published between 1993 and 2023, encompassing 2,842 participants across diverse hospital settings. Findings indicate that extended postpartum magnesium sulfate administration is associated with delayed breastfeeding initiation, delayed maternal perception of SA, and greater reliance on milk expression. Most researchers did not report maternal side effects or quantitatively measure the frequency of breastfeeding or pumping. Studies reported hospital policies that restricted rooming-in and breastfeeding during magnesium infusion.
Conclusions: Postpartum magnesium sulfate administration is associated with delays in lactation initiation, missing the evidence-based critical window for frequent early milk removal. However, studies in this review rarely examine maternal side effects or feeding frequency in detail. Future research should use standardized definitions, document both frequency and mode of milk removal, evaluate objective measures of SA, evaluate maternal experience, and hospital policies.

Keywords: magnesium sulfate, breastfeeding, hypertensive disorders, preeclampsia, lactation

Introduction

Hypertensive disorders of pregnancy (HDP) account for a rising share of maternal and perinatal morbidity and mortality worldwide, with a global prevalence of 3.51 million cases contributing substantially to preventable maternal and neonatal deaths.[1–3] HDP is an umbrella term covering a range of conditions characterized by high blood pressure during pregnancy, including gestational hypertension, chronic hypertension with superimposed preeclampsia, preeclampsia, and eclampsia.[3,4] In the United States, HDP now complicates more than 15% of pregnancies, with nearly one-third of maternal deaths during delivery hospitalization linked to these disorders.[1] Beyond the peripartum period, women have an associated two- to four-fold higher lifetime risk of cardiovascular disease.[1,5–7]

The management of severe cases of HDP (e.g., severe preeclampsia) has been transformed by intravenous magnesium sulfate, the most effective therapy demonstrated to prevent and control eclamptic seizures.[8–11] Yet, this life-saving intervention inevitably has side effects that tend to worsen with higher doses and more prolonged exposure.[12–14] Flushing, nausea, and vomiting are among the most common reactions, affecting about one-quarter of patients at a 1 gram/hour continuous infusion

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rate and rising to over 70% at a 2 gram/hour rate.[12,13] The extended treatment duration further exacerbates these effects, with increased fatigue that directly impairs breastfeeding.[14]

Magnesium sulfate therapy overlaps with the critical period of lactation initiation, which hinges on timely and frequent breast stimulation in the first hours after birth.[15] Early milk removal (whether via direct breastfeeding or pumping) is not merely beneficial, but biologically essential, catalyzing the cascade of secretory activation (SA; MOM sodium [Na] concentration ≤ 16 mM) that underpins sustained effective lactation.[15–17] Delayed or infrequent attempts in these pivotal hours are strongly associated with delayed SA and lower rates of breastfeeding duration and exclusivity.[18,19] The failure to establish effective breastfeeding in this vulnerable population removes critical protective benefits when they are needed most. Breastfeeding can reduce the risk of preeclampsia in future pregnancies and provides protective cardiovascular benefits that may help lessen some long-term consequences of HDP, in addition to the well-known advantages for infant health.[20–23] For women with HDP, this risk is acute: both the physiological sequelae of preeclampsia and the logistics of postpartum magnesium therapy may compound barriers to optimal lactation outcomes.

Prior research has shown that women with preeclampsia exhibit lower breastfeeding rates, shorter duration, and delayed SA compared with normotensive counterparts.[24–27] Unfortunately, many studies on lactation outcomes do not distinguish between women who received magnesium sulfate and those who did not, making it hard to determine whether lactation challenges are due to both the underlying pathophysiology of HDP and/or side effects of magnesium sulfate or other influences. Additionally, while intrapartum magnesium sulfate can cause neonatal side effects such as hypotonia and feeding difficulties, postpartum administration only minimally elevates milk magnesium levels and shows low oral absorption in breastfeeding infants.[28,29]

This integrative review was designed to evaluate and synthesize the current evidence on how postpartum magnesium sulfate administration affects lactation outcomes, including breastfeeding initiation, exclusivity, duration, pumping behavior, and SA, in patients with HDP.

Methods

Design

This integrative review was conducted following Whittemore and Knafl's five-stage framework[30] and is reported in accordance with PRISMA 2020 guidelines.[31] This approach allows for the systematic inclusion and synthesis of both experimental and non-experimental research studies, resulting in a comprehensive assessment of how postpartum magnesium sulfate exposure impacts lactation outcomes.

Data sources and search strategy

A structured search was conducted in May 2025 across five databases: PubMed, CINAHL, Embase, Scopus, and Web of Science. Keywords and MeSH terms were combined using Boolean operators related to "breastfeeding," "lactation," "milk expression," "secretory activation," and "magnesium sulfate." (See Supplementary Table S1). No date limits were applied. Reference lists of included studies were manually screened to identify additional sources. The search was performed with librarian assistance and managed through Covidence software.

Eligibility criteria

Studies were included if they met the following criteria:

1. Conducted with human participants.
2. Reported intravenous magnesium sulfate therapy administered for the prevention or treatment of eclampsia among women diagnosed with HDP (e.g., preeclampsia, eclampsia, gestational or chronic hypertension).
3. Examined at least one lactation outcome, such as initiation, frequency, or duration of breastfeeding, milk expression, pumping habits, or SA.
4. Primary research.
5. Published in a peer-reviewed journal.
6. Available in English.

Screening and selection

A total of 1,184 records were identified, and 590 unique studies remained after duplicates were removed. Title and abstract screening excluded 532 articles that did not meet the inclusion criteria. Fifty-eight full texts were reviewed in detail, resulting in 11 studies included in the final analysis (see Fig. 1, PRISMA flow diagram). Any published article that was not primary research (e.g., review) was analyzed for applicable studies before exclusion. All 11 full-text articles were systematically screened to ensure consistency, using a standardized inclusion/exclusion protocol.[32] Screening was conducted by the primary author (H.H.S.), with discrepancies and uncertainties resolved through discussion and consensus with two additional reviewers (D.L.S. + R.R.S.C.).

Data evaluation

Each included study was assessed for methodological quality using the official Joanna Briggs Institute (JBI) critical appraisal checklist corresponding to its study design (e.g., cohort, RCT, case series).[33] Responses were systematically documented as "Yes," "No," "Unclear," or "Not Applicable," and recorded in a comparative appraisal table where questions that did not result in a "Yes" response were clarified. Weaknesses identified via these checklists were noted for complete transparency, but no overall numeric summary score was assigned. Levels of evidence were classified according to Melnyk and Fineout-Overholt's[34] hierarchy.

Data extraction and analysis

Key study characteristics, including design, sample size, maternal diagnosis, lactation-related information, and magnesium sulfate regimen (dosage and duration), were extracted using a standardized review table (Table 1: Article summary). Given the wide variability in magnesium sulfate exposure reporting, studies were categorized in-text by exposure clarity: either "known postpartum duration" or "uncertain/unspecified/none." Additionally, a figure was created (see Fig. 2: Hours of postpartum magnesium sulfate) to analyze visually postpartum duration differences. Lactation outcomes were

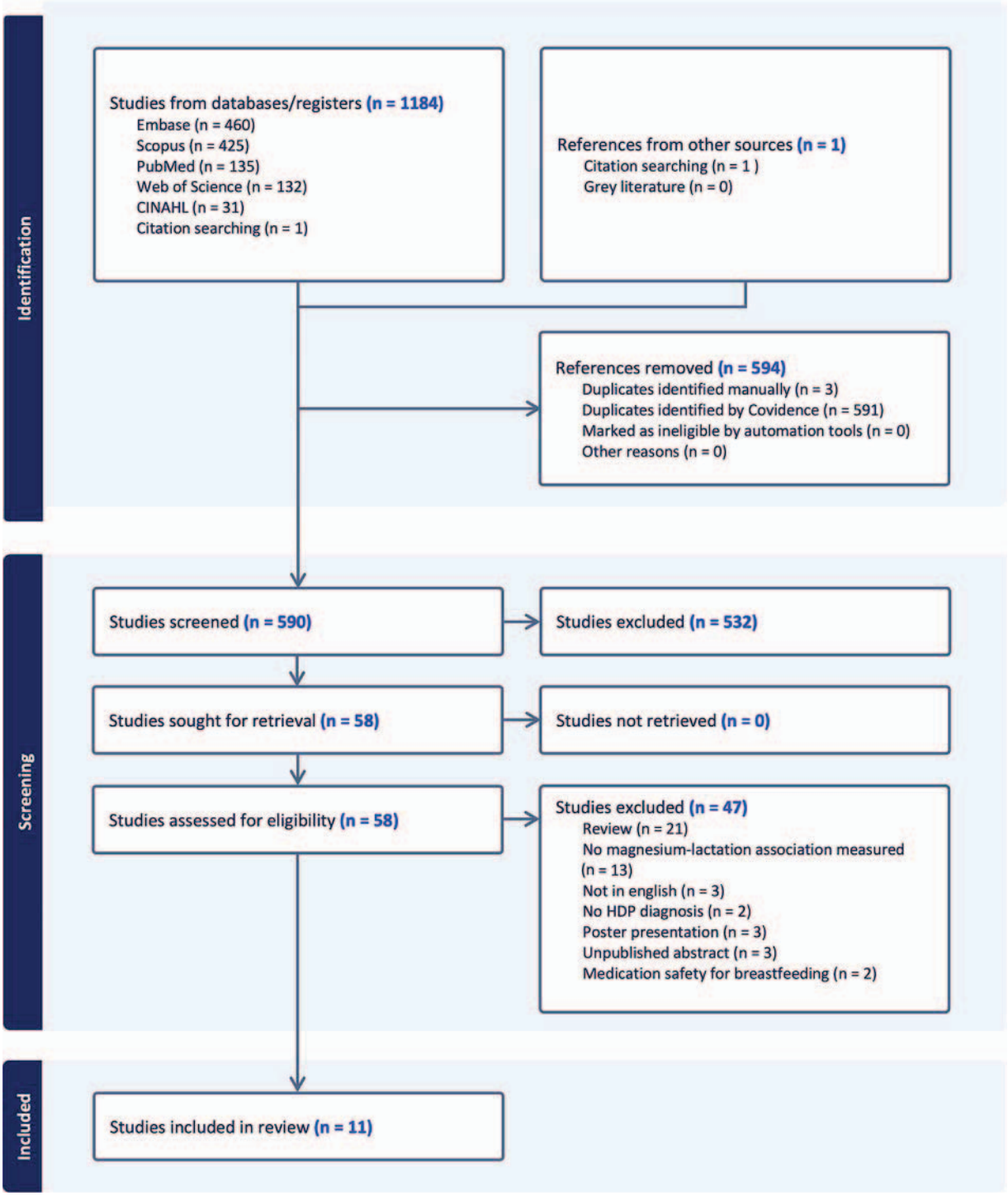

FIG. 1. PRISMA flow diagram for the review of magnesium sulfate and breastfeeding outcomes.

synthesized comparatively, with particular emphasis on time to initiation, discharge rates, SA, and available lactation support due to the availability in the studies.

Results

Study characteristics

Eleven studies published between 1993 and 2023 met all inclusion criteria for final synthesis. Most studies were conducted in the United States ($N = 6$), with others from India ($N = 1$), Mexico ($N = 1$), Pakistan ($N = 1$), and one location only specified as "Latin America" ($N = 1$). The included studies comprised three randomized controlled trials, four retrospective cohorts, one cross-sectional study, one case series, and two case reports. Sample sizes ranged from single-case reports[41,43] to multicenter cohorts of over 1,100 participants.[45] The majority of studies focused on women with severe preeclampsia; other hypertensive pregnancy disorders were rarely represented.

TABLE 1. ARTICLE SUMMARY

Author (year)	*Study aim & design*	*Setting and sample size*	*Magnesium sulfate outcomes*	*Lactation outcomes measured*	*Key findings*	*Level of evidence and JBI strengths and weaknesses*
Burgess et al., 2019[35]	**Aim:** To describe lactation practices among women with early versus late-onset preeclampsia and examine associations with postpartum blood pressure **Design:** Retrospective cohort study	**Setting:** A large suburban tertiary referral center in South Central Pennsylvania, USA **Sample:** $N = 246$ (120 early-onset, 126 late-onset preeclampsia)	Magnesium sulfate was used in 95.5% of the sample. Early-onset was 100%, and late-onset was 91.3% during hospitalization. It is not specified for antepartum, intrapartum, and/or postpartum	Breastfeeding intent on admission Breastfeeding at discharge Breastfeeding at 4–6 weeks postpartum visit	Breastfeeding intention of the total sample: 67.5% intended to breastfeed, 15% formula fed, 5.7% undecided, and 2.45% mix fed The total sample's breastfeeding rate at discharge was 85.7%. Breastfeeding status at hospital discharge was defined as women feeding their newborn their own breast milk via any mode Of 99 women with accessible records, 49.5% were breastfeeding at the postpartum visit	Level of Evidence: **4** **Strengths:** Groups were recruited from the same population using consistent criteria Exposures (lactation status, blood pressure readings) were measured using standardized protocols in electronic health records at multiple time points Breastfeeding status and blood pressure outcomes were objectively measured, thereby generally increasing measurement reliability Confounding factors (gestational age, chronic hypertension, NICU admission, antihypertensive use) were clearly identified Follow-up duration was sufficient for immediate postpartum and post-discharge outcomes **Weaknesses:** Documentation relied on existing EHR records, so nuances of feeding (frequency, technique) and breastfeeding support may be missed There was incomplete follow-up, especially among the early-onset group, due to transfer of care, and reasons for loss were acknowledged but not statistically adjusted for No strategies were used to address incomplete follow-up or to manage loss-to-follow-up bias statistically
Cordero et al., 2012[36]	**Aim:** To examine feeding practices and factors associated with breastfeeding initiation in women with severe preeclampsia (SP) **Design:** Retrospective cohort study	**Setting:** Wexner Medical Center, The Ohio State University (USA) **Sample:** 281 total, with 277 having severe preeclampsia and 4 having chronic hypertension with superimposed preeclampsia	All mothers received IV Magnesium sulfate for 24 hours postpartum per institutional protocol The author noted that clinical effects seen with severe preeclampsia and usage of magnesium sulfate included headaches, nausea, and altered sensorium, causing limited visitations to the NICU	Breastfeeding intention Breastfeeding initiation Infant feeding type at discharge	Breastfeeding initiation was "successful" if ≥ 50% of feedings at discharge were direct breastfeeding or expressed breast milk. Among the 281 women in the sample, 149 intended to breastfeed, 73 intended to formula feed, and 59 were undecided. Initiation rates varied by intention: 76% of those intending to breastfeed initiated, compared with 5% of those intending to formula-feed and 46% of those undecided. Overall, 51% of the total sample initiated breastfeeding. Breastfeeding intention was the strongest predictor for breastfeeding initiation (OR = 18.6, $p < 0.0001$)	Level of Evidence: **4** **Strengths:** Multiple confounding factors, such as delivery mode, NICU admission, prior breastfeeding, and demographic variables, were identified and adjusted for in the analysis Outcomes were objectively defined (inpatient feeding status at discharge) and statistical analysis was appropriate for the cohort design **Weaknesses:** Follow-up was limited to the immediate inpatient period with no data on post-discharge lactation duration or exclusivity Frequency, timing, and method of milk removal or breastfeeding problems were not captured in

(*continued*)

TABLE 1. (CONTINUED)

Author (year)	*Study aim & design*	*Setting and sample size*	*Magnesium sulfate outcomes*	*Lactation outcomes measured*	*Key findings*	*Level of evidence and JBI strengths and weaknesses*
					Among well-baby nursery infants (n = 129), 78% had maternal contact within 24 hours postpartum (p < .01), and 29 infants had their first visit after maternal discharge. Breastfeeding timing varied: 37 infants nursed in the first 24 hours, 23 on day 2, and 10 on day 3 or later. At discharge, 33% were exclusively breastfed, 22% mixed-fed, and 45% formula-fed NICU infants had more delayed feeding p < .01:only 6 received expressed milk on day 1, 24 on day 2, and 44 on day 3 or later. At discharge, 26% were exclusively breastfed, 23% mixed-fed, and 51% received formula only. Only 6 NICU infants had maternal contact in the first 24 hours; the rest (n = 146) first encountered their mothers after maternal discharge from labor and delivery.	detail; maternal symptoms during magnesium therapy were not reported Reliance on EHR for feeding outcomes may limit accuracy and completeness, and some lactation definitions depended on subjective clinical documentation
Cordero et al., 2020[37]	**Aim:** Compare breastfeeding initiation among women with late-onset preeclampsia with severe features (PSF) and preeclampsia with diabetes (PDM), both receiving postpartum $MgSO_4$ **Design:** Retrospective cohort study	**Setting:** Ohio State University Wexner Medical Center **Sample:** 158 participants with preeclampsia with severe features, 111 Preeclampsia with severe features and diabetes (PDM) mother–infant dyads	All women received 24-hour postpartum intravenous $MgSO_4$ for seizure prophylaxis	Time to first breastfeeding Exclusive breastfeeding at discharge (direct or expressed breast milk) Partial breastfeeding at discharge Intention to breastfeed	–Exclusive breastfeeding at discharge: 37% PSF versus 18% PDM (p = .001) –Any breastfeeding at discharge: 70% PSF versus 54% PDM Breastfeeding rates (exclusive and partial) lower in PDM group –High rates of NICU admission and cesarean birth, esp. in PDM –Early mother-infant interaction delayed in both groups (p = not significant); <25% breastfed in first 2 postpartum hours –Hospital practices (bedrest, monitoring, separation) noted as confounders	Level of evidence: **4** **Strengths:** Large sample, direct medical record data, group comparability, well-defined eligibility, inclusion of several confounders **Weaknesses:** No post-discharge follow-up due to design, No details on maternal magnesium sulfate side effects, no data on frequency of milk removal, lactation-related definitions
Cordero et al., 2021[38]	**Aim:** To compare breastfeeding initiation among women with late-onset preeclampsia with severe features (PWSF) treated with magnesium sulfate to those with preeclampsia without severe features (WOSF) who did not receive postpartum magnesium sulfate **Design:** Retrospective cohort study	**Setting:** The Ohio State University Wexner Medical Center **Sample:** N = 262 (158 PWSF, 104 WOSF), gestational age ≥34 weeks *Only the sample of 158 were included in the analysis	PWSF group received 24-hour postpartum magnesium sulfate per standard protocol; WOSF group received no postpartum magnesium sulfate	**For mothers who received postpartum magnesium sulfate:** Maternal breastfeeding antepartum intention: **80%** of the sample Time to first breastfeeding: <1 hour = 18% 1–2 hours = 7% (p = .003) 3–6 hours = 15% 7–24 hours = 19% 25 hours and over = 21% (p = .0002) Exclusive/partial/formula feeding at discharge:	Breastfeeding intention rates were similar between groups (80% versus 84%; not significant) Exclusive breastfeeding at discharge was similar (37% PWSF versus 39% WOSF) PWSF (on magnesium sulfate) group relied more on expressed breast milk only (28% versus 0%) (p = .0001) Direct breastfeeding at discharge was significantly lower in PWSF (43%) versus WOSF (93%) (p = .0001)	Level of Evidence: **4** **Strengths:** Large sample size and use of established clinical criteria for both exposure (preeclampsia severity) and outcome (breastfeeding initiation) Groups were generally comparable in demographic and clinical baseline characteristics, supporting internal validity Utilized appropriate statistical tests for comparing outcomes between groups, improving the credibility of results

(*continued*)

TABLE 1. (CONTINUED)

Author (year)	*Study aim & design*	*Setting and sample size*	*Magnesium sulfate outcomes*	*Lactation outcomes measured*	*Key findings*	*Level of evidence and JBI strengths and weaknesses*
				Exclusive Breast milk = 37% Combined direct breast milk and formula = 33% Formula feeding exclusively = 30%		**Weaknesses:** Lack of follow-up after hospital discharge prevents evaluation of sustained breastfeeding outcomes and long-term impact No multivariable analyses to adjust for baseline differences (e.g., primiparity, gestational age, NICU admission) that could influence outcomes Mother-infant separation and severity of illness may introduce unmeasured confounding not fully addressed in the analysis
Demirci et al., 2018[39]	**Aim:** To illustrate a potential association between women with hypertensive disorders of pregnancy and suboptimal breastfeeding outcomes **Design:** Case series of 4 women from an RCT on antenatal milk expression (AME)	**Setting:** A hospital-based midwifery practice in the northeastern United States **Sample:** A total of 4 participants with 2 relevant cases (M and S) receiving magnesium sulfate; "M" had Preeclampsia, and "S" had Gestational Hypertension with severe range blood pressures	Both received magnesium sulfate intrapartum and 24 hours postpartum "M": 56.4 g over a total of 49 hours "S": 83.8 g over a total of 44 hours	Breastfeeding intention Breastfeeding initiation after birth Perceived timing of lactogenesis II/secretory activation Breastfeeding at and after discharge	Participant "M" intended to exclusively breastfeed for six months and continue breastfeeding until one year postpartum Breastfeeding was initiated at 1.5 hours postpartum for "M" and "S." Perception of lactogenesis II/secretory activation was on day 5 for "M" and day 4 for "S" "M" was exclusively breastfeeding at the 1–2 weeks postpartum follow-up and at 3–4 months. "S" was partially breastfeeding at the 1–2-week postpartum follow-up and exclusively at 3–4 months	Level of Evidence: **6** **Strengths:** The case series uses clear inclusion criteria and applies standard, reliable clinical methods for identifying preeclampsia and lactation outcomes Demographic and clinical details for participants M and S are thoroughly reported, allowing for contextual understanding of their experiences Lactation outcomes and follow-up are clearly described for both cases, including feeding type, supplementation, and longer-term breastfeeding status **Weaknesses:** Participants were not included consecutively, which introduces selection bias and limits generalizability The study provides only descriptive and narrative analysis, without statistical testing, limiting its inferential value Limited reporting on the presenting clinic's population and broader applicability to other settings
Gutiérrez-Vela et al., 2021[40]	**Aim:** To evaluate the efficacy and maternal/neonatal advantages of a shortened (<8 hours) versus extended (>8 hours) postpartum magnesium sulfate regimen in preventing eclampsia **Design:** Retrospective, cross-sectional, and comparative case series study	**Setting:** Regional Maternal and Child Hospital, Nuevo León, Mexico **Sample:** 379 cases with a diagnosis of preeclampsia with severity data and 25 with superadded preeclampsia. *N* = 379 (76 in group A; 303 in B group)	All participants received loading and maintenance magnesium sulfate before delivery. 250 mL of 5% glucose solution with 4 g of magnesium sulfate was administered to pass in 20 minutes, followed by maintenance doses of 60 mL of 5% glucose solution with 8 g of magnesium sulfate to pass at 17 mL/h (1 g/h) Postpartum magnesium sulfate administration groups: **Group A:** patients with a schedule of less than 8 hours (average ~3–07 hours) **Group B:** patients with a schedule	Breastfeeding Intiation	The time to breastfeeding initiation was quicker in the group with less magnesium than in the group with more magnesium (14.1 hours versus 26.06 hours; $p = 0.000$)	Level of Evidence: **6** **Strengths:** Clear and detailed inclusion/exclusion criteria based on established diagnostic standards Consecutive sampling and comprehensive documentation of clinical interventions and outcomes Objective, standardized measurements for both exposure (magnesium sulfate administration) and outcomes (e.g., breastfeeding initiation, maternal/infant complications) Appropriate bivariate statistical analyses reported with clear presentation of group differences and *p*-values

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TABLE 1. (CONTINUED)

Author (year)	*Study aim & design*	*Setting and sample size*	*Magnesium sulfate outcomes*	*Lactation outcomes measured*	*Key findings*	*Level of evidence and JBI strengths and weaknesses*
			of more or less than 8 hours (average ~18 hours)			**Weaknesses:** Lack of multivariable statistical adjustment means confounding variables (e.g., gestational age, birth weight, pre-birth treatment) may influence results Findings may be affected by differences in care protocols determined by physician discretion rather than randomization
Haldeman, 1993[41]	**Aim:** To discuss a possible case of delayed lactogenesis linked to prolonged postpartum magnesium sulfate therapy for pregnancy-induced hypertension (PIH) **Design:** Case report	**Setting:** A private lactation consultant in the United States **Sample:** 1 case of a 29-year-old primiparous mother with PIH	Loading dose: 6 g over 20 minutes; Maintenance: 2 g/hour over 18 hours intrapartum and an additional 48 hours postpartum (total dose = 102 g over 66 hours	Perceived day of lactogenesis II/secretory activation Breastfeeding initiation, frequency, and duration Pumping attempts and supplement use	Perceived maternal lactogenesis II/secretory activation is delayed until postpartum day 10, milk came in suddenly, and exclusive breastfeeding continued for 6 months Despite frequent nursing and pumping through day 7, no colostrum or milk had been expressed with the help of a lactation consultant. At this point, the mother had discontinued all breastfeeding and pumping The baby was fed artificial milk by a feeding tube on day 4 without prior supplementation	Level of Evidence: **6** **Strengths:** Provides a detailed and chronological account of a patient's demographic information, clinical history, and response to magnesium sulfate therapy, including timeline of events and feeding outcomes Diagnostic findings (blood pressure, urine protein, breast and nipple assessment) and treatment procedures (magnesium sulfate course, lactation support) are clearly described, allowing for clear clinical interpretation **Weaknesses:** As a single case report, generalizability is limited
Mushtaq et al., 2023[42]	**Aim:** To compare the outcomes of 8-hour versus 24-hour postpartum magnesium sulfate therapy for eclampsia prophylaxis in women with moderate to severe preeclampsia **Design:** Randomized controlled trial	**Setting:** Gynecology and Obstetrics Department, MCH-1, PIMS Hospital, Islamabad, Pakistan **Sample:** $N = 108$ (54 in each group)	**Group A:** Received $MgSO_4$ for 8 hours (8 microdrops/min) **Group B:** Received $MgSO_4$ for 24 hours only (8 microdrops/min)	Time to breastfeeding initiation	The time to breastfeeding was significantly shorter in the 8-hour group (14.6 ± 1.9 hours) compared with the 24-hour group (24.3 ± 8.3 hours), $p = 0.001$ The author noted that women receiving postpartum magnesium sulfate are kept under observation in a high dependency unit, which results in a delay in breastfeeding; it is unknown if breast pumping can be done in this unit or if it was done with this sample. Also, this article does not define breastfeeding, limiting readers' understanding	Level of Evidence: **2** **Strengths:** Identical Care Except for Intervention Complete Follow-Up Intention-to-Treat Analysis Outcomes (eclamptic fits, breastfeeding initiation, ambulation time, hospital stay, patient satisfaction) were measured in the same, reliable way for both groups Statistical tests (independent t-tests for continuous data, descriptive for categorical) matched the outcome types and group structure All outcomes were clearly specified and reported **Weaknesses:** The study did not use blinding for participants, treatment providers, or outcome assessors. This could introduce performance and detection bias, especially for subjective outcomes like patient satisfaction

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TABLE 1. (CONTINUED)

Author (year)	*Study aim & design*	*Setting and sample size*	*Magnesium sulfate outcomes*	*Lactation outcomes measured*	*Key findings*	*Level of evidence and JBI strengths and weaknesses*
						The paper does not specify whether allocation to treatment groups was concealed, so there could be potential for selection bias during group assignment The article does not state whether data were checked for normality or, if non-normally distributed, whether appropriate nonparametric tests were considered The study did not report any multivariable modeling to account for potential confounders (though group assignment via randomization mitigates some confounding risk)
Sithara, 2015[43]	**Aim:** Clarifying when thrombocytopenia is clinically important, guiding diagnosis, management options, and information about potential risks to the mother and fetus, and reviewing relevant literature **Design:** Case report	**Setting:** Sri Ramachandra Medical College and Hospital in India **Sample:** 1 primigravida Participant with diagnosed gestational hypertension	The patient received "parenteral magnesium sulfate" after being diagnosed with gestational hypertension with "imminent signs of eclampsia" at 38 weeks of gestation	Breastfeeding after birth	After birth, the baby was seen by a neonatologist, who stated that it was "healthy, and breastfeeding was established successfully."	Level of Evidence: **6** **Strengths:** Comprehensive Patient Description Detail in Chronology and Interventions Inclusion of post-intervention outcomes and explicit reporting of adverse events strengthens the quality of clinical information, which is essential for understanding both benefits and risks **Weaknesses:** Potential for Subjectivity Limited Generalizability
Vigil De-Gracia et al., 2017[44]	**Aim:** To compare the effectiveness of 6-hour vs. 24-hour postpartum magnesium sulfate in preventing eclampsia in women who received < 8 hours of magnesium sulfate before delivery of the newborn **Design:** Randomized, multicenter, open study	**Setting:** three maternity teaching hospitals in Panama **Sample:** $N = 284$ (143 in 24-hour group, 141 in 6-hour group)	All patients received 4 g of magnesium sulfate infusion and 4 hours of magnesium sulfate before birth Postpartum: Control group= 24 hours; Intervention group = 6 hours	Time to initiate breastfeeding (in hours)	Breastfeeding began significantly earlier in the 6-hour group, 25.7 ± 19.8, than in the 24-hour group, 36.5 ± 16.8, $p = 0.001$ **Key notes:** Hospital policies delayed breastfeeding while magnesium sulfate was active. "In our hospitals, breastfeeding is allowed in patients with cesarean from 6 hours postpartum, and in patients with magnesium sulfate, it is allowed after 24 hours when magnesium sulfate has been removed." Secondly, it was mentioned that the 6-hour group could breastfeed after the 6 hours were completed: "The patients who received magnesium sulfate for six hours were allowed to ambulate and breastfeed as tolerated after six hours." Approximately 66% of the population underwent a cesarean section The paper does not define	Level of Evidence: **2** **Strengths:** The study was performed across three teaching maternity hospitals in Panama, increasing generalizability and clinical relevance Clear protocol and intent-to-treat analysis: Participants were randomized and all analyzed according to their assigned group, minimizing selection and analysis bias Objective, clinically relevant outcomes and reliably measured Direct practice implications: The comparison of 6 versus 24 hours postpartum magnesium has immediate clinical significance for both providers and patients, especially in resource-constrained settings Ethical approvals and transparency: The study included appropriate ethics approval, verbal and written consent, and was registered with clinicaltrials.gov

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TABLE 1. (CONTINUED)

Author (year)	*Study aim & design*	*Setting and sample size*	*Magnesium sulfate outcomes*	*Lactation outcomes measured*	*Key findings*	*Level of evidence and JBI strengths and weaknesses*
					breastfeeding, with no mention of whether breast pumping while on magnesium sulfate was supported	Potential benefits for maternal recovery: Shorter magnesium duration led to earlier ambulation and breastfeeding without compromising safety **Weaknesses:** Not double-blinded: The study was open-label; neither participants nor providers were blinded, leading to possible performance and detection bias, especially for subjective outcomes Single-country context: While multicenter, all sites were in Panama, so findings may need validation in other populations/settings Both groups received active magnesium, so the results apply only to the regimen's duration and not to absolute benefit over no postpartum magnesium
Vigil De-Gracia et al., 2018[45]	**Aim:** To evaluate whether continuing magnesium sulfate for 24 hours postpartum or not receiving any postpartum reduces eclampsia risk in women already treated with magnesium sulfate ≥ 8 hours before delivery **Design:** Multicenter randomized clinical trial in parallel and open study	**Setting:** Nine tertiary-care maternity teaching hospitals in Latin America **Sample:** $N = 1{,}113$ women with severe preeclampsia (555 continued magnesium sulfate postpartum; 558 discontinued at delivery)	All received a 4 g IV loading dose + 1 gram/hour IV infusion for ≥ 8 hours pre-delivery The control group continued magnesium sulfate for 24 hours postpartum, while the intervention group stopped at delivery	Time to initiate breastfeeding (hours postpartum)	Time to breastfeeding was significantly shorter in no-magnesium sulfate group: 17.1 ± 16.8 hours versus 24.1 ± 17.1 hours ($p < 0.0001$) **Key points:** They note that hospitals, especially in Latin America, generally do not permit breastfeeding while on magnesium sulfate, although the authors do not specify whether this occurred in their sample Women not on magnesium sulfate had an average time to breastfeed initiation at 17 hours, which should be a significant delay even without the magnesium intervention The article does not define breastfeeding, with no mention of whether breast pumping while on magnesium sulfate was supported	Level of Evidence: **2** **Strengths:** Key outcomes (time to ambulation, time to lactation, etc.) were consistently recorded by hospital staff according to protocol, reducing detection bias Data analysis was conducted on an intention-to-treat basis, with nearly all randomized women included regardless of minor protocol deviations, which minimizes the risk of selection bias from loss to follow-up Appropriate statistical tests Completed follow-up **Weaknesses:** Limited Blinding Information While the trial generally followed a parallel-group RCT design, a few women received magnesium sulfate for less than the planned duration but were still analyzed as randomized; any deviations from protocol should be closely examined for their impact

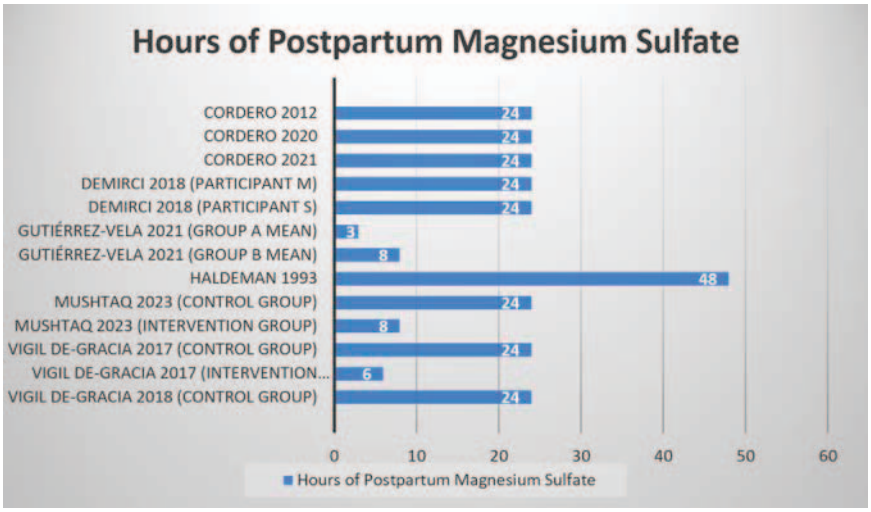

FIG. 2. Postpartum magnesium sulfate duration.

Participant and infant characteristics

Across the 11 studies included in this review (N = 2,842 women), most participants were diagnosed with severe preeclampsia or preeclampsia with severe features, accounting for over 60.3–98.6% of the study samples.[36–40,44,45] A minority of women were diagnosed with superimposed preeclampsia (1.4–19.5%),[36,37,40,44,45] and gestational hypertension or pregnancy-induced hypertension.[39,41,43] Mushtaq et al. specifically focused on moderate to severe preeclampsia as an inclusion criterion, without stratifying by severity,[42] whereas Burgess et al. reported an equal distribution between early-onset and late-onset preeclampsia, without specifying severity (48.8% and 51.2%, respectively).[35]

Maternal age was generally consistent across studies, with most reporting mean ages typically ranging from 24 to 30 years.[35–38,40,42,44,45] Smaller studies had individual patient ages ranging from 26 to 35 years.[39,41,43] Primiparous patients made up the majority (55–65%) across studies.[36–41,43–45] Among studies reporting data, the prevalence of pregestational and gestational diabetes ranged from 2.3%[40] to 15%,[35] except for Cordero et al. (2020), which reported 70% of their sample with diabetes due to its focus on that population.[37] Maternal body mass index was inconsistently reported, generally within the overweight to highly obese range, consistent with the risk profile of hypertensive pregnancies.[35,37,39] However, many studies did not specify when weight was measured, limiting reliability.[36,38,40–45]

Gestational age at delivery clustered around a mean of 36–37 weeks, mainly reflecting late preterm to early term births.[34,37,38,42,44,45] Some variability was observed, with some studies reporting means or the majority between 34–36 weeks.[35,36,40] Smaller studies involving single cases[39,41,43] reported gestations ranging from 37 to 39 weeks.

Cesarean birth rates were consistently elevated compared to national averages, with most studies ranging from 52% to 75%, reflecting the high acuity and management of these hypertensive pregnancies.[35–37,40,44,45] Cordero et al. (2021) reported lower cesarean rates with 58% vaginal and 42% cesarean deliveries.[38] Smaller case series reported a combined average cesarean rate of 50%.[39,41,43] Among studies that reported neonatal data, neonatal intensive care unit (NICU) admission rates ranged from 44% to 58%.[35–39] Most studies did not report on NICU admission data.[40–45]

Magnesium sulfate regimens

Known postpartum magnesium sulfate duration. In most studies, postpartum magnesium sulfate regimens typically involved a 24-hour continuous infusion after delivery.[36–39,42,44,45] Several studies compared these standard protocols with shorter postpartum exposures (6–8 hours) or discontinuation at birth.[42,44,45] Haldeman (1993) was unique in having a prolonged postpartum exposure of 48 hours[41] (see Fig. 2: Postpartum magnesium sulfate duration).

Uncertain/Unspecified postpartum magnesium sulfate duration. A minority reported only that magnesium sulfate was used, with limited further information and an unclear or unspecified duration.[35,43]

Dosage information. Most studies that reported dosage information ranged from 1 gram per hour[40,44,45] to 2 grams per hour.[39,41] There was also a 4-gram[40,44,45] or 6-gram[41] loading dose. Mushtaq et al. (2023) participants received 8 microdrops/minute with unknown volume or grams of the bag[42] (See Table 2: Magnesium dosage). Specific dosage information was not provided in some studies.[35–38,43]

Lactation outcomes

Breastfeeding definitions. Some studies have definitions related to lactation.[35–38] Cordero defined breastfeeding broadly: in 2012, "successful initiation" meant ≥50% of feedings were human milk (either direct or expressed) at discharge, with 84% meeting this criterion.[36] In contrast, Burgess et al. (2019) defined breastfeeding as women feeding their newborns with their own milk through any modality.[35] Cordero et al. (2020 and 2021) defined breastfeeding initiation as any exclusive or partial breastfeeding during the last 24 hours before hospital discharge, with exclusive being mothers' own milk by

Table 2. Postpartum Magnesium Sulfate Dosage Information

Author	*Loading dose + infusion rate*
Burgess et al., 2019[35]	NR
Cordero et al., 2012[36]	NR
Cordero et al., 2020[37]	NR
Cordero et al., 2021[38]	NR
Demirci et al., 2018[39]- "S"	NR + 2 grams/hour
Demirci et al., 2018[39]- "M"	NR + 2 grams/hour
Gutiérrez-Vela et al., 2021[40] (group A)	4 grams + 1 gram/hour
Gutiérrez-Vela et al., 2021[40] (group B)	4 grams + 1 gram/hour
Haldeman 1993[41]	NR + 2 grams/hour
Mushtaq et al., 2023[42] (control group)	NR + 8 microdrops/min
Mushtaq et al., 2023[42] (intervention group)	NR + 8 microdrops/min
Sithara 2015[43]	NR
Vigil De-Gracia et al., 2017[44] (control group)	4 grams + 1 gram/hour
Vigil De-Gracia et al., 2017[44] (intervention group)	4 grams + 1 gram/hour
Vigil De-Gracia et al., 2018[45] (control group)	4 grams + 1 gram/hour
Vigil De-Gracia et al., 2018[45] (Intervention group)	0

any modality or donor milk, and partial involving formula supplementation.[37,38] Most studies did not clarify whether initiation referred to direct breastfeeding or pumping, or whether patients restricted from direct breastfeeding were permitted to pump.

Initiation timing. Despite definitional differences, a consistent pattern emerged: shorter magnesium sulfate exposure was linked to earlier breastfeeding initiation. Across multiple studies, shorter postpartum regimens (6–8 hours) or none (0 hours) resulted in initiation 8–12 hours earlier than standard 24-hour protocols, with mean initiation times ranging from approximately 14 to 26 hours in shorter-duration groups compared to 17 to 37 hours in longer-duration groups.[40,42,44] Case reports indicated initiation rates of 30–90 minutes postpartum.[39,41] All women in the preeclampsia with severe features (PWSF) group remained in labor and delivery during the first 24 hours postpartum. The main disruption in mother–infant contact after birth was due to the need for immediate transfer of symptomatic prematurely born infants to the NICU (43% of the PWSF and 14% of the preeclampsia without severe features [WOSF] group).[38]

Where the intention to breastfeed was documented, initiation rates were high, although the timing varied considerably.[36–38] Cordero et al. (2020 and 2021) reported that only 16–18% of mothers started breastfeeding within the first hour, while 40–42% delayed initiation beyond 7 hours.[37,38] The 2012 study by Cordero et al. showed that 51% of the total sample-initiated breastfeeding, with 29% of neonates transferred to the Well-Baby Nursery being breastfed at least once on the first day and 26% initiating on the second day or later.[36] Two studies did not specify the timing of initiation.[35,43]

Breastfeeding rates and duration. Findings on exclusivity and discharge feeding status were mixed, with only half of the studies addressing these aspects. Exclusive breast milk feeding ranged from 26% to 37%, while mixed feeding ranged from 22% to 34%, with lower rates seen in babies admitted to the NICU.[36–38] Conversely, Burgess et al. (2019) reported overall breastfeeding discharge rates of 85.7% (n = 210).[35] In smaller studies, exclusive breast milk feeding was observed in 2 out of 3 participants.[39,41] Half of the studies did not report breastfeeding discharge rates, and data on breastfeeding after discharge were limited; only some studies provided longer-term outcomes.[35,39,41] These results varied, with Burgess reporting breastfeeding at the first postpartum visit at 49.5%, Demirci et al. reporting by 3–4 months, and Haldeman reporting at day 10—all of whom were exclusively breast milk fed. Many studies did not report breastfeeding discharge rates.[36,40,42,43,45]

Perceived SA. Only two studies reported explicit data on SA. Where reported, perceived onset of copious milk ranged from day 4[39] to day 10[41] postpartum. None of the studies reported objective data, such as sodium and lactose biomarkers, to measure SA. Additionally, none of the studies reported the use of pre- and post-weights to determine milk intake.

Expressed milk and pumping habits. There is significant variation in how milk expression and pumping practices are defined and reported. Haldeman (1993) specifically documented using an electric breast pump on both breasts after each feeding for 10 minutes per session from postpartum day 3 through 7 due to concerns about milk supply.[41] In contrast, Cordero et al. (2012, 2020, 2021) used the term "expressed milk" to include both pumping and possible hand expression, without providing details on the method, timing, or frequency.[36–38] At hospital discharge, 33–36% of patients who received magnesium sulfate provided pumped milk to their infants, with 9–10% exclusively feeding pumped milk.[37,38] Among NICU neonates (n = 155, 54%) in Cordero et al. (2012), the initiation of expressed milk varied widely: 6 infants on day 1, 24 on day 2, and 44 on or after day 3.[36] Demirci et al. (2018) described postpartum ICU patients engaging in hand expression and pumping, with consistent post-discharge pumping six times per 24 hours.[39] Other studies (Burgess et al., 2019; Gutiérrez-Vela et al., 2021; Mushtaq et al., 2023; Sithara, 2015; Vigil-De Gracia et al., 2017 & 2018) did not provide specific details on pumping or milk expression.[35,40,42–44]

Lactation support. Lactation support was sparsely reported across studies. Cordero et al. (2020 and 2021) noted that approximately 77–87% of their sample received postpartum lactation consultation when reported.[37,38] The 2012 study by Cordero et al. described standard protocols ensuring lactation support access for women planning or undecided about breastfeeding,[36] while individualized support was detailed in case studies.[34,39] Most other studies did not provide information on lactation support, including Burgess et al., Gutiérrez-Vela et al., Mushtaq et al., Sithara, and Vigil-De Gracia et al.[35,40,42–44]

Discussion

This integrative review demonstrates that postpartum magnesium sulfate exposure complicates lactation outcomes for women with HDP, impacting both breastfeeding initiation and discharge rates. The reviewed studies consistently describe a high-risk perinatal population: primarily presenting as women with severe preeclampsia delivering late-preterm to early-term neonates by cesarean, with high NICU admission rates. These clinical factors frequently coincide,

reducing early opportunities for milk removal and delaying breastfeeding initiation.

The maternal side effects of magnesium sulfate, especially at higher doses, often hinder early breastfeeding. Maternal drowsiness and sedation, which become more pronounced with longer or higher-dose treatments, can disrupt breastfeeding and bonding.[12–14,46] The incidence of these side effects ranged from 24% (1 g/h) to 71% (2 g/h), demonstrating a clear dose–response relationship.[12,13] Burgess et al. noted that women with hypertensive disorders during pregnancy were less likely to breastfeed or pump, often citing illness or medication as reasons for not starting or stopping.[47] Cordero et al. specifically found that among women receiving magnesium sulfate, only 17–18% initiated breastfeeding within the first hour, whereas 40%–42% started it after 7 hours, despite 77–80% intending to breastfeed exclusively. Ultimately, only 30–37% were able to do so at discharge.[37,38] These figures are notably lower than the Ohio state average of 51.8% for exclusive breastfeeding.[48]

Notably, most lactation studies do not clearly separate the effects of HDP, magnesium sulfate exposure, or other comorbidities. This greatly limits the ability to determine whether lactation difficulties stem from hypertension itself, medication effects, or other confounding factors. Nevertheless, existing research suggests that HDP is linked to shorter breastfeeding duration, delayed SA, and lower latch scores compared with women without hypertension.[24–27] Emerging mechanistic evidence also connects HDP to impaired lactation through inflammatory and placental pathways.[49] HDP can cause placental dysfunction, which disrupts hormonal signaling necessary for mammary gland development and secretory differentiation,[49] potentially leading to problems with SA. HDP has been associated with significantly delayed SA and reduced pumping frequency.[50]

Lactation support has been shown to have a dose-response relationship with increased rates of exclusive breastfeeding at 6 months.[51] Proactive lactation management can mitigate risks among high-risk mothers, particularly those with NICU infants. For example, among preterm (<34 weeks) mothers (41% preeclamptic, 59% cesarean), pumping in the first 5 days postpartum was strongly associated with improved SA.[52] Each additional hour of pumping daily increased the odds of timely SA by 2.8-fold;[52] similar benefits have been observed for early, regular milk expression outside the NICU setting.[53] Technological advances now enable rapid, biomarker-based clinical assessment of SA.[54,55] Validated biomarker protocols using human milk sodium-to-potassium (Na:K) ratios provide objective, standardized measurement of SA timing,[54,56] enabling precise identification of at-risk dyads for targeted intervention. Coupled with evidence-based institutional protocols such as the Spatz 10-step method, this represents a key avenue for improving high-risk lactation outcomes.[57,58]

Elevated NICU admission and cesarean rates are related confounders that increase the risk of lactation issues but may be modifiable through better clinical and institutional practices. NICU admission rates in the reviewed studies ranged from 44% to 56.6%, significantly higher than the national average of 9.8%.[59] Cordero et al. (2012) found that only 4% of NICU neonates received their mother's own milk on day 1; delayed milk expression directly contributes to later breastfeeding cessation and suboptimal supply, making pumping essential for achieving adequate volume.[26,36,60,61] However, Burgess et al. (2019) reported that targeted lactation support within the NICU can mitigate some adverse effects, as evidenced by increased human milk receipt at discharge.[35]

Separation of mother and infant due to hospital protocols on magnesium sulfate therapy further restricts opportunities for early initiation and rooming-in. In Cordero et al. (2012), only 78% of neonates in the Well-Baby Nursery saw their mothers within 24 hours, and 22% did so only after discharge from labor and delivery following magnesium sulfate therapy.[36] Postpartum breastfeeding initiation is complicated by hospital protocols that require women on magnesium sulfate to remain on strict bed rest and refrain from breastfeeding until the infusion ends, usually after 24 hours.[44,45] Additionally, rooming-in separation may occur because the mother stays on the Labor and Delivery unit or is transferred to the high-dependency unit after birth without her baby, or the baby is transferred to the NICU or nursery.[37,42] Such delays reduce opportunities for skin-to-skin contact and are consistently associated with decreased breastfeeding, highlighting the need for policy changes.[62,63]

In summary, ongoing reliance on institutional policies that restrict breastfeeding during magnesium therapy, frequent mother-infant separation, and inconsistent tracking of feeding and milk expression practices create significant interpretive challenges. Relying on subjective rather than biomarker-confirmed measures of SA further hampers scientific progress, along with short follow-up periods and inconsistent reporting of key lactation behaviors. Importantly, the lack of qualitative studies examining both the side effects of magnesium sulfate and lactation outcomes leaves a substantial gap in understanding.

Clinical implications

Based on the findings of this integrative review, magnesium sulfate negatively impacts lactation outcomes in the early postpartum period. Considering the evidence of delayed breastfeeding initiation, disrupted SA, and reduced pumping frequency, clinical teams should prioritize immediate postpartum lactation assessments and provide additional support to these mother-infant pairs. A modified lactation protocol guided by the Spatz 10-step method may be especially helpful in addressing specific challenges such as magnesium side effects, high cesarean section rates, and increased NICU admissions leading to maternal-infant separation. Early and frequent milk removal, whether through direct breastfeeding or pumping, should be actively promoted, with close monitoring to mitigate the effects of therapy-related maternal fatigue or hospital policies on stimulation. Ultimately, individualized feeding plans, education, and institutional support for rooming-in during magnesium therapy can help improve breastfeeding outcomes for this high-risk group.

Future research

To improve care for high-risk mother-infant pairs exposed to HDP and magnesium sulfate, future research should focus on: (1) the use of human milk biomarkers (sodium and lactose) instead of relying on mothers' subjective reports of "milk coming in," allowing for precise detection of delayed

SA within the critical window. (2) Detailed documentation of milk removal behaviors: Future research must systematically record the frequency, duration, and mode (direct breastfeeding versus pumping) of milk removal during the first 72 hours postpartum, as early and frequent stimulation is biologically vital for SA. (3) Qualitative exploration of maternal experiences: Qualitative studies are necessary to understand how mothers perceive magnesium sulfate side effects (sedation, nausea, weakness), manage institutional policies (such as rooming-in restrictions and lactation support access), and overcome barriers to early milk removal. (4) Examination of modifiable clinical and institutional factors: Research should identify specific hospital policies, lactation support protocols, and magnesium sulfate dosing strategies that can be adjusted to improve lactation outcomes while ensuring maternal safety.

Limitations

Screening for this review was conducted as part of this first author's qualifying exam for her PhD as per the requirements of the university. The other two authors were consulted for areas of uncertainty or discrepancies. This approach may introduce potential selection bias into the process of identifying studies. Only studies published in English were included, which can limit the comprehensiveness and generalizability of the results. Additionally, relevant unpublished data or studies outside the searched databases might not have been identified, potentially affecting the review's scope.

Conclusions

Postpartum magnesium sulfate therapy in women with HDP is consistently linked to significant delays in starting lactation, including the beginning of breastfeeding and SA. This disruption is possibly caused by both the medication's side effects, such as sedation and maternal fatigue, and hospital policies that restrict early infant feeding, rooming-in, and maternal–infant interaction during magnesium treatment. The overall evidence indicates that mothers who undergo extended magnesium therapy face significant obstacles to their lactation journeys, which prevent both mother and child from receiving optimal health benefits.

Authors' Contributions

H.H.S.: Conceptualization, methodology, literature screening and selection, data extraction, formal analysis, writing—original draft, writing—review and editing, and project administration. D.L.S.: Supervision of PhD student and consultation through the entire process and final editing of the article. R.R.S.C. and D.L.S.: Assessment of eligibility for inclusion or exclusion in cases of uncertainty, methodological evaluation, contributions to organizational clarity through multiple rounds of article review.

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Supplementary Material

Supplementary Table S1
Supplementary Table S2

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